FINAL DOCUMENT OF ENVIRONMENTAL PROTECTION (DEP)

ACTIVITY:
MINUTEMAN III MODIFICATION AND FUZE MODERNIZATION FLIGHT TESTS AND GROUND-BASED STRATEGIC DETERRENT (GBSD) FLIGHT TESTS

CONTROL NUMBER DEP-22-SMDC-01.1

JULY 2022

Effective Date November 22, 2022

US ARMY GARRISON-KWAJALEIN ATOLL
IN THE
REPUBLIC OF THE MARSHALL ISLANDS

PREPARED BY
KFS, LLC
HUNTSVILLE, ALABAMA

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DOCUMENT NUMBER DEP-22-SMDC-01.1

October 2022

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August 2022

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DOCUMENT NUMBER DEP-22-SMDC-01.1

August 2022

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August 2022

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United States Environmental Protection Agency – Region 9

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DOCUMENT NUMBER DEP-22-SMDC-01.1

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October 3rd th 2022

David C. Hasley
Chief, Environmental Division
Deputy Chief of Staff, Engineer/DCSENG

Moriana Phillip
General Manager
RMI Environmental Protection Authority

Subject: RMI EPA Response GBSD DEP

Thank you for the opportunity to review the GBSD DEP. We especially appreciated reviewing the comments from USEPA and NMFS, with which we agree. RMIEPA hereby offers written approval of this DEP.

While we wish this particular program to move forward, we note again our concerns regarding the lack of serious attention to cumulative impacts from all the various missile testing programs that have already been implemented, that are ongoing, or that are contemplated in future. We ask again that a cumulative DEP be developed for all missile testing at Kwajalein, and that cumulative impacts be addressed in full in accompanying EA and EIS documentation. We do not have the capacity to make these scientific determinations on our own, and rely on U.S. expertise to set forth the appropriate science and environmental cautions.

Moriana Phillip
General Manager, RMIEPA

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DOCUMENT OF ENVIRONMENTAL PROTECTION

DATE SUBMITTED: July 2022
DEP EFFECTIVE DATE: November 22, 2022
DEP EXPIRES: Five Years After Final Signature

The Compact of Free Association between the Republic of the Marshall Islands (RMI) and the United States (US), as amended, at Section 161(a)(i) requires all US Government activities at US Army Garrison-Kwajalein Atoll (USAG-KA) controlled sites (known as US Army Kwajalein Atoll (USAKA)), where Ronald Reagan Ballistic Missile Defense Test Site (RTS) is a tenant organization, to conform to specific compliance requirements, coordination procedures, and environmental standards identified in the Environmental Standards and Procedures for United States Army Kwajalein Atoll Activities in the Republic of the Marshall Islands (UES, 16th ed.; USASMDC 2021). As specified in Section 2-2 of the UES 16th Edition, these standards also apply to all USAG-KA and RTS activities occurring elsewhere within the RMI, including the territorial waters of the RMI.

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TECHNICAL DESCRIPTION OF ACTIVITY

The activities described in this DEP are for conducting Minuteman III (MMIII) Intercontinental Ballistic Missile (ICBM) Modification and Fuze Modernization program and Ground Based Strategic Deterrent (GBSD) flight tests.

The UES requires renewal of Documents of Environmental Protection (DEPs) for continuing activities, and new DEPs for new activities. Per the UES, DEPs expire after 5 years. In 2005, the original Notice of Proposed Activity (NPA) and companion DEP (USAKA 2005) went into effect for the MMIII Modification Flight Tests at RTS. The UES requires renewal of DEPs for continuing activities, thus requiring a Notice of Continuing Activity (NCA) for the MMIII program. An NCA was issued for continuing MMIII activities on 29 September 2014 (USAKA 2015). Subsequently, a DEP for the continuing MMIII Modification Flight Tests, to include the Fuze Modernization program was finalized on September 14, 2017 (USAKA 2017; Appendix C). Upon issuance, the renewed DEP covered a 5-year period (2017 – 2022). As described in the GBSD Test Program EA/OEA (USAF 2021) and in this DEP, the Department of Defense (DOD) is planning on transitioning from the MMIII program to the GBSD program over a period of 10 years. This 2022 DEP and companion NPA (Appendix A) for the MMIII Modification Flight Tests, Fuze Modernization, and GBSD flight tests will only cover a 5-year period (2022-2027). Therefore, when this 2022 DEP expires in 2027, a future GBSD DEP and NCA will be required to cover flight tests occurring after 2027.

The DOD is extending the life of the existing force of MMIII ICBMs and including a Fuze Modernization program using the same missile platform and infrastructure support. The GBSD weapon system addressed in this DEP has been officially named Sentinel, and represents the continual modernization of the United States' land-based nuclear arsenal with replacement of the aging MMIII. As a life-extension action, the MMIII weapon system will continue through year 2030 with up to four annual MMIII flight tests, and additionally up to four Fuze Modernization flight tests over a 4-year period. Between 2021 and end of fiscal year 2029, there could be up to 33 MMIII test flights. All flight tests will launch from Vandenberg Space Force Base (VSFB), California, to the RTS in the RMI. Flight tests are necessary to ensure the safety, accuracy, and reliability of the MMIII and Fuze Modernization systems.

The ICBM Fuze Modernization program activities will include replacement of the existing MMIII Mark 21 fuze to meet warfighter requirements and maintain current capability. Additionally, the ICBM Fuze Modernization program will address the associated MMIII weapon modifications, system testing, support equipment, data, training, and fielding efforts required to support and develop a new Mark 12A fuze capability to integrate with the new Mark 21 fuze and Mark 12A/W78 Life Extension Program.

The flight-testing activities for MMIII have not changed substantially over the years, with the exception of the removal of the requirement for land impacts in 2017, and the MMIII program or the Fuze Modernization activities will not undergo significant changes. Environmental resource areas impacted by the continuing MMIII program and Fuze Modernization activity missions are discussed in the 2017 NCA (Appendix C). Requirements for notification and reporting in the 2017 NCA are consistent with those in the 2005 NPA. A new companion NPA for this DEP was

completed because of new GBSD testing locations, including potential land impacts in the RMI (Appendix A). Monitoring procedures are addressed in this DEP.

The proposed GBSD Test Program involves the development and testing of a new ICBM weapon system that would eventually replace the aging MMIII weapon system. Implementation of the test program would include facility construction or modifications at Hill Air Force Base (HAFB), VSFB, and Dugway Proving Ground. In addition, GBSD flight test activities would be conducted from VSFB and include target impacts at USAKA sites in the RMI. The Department of the Air Force (DAF) currently plans only one flight test with impact on land at Illeginni Islet for the GBSD Test Program, but up to three total land reentry vehicle (RV) impacts may be possible through end of fiscal year 2029. Because deployment of the new GBSD weapon system cannot occur until it has been adequately tested and proven sufficiently mature for operational use, both GBSD and MMIII flight test activities and related operations would overlap at HAFB, VSFB, and USAKA. Such testing would overlap for up to 10 years or until decisions are made to remove the MMIII weapon system from active status. Between 2021 and end of fiscal year 2029 there could be up to 33 MMIII test flights and up to 28 GBSD test flights, for a total of 61 test flight over a 9-year period.

LOCATION OF ACTIVITY

In the RMI, proposed activities may occur at three locations: the Kwajalein Missile Impact Scoring System (KMISS) range located off the east reef near Gagan Islet, RTS, RMI; the RV impact site at Illeginni Islet; and in the vicinity of Illeginni Islet. RTS is a tenant of USAG-KA at USAKA, which includes 11 RMI islets leased by the United States, the Mid-Atoll Corridor and surrounding air and water areas at Kwajalein Atoll.

COMPLIANCE STATUS

The MMIII Modification and Fuze Modernization program and GBSD flight testing activities at RTS are in compliance with the UES. The testing activities and potential effects on endangered and threatened species will be monitored by DAF (aka, Defense Program) and RTS and reported by United States Army Space and Missile Defense Command (USASMDC) to the UES Appropriate Agencies in accordance with this DEP to ensure compliance.

MILESTONE SCHEDULE (UES §2-17.3.6 (5))

Number	Requirement	Responsible Party	Due Date
General Requirements and Limitations			
1	Brief test personnel on Best Management Practices (BMPs) and requirements and the requirement to adhere to them during test activities. **(Section 1.3.e)**	Defense Program, USAG-KA, RTS, & USASMDC	Prior to test
2	Evacuate nonessential personnel within the Mid-Atoll Corridor and shelter critical personnel. **(Section 1.1.a)**	Defense Program, USAG-KA, & RTS	Prior to test
3	Publish Notices to Airmen (NOTAM) and Notices to Mariners (NOTMAR). **(Section 1.1.a & 4.2.c)**	Defense Program, USAG-KA, & RTS	Prior to test
4	Equipment and materials shipped from the US to RTS shall be washed and inspected to ensure that it does not contain any insects, animals, plants, or seeds. **(Section 1.1.f)**	Defense Program, USAG-KA, & RTS	Prior to equipment transport to RTS
5	Equipment and materials returning to the US shall be washed and inspected to ensure that it does not contain any insects, animals, plants, or seeds. **(Section 1.1.g)**	Defense Program, USAG-KA, & RTS	Prior to equipment transport to US
6	If activity-specific hazardous materials are imported, submit a Hazardous Materials Procedure to Commander, USAG-KA. **(Section 1.4.b)**	Defense Program, USAG-KA, & RTS	Within 15 days of import or before use, whichever comes first
7	Conduct overflights of terminal activity location(s) to survey for marine mammals and sea turtles. **(Sections 1.1.b & 2.0.a)**	Defense Program, USAG-KA, & RTS	Flights during week prior to the test / as close to launch as safely practicable (within 24 hours if practicable)
8	Monitor for, record, and report opportunistic observations of marine mammals and sea turtles. **(Sections 1.1.i, 1.1.o, & 2.0.c)**	Defense Program, USAG-KA, & RTS	During travel to and from test support locations
9	Conduct overflights of terminal test locations to survey for dead or injured marine mammals and sea turtles. Report as required in **Section 2.0.e**. **(Section 1.1.q)**	Defense Program, USAG-KA, & RTS	As soon as safely practical after test

Number	Requirement	Responsible Party	Due Date
10	Conduct regular (monthly or quarterly if possible) hydrophone or other surveys of marine mammals in the KMISS and the RMI broad ocean area. **(Section 1.3.j)**	Defense Program	Throughout testing period as funds are available
11	Conduct additional marine surveys around all of the USAKA islands and in the Mid-Atoll Corridor. **(Section 1.3.i)**	Defense Program	As funds are available
12	A post-flight notification for MMIII and GBSD activities will be provided to USASMDC and USAG-KA. **(Section 4.3.c)**	Defense Program, USASMDC & USAG-KA	After test
13	Response to releases of oil, fuels and lubricants into the USAKA environment shall be in accordance with the Kwajalein Environmental Emergency Plan (KEEP) (UES §3-6.5.8) **(Section 1.4.c & 1.1.e)**	Defense Program, USAG-KA, & RTS	Prior to and after test
14	If cultural or historic remains are discovered, work shall cease and the USAG-KA Environmental Office shall be notified. The RMI Historic Preservation Office will then be notified in accordance with **Section 2.0.d**	Defense Program & USAG-KA	Prior to and after test
Land Impact Illeginni Requirements and Limitations			
15	Survey Illeginni Islet for sea turtles or sea turtle nests. Report as in **Section 2.0.h**. **(see Section 2.0.g)**	Defense Program, USAG-KA, & RTS	Weekly for at least 8 weeks prior to test
16	Conduct search for black-naped tern nests and chicks prior to any pre-test equipment mobilization. Flag discovered nests with at a stake 3 feet (1 meter) from nest to prevent disturbance. Prior to test, cover with an A-frame structure as per current USFWS guidance. **(Section 1.1.r)**	Defense Program. USAG-KA, & RTS	Prior to test
17	Cover support equipment with tarps or other material and/or use "scare" techniques (e.g., scarecrows, mylar ribbons, and/or flags) to prevent bird nesting on equipment. **(Section 1.1.s)**	Defense Program, USAG-KA, & RTS	Prior to test
18	For land impact, inspect beach area for active turtle nests or hauled out sea turtles at Illeginni Islet. **(Section 1.1.p)**	Defense Program & RTS	Prior to test, as close to launch as safely practicable

Number	Requirement	Responsible Party	Due Date
19	Survey the islet and near-shore waters for injured wildlife and damaged coral or sensitive habitat. **(Section 1.1.t)**	Defense Program, USAG-KA, & RTS	When feasible, within 1 day after land impact test
20	Test soil samples to ensure that the concentrations of Be, U, and other metals do not exceed established UES standards. **(Section 1.1.l, m)** If standards are exceeded, follow requirements in **Sections 1.1.l, m, & n**.	Defense Program & RTS	After test
21	If an RV impact affects the reef or shallow waters or debris enters these areas, mitigation measures in **Sections 1.1.u, v, w, & x**; **1.3.f, g, & h**; and **4.3.a** shall be implemented.	Defense Program, USAG-KA, RTS, & USASMDC	After test and within 24 hours
KMISS/Illeginni Vicinity Impact Requirements and Limitations			
22	Recover any floating debris from the test vehicle and properly dispose of it. **(Section 1.2.b)**	Defense Program, RTS & USAG-KA	After test
Reporting Procedures			
23	Record and report all action-related take of UES-consultation species **(Sections 1.3.h & 6.0.b)**	Defense Program & USASMDC	After test
24	Provide Survey/Impact Report to NMFS, RMIEPA, and USFWS. **(Sections 1.3.h (5) & 6.0.d)**	Defense Program & USASMDC	Within 6 months of end of each fiscal year (April 1 to September 30)
25	Notify the UES Appropriate Agencies and the Government of the RMI of a test event which involves a test failure, anomalies, or termination within the RMI. **(Section 6.0.a)**	Defense Program, USAG-KA, RTS, & USASMDC	Within 5 calendar days
26	Report any emergency notification of an incident involving species and habitats of special Concern to NMFS, USFWS, and the RMIEPA. **(Sections 1.3.h & 6.0.b)**	Defense Program & USASMDC	Within 10 calendar days
27	Update the 2012 MMIII Recovery Plan (Yakuma 2012) to include the GBSD Program. **(Section 1.2.a)**	Defense Program	Prior to test

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APPENDICES

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APPENDIX A Minuteman III Modification and Fuze Modernization Flight Tests / Ground-Based Strategic Defense Flight Tests Notice of Proposed Activity A-1

APPENDIX B Formal Consultation under the Environmental Standards for United States Army Kwajalein Atoll Activities in the Republic of the Marshall Islands Biological Opinion and Endangered Species Act- Section 7 Consultation for Ground Based Strategic Deterrent (GBSD) Test Program Activities 2021 ..... B-1

APPENDIX C Document of Environmental Protection (DEP): Minuteman III Modification and Fuze Modernization Flight Tests, DEP-14-003.0 January 2017 C-1

APPENDIX D Citations From the Final Ground-Based Strategic Deterrent (GBSD) Environmental Assessment/Overseas Environmental Assessment (EA/OEA) D-1

ABBREVIATIONS AND ACRONYMS

BA	Biological Assessment
Be	Beryllium
BO	Biological Opinion
BMP	Best Management Practice
CO_2	Carbon Dioxide
DAF	Department of the Air Force
DEP	Document of Environmental Protection
DOD	Department of Defense
DU	Depleted Uranium
ECA	Eniwetak Conservation Area
GBSD	Ground Based Strategic Deterrent
HAFB	Hill Air Force Base
ICBM	Intercontinental Ballistic Missile
IPCC	International Panel on Climate Change
KEEP	Kwajalein Environmental Emergency Plan
KMISS	Kwajalein Missile Impact Scoring System
LCU	Landing Craft Utility
LLNL	Lawrence Livermore National Laboratory
MMIII	Minuteman III
NCA	Notice of Continuing Activity
NMFS	National Marine Fisheries Service
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NPA	Notice of Proposed Activity
PBA	Programmatic Biological Assessment
PCCSP	Pacific Climate Change Science Program
RMI	Republic of the Marshall Islands
RMIEPA	Republic of the Marshall Islands Environmental Protection Authority
RMIHPO	Republic of the Marshall Islands Historic Preservation Office
RTS	Reagan Test Site (Ronald Reagan Ballistic Missile Defense Test Site)
RV	Reentry Vehicle
UES	USAKA Environmental Standards and Procedures
U	Uranium (measured as Depleted Uranium)
US	United States
USAF	United States Air Force
USAFGSC	United States Air Force Global Strike Command
USAG-KA	United States Army Garrison-Kwajalein Atoll
USAKA	United States Army Kwajalein Atoll
USASMDC	United States Army Space and Missile Defense Command
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
VSFB	Vandenberg Space Force Base

1.0 REQUIREMENTS AND LIMITATIONS

(Predetermined responsibility for tasks is provided where appropriate.)

1.1 General Requirements and Limitations:

a. Prior to a flight test, safety precaution measures shall be implemented. Within the Mid-Atoll Corridor nonessential personnel shall be evacuated and mission critical personnel shall be sheltered. Notices to Airmen (NOTAMs) and Notice to Mariners (NOTMARs) shall be published and circulated in accordance with established procedures. Radar and visual sweeps of the hazard area shall be accomplished immediately prior to a test flight to ensure clearance of non-critical personnel. [Defense Program, United States (US) Army Garrison-Kwajalein Atoll (USAG-KA), & Ronald Reagan Ballistic Missile Defense Test Site (RTS)]

b. Personnel shall conduct a helicopter or fixed-wing aircraft overflight in the vicinity of the Kwajalein Missile Impact Scoring System (KMISS) or Illeginni Islet impact area during the week prior to the test and as close to launch as safely practical to survey for marine mammals and sea turtles. The overflight shall be made within one day of the proposed launch if practicable. Results of all surveys including dates, times, surveyed area, number and species of organisms observed (or record of no marine mammal or sea turtle observations), and location of observations shall be consolidated and reported to the US Army Space and Missile Defense Command (USASMDC) for distribution to the National Marine Fisheries Service (NMFS) and Republic of the Marshall Islands (RMI) Environmental Protection Authority (RMIEPA) as per reporting requirements in Section 1.3.h(5). [Defense Program, USAG-KA, & RTS]

c. During terminal flight and impact at USAKA, each test reentry vehicle (RV) has the potential to affect land areas with sonic booms. There are no residences at Illeginni Islet or Gagan Islet. Gagan Islet is located at least 3 nautical miles (5.6 kilometers) west of the KMISS, where the test RVs would be targeting. The closest non-DoD receptors would be at Roi-Namur which is at least 6.8 miles from the KMISS area and 33 miles from Illeginni Islet. Range evacuation procedures during flight tests prevent residents or personnel from being subjected to noise-related impacts. During the flight test, personnel in the vicinity of the impact area shall comply with the Army's Hearing Conservation Program. Depending on their location, personnel may be required to wear hearing protection. [Defense Program]

d. Vessel operations, particularly in the vicinity of KMISS or Illeginni, shall only occur when weather and sea conditions are acceptable for safe travel. [Defense Program & USAG-KA]

e. Vessel operations shall not involve any intentional ocean discharges of fuel, toxic wastes, or plastics and other solid wastes that could potentially harm marine life. [Defense Program, USAG-KA, & RTS]

f. Prior to the shipment of test support equipment and materials from the US to RTS, the equipment shall be washed, and a certified Pest Control Technician or Military Veterinarian shall inspect the equipment to ensure that it does not contain any insects, animals, plants, or seeds. [Defense Program, USAG-KA, & RTS]

g. Prior to returning the test support equipment and materials to the US, the equipment shall be washed, and a certified Pest Control Technician shall inspect the equipment again to ensure that it does not contain any insects, animals, plants, or seeds that might

have been picked up during fielding. Personnel will be judicious and not overwater, to ensure the freshwater would evaporate in place and not flow into the lagoon. This will prevent possible contamination from entering the marine environment. [Defense Program, USAG-KA, & RTS]

h. To avoid impacts on coral heads off Gagan Islet and Illeginni Islet, sensor rafts shall not be located in waters less than 10 feet (3 meters) deep. [Defense Program & RTS]

i. During ocean travel to and from impact and test support areas, ship personnel shall monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators shall also adjust their speed based on expected animal densities, and on lighting and turbidity conditions. Opportunistic sightings of marine mammals and sea turtles should be recorded and reported as per procedures in Section 1.1.b. [Defense Program, USAG-KA, & RTS]

j. If practical within mission requirements, the flight test shall be conducted during midday when birds are typically at rest and less likely to be within the impact area. [Defense Program & RTS]

k. Following impact, all sensor rafts shall be recovered using Landing Craft Utility (LCU) vessels. [Defense Program]

l. Following a land-impact test, the Department of the Air Force (DAF) and USAG-KA shall collect soil and groundwater samples at various locations around the impact site and test the samples for Beryllium (Be), Depleted Uranium (DU) as Uranium (U), and other heavy metals (not limited to, but including: Arsenic, Barium, Cadmium, Chromium, Lead; see UES Table 2-22.1 and Table 3-6B.1). Field Duplicate (QA/QC) samples will be taken due to past heterogeneous sample results. Testing results exceeding the US Army at Kwajalein Atoll (USAKA) Environmental Standards and Procedures (UES) standards shall trigger an immediate investigation of the soil on Illeginni Islet, as detailed in the UES Section 3-6.5.8. Coordination shall be initiated with the Defense Program, USASMDC, RMIEPA, and the other UES Appropriate Agencies to determine the scope and methods/procedures to be followed during the investigation and any subsequent soil removal or other remediation activities. [Defense Program & RTS]

m. Following the soil investigation (see UES Section 3-6.5.8) required upon exceeding UES standards for Be, U, and other heavy metals (not limited to, but including: Arsenic, Barium, Cadmium, Chromium, Lead) the USASMDC shall transmit the records and reports of Be, DU, and other heavy metal concentrations in soil to the RMIEPA General Manager, US Environmental Protection Agency (USEPA) Region 9, NMFS Pacific Islands Regional Office, and the US Fish and Wildlife Service (USFWS) Pacific Islands Fish and Wildlife Office within two weeks from the date of receipt of such records from Lawrence Livermore National Laboratory (LLNL) or other analytical laboratories. [Defense Program & USASMDC]

n. During the above-referenced soil investigation, the possibility of UES-protected Consultation Species (UES Appendix 3-4A) moving into the area shall be monitored, and work shall be delayed until any such species is out of harm's way or leaves the work area of their own volition. [Defense Program & RTS]

o. The monitoring program for marine mammals established for the open water areas at USAKA shall be continued. Opportunistic sightings of marine mammals from various

air and watercraft operating in the Atoll shall be recorded and reported as per procedures in Section 1.1.b. As funds become available, remote sensing would be performed in the open water range south of Illeginni Islet and in the KMISS range east of Gagan Islet. [Defense Program, USAG-KA, & RTS]

p. As close to the time of launch as safely practical, qualified biologists or environmental staff members shall inspect the proposed impact area for sea turtles or evidence of active sea turtle nests. Such sightings shall be reported to the USAG-KA Environmental Office, the RTS Range Directorate, the Kwajalein Test Director, and USASMDC which will distribute sighting reports to USFWS, RMIEPA, and NMFS. [Defense Program, USAG-KA, & RTS]

q. Personnel shall conduct a helicopter or fixed-wing aircraft overflight of the impact vicinity as soon as safely practical after the test to survey for any dead or injured marine animals and sea turtles with reporting requirements as per **Section 2.0.e** of this Document of Environmental Protection (DEP). [Defense Program, USAG-KA, & RTS]

r. For land impacts on Illeginni, searches will be conducted for black-naped tern nests and chicks prior to any pre-test equipment mobilization. Any discovered nests in the action area will be flagged with a stake 3 feet (1 meter) from the nest to prevent disturbance. Prior to the test, nests in the impact area would be covered with A-frame structures as per current USFWS guidance. [Defense Program, USAG-KA, & RTS]

s. To prevent birds from nesting on the support equipment after initial setup, the equipment would be appropriately covered with tarps or other materials and "scare" techniques (e.g., scarecrows, mylar ribbons, and/or flags) would be used on or near the equipment. [Defense Program, USAG-KA, & RTS]

t. When feasible, within one day after the land impact test at Illeginni Islet, USAKA RTS environmental staff would survey the islet and the near-shore waters for any injured wildlife, damaged coral, or damage to sensitive habitats (i.e., reef habitat). Any impacts to biological resources would be reported to the UES Appropriate Agencies via USASMDC, with USFWS, RMIEPA, and NMFS offered the opportunity to inspect the impact area to provide guidance on mitigations. [Defense Program, USAG-KA, & RTS]

u. If an inadvertent impact occurs on the reef, reef flat, or in shallow waters less than 3 m deep, an inspection by project personnel would occur within 24 hours. Representatives from NMFS, USFWS, and RMIEPA would be offered the opportunity to inspect the site as soon as practical after the test. The inspectors would assess any damage to coral and other natural and biological resources and, in coordination with DAF, and RTS representatives, decide on any response measures that may be required. [USASMDC & RTS]

v. In the event of an RV impact that affects the reef, personnel shall secure or remove from the water any substrate or coral rubble from the ejecta impact zone that may become mobilized by wave action. [Defense Program & RTS]

w. If any man-made debris were to enter the marine environment and divers were required to search for payload debris on the adjacent reef flat, they would be briefed prior to operations about coral fragility and provided guidance on how to carefully retrieve the very small pieces of payload debris that they would be looking for. [Defense Program & RTS]

x. In the event of a RV impact that affects the reef, the Defense Program shall require its personnel or contractors to reduce impacts on corals, top shell snails, and giant clam mollusks. (Note: these requirements are also listed under Incidental Take Terms and Conditions, **Section 1.3** in this DEP.) [Defense Program & RTS]

(1) Survey the ejecta field for impacted corals, top shell snails, and giant clam mollusks. Also be mindful for any other UES-consultation species that may have been affected.

(2) Rescue and reposition any living top shell snails and giant clam mollusks that are buried or trapped by rubble.

(3) Relocate to suitable habitat, any living top shell snails and giant clam mollusks that are in the path of any heavy equipment that must be used in the marine environment.

y. In accordance with previous consultation with USFWS, the Defense Program shall abide by the 2005 USFWS Biological Opinion (BO; USFWS 2005) through 2030 and continue to maintain sea turtle nesting habitat on Eniwetak Islet based on the current Eniwetak Conservation Area (ECA) Management Plan developed and followed by USAG-KA. The ECA includes Eniwetak Islet and its marine waters and surrounding reefs extending at a minimum 984 feet (300 m) seaward of the mean low water line. The DAF plans to continue to fund and support the preserve through 2030. The ECA Management Plan (Kwajalein Range Services 2017) contains a detailed description of the conservation activities that the DAF supports in maintaining the preserve. These activities include protocols to ensure that unauthorized personnel do not have access to Eniwetak, enforcement of a no-anchor zone at the conservation area, sea turtle nest monitoring, and maintenance of sea turtle nesting habitat.

z. USAG-KA is responsible for UES compliance for all USAKA areas and activities (USASMDC 2021). USAKA activities within the RMI may include potential environmental effects that are outside of USAKA and that may need site-specific environmental studies (USASMDC 2021). In accordance with UES Section 2-5 USAG-KA Responsibilities, following any credible reports from local RMI communities outside of the leased area of debris impacts, including in or proximate to the Broad Ocean Area, USAG-KA representatives shall be invited by RMIEPA to assess reports and/or meet with local representatives.

1.2 KMISS/Illeginni Vicinity Impact Requirements and Limitations:

a. Prior to test, the Defense Program shall prepare a detailed cleanup plan that satisfies human health and safety requirements and incorporates measures to minimize ocean pollution. The Defense Program shall update the 2012 Minuteman III (MMIII) Recovery Plan for USAKA/RTS Illeginni Island to include the Ground Based Strategic Deterrent (GBSD). [Defense Program]

b. Although no floating debris from the delivery vehicle or payload impact in the vicinity is expected, ship personnel shall recover any floating debris from the vehicle after the test and properly dispose of it. This shall include the recovery of visible debris in shallow (less than 100 feet (30 meters)) ocean waters by range divers. [Defense Program, RTS, & USAG-KA]

c. Personnel shall conduct a helicopter or fixed-wing aircraft overflight of the impact area vicinity as soon as safely practical after the test to survey for any dead or injured marine animals. The date, time, survey location, and number, type, and location of organism (or report of no sightings) shall be reported to the USAG-KA Environmental Office, the RTS Range Directorate, the Kwajalein Test Director, and USASMDC; USASMDC shall then forward the information to the UES Appropriate Agencies. [Defense Program, USAG-KA, RTS, & USASMDC]

1.3 Incidental Take Terms and Conditions (Based on USFWS Biological Opinion 2005, NMFS Biological Opinion 2015, and NMFS Biological Opinion 2021) [Defense Program]

a. Incidental Take Statement: For MMIII, incidental take may occur in the form of harm or harassment to the breeding success; loss of up to three green turtle nests or injury, loss of up to 300 eggs or hatchlings. as a result of project-related payload impacts on USAKA and RTS. No payload impacts would occur at Illeginni Islet for the MMIII program; therefore, the take estimates in the 2015 BO for MMIII (NMFS 2015) have been superseded and no take of top shell snails or coral colonies would occur or is authorized.

b. Incidental Take statement: For GBSD, flight tests at USAKA might result in incidental take of up to 31,224 colonies within seven UES-consultation coral species, up to nine top shell snails, up to 219 individuals within two clam species, and up to 324 humphead wrasse.

c. Payload shall be aimed away from known sea turtle nesting areas within the Mid-Atoll Corridor Impact Area in order to minimize the number of turtle nests destroyed (non-discretionary term of 2005 USFWS BO). [Defense Program]

d. The Defense Program shall inspect the impact zones to assess sea turtle mortality after the Flight Test (non-discretionary term of 2005 USFWS BO). Baseline data shall be collected at Illeginni prior to the Flight Test for comparison purposes.

e. The Defense Program shall reduce impacts on UES-protected corals and mollusks and their habitats through the employment of Best Management Practices (BMPs) and conservation measures (non-discretionary term of 2021 NMFS BO).

(1) The Defense Program shall ensure that personnel comply fully with the BMPs, and conservation measures identified in the 2015 Biological Assessment (BA), the 2021 BO (NMFS 2021), and provided in the sections below.

(2) The Defense Program shall work with USAG-KA, RTS, and USASMDC to ensure that all relevant personnel associated with MMIII and GBSD flight tests are fully briefed on the BMPs and the requirement to adhere to them for the duration of MMIII and GBSD flight tests.

f. In the event the payload land impact affects the reef at Illeginni, the Defense Program shall require its personnel to secure or remove from the water any substrate or coral rubble from the ejecta impact zone that may become mobilized by wave action as soon as possible (non-discretionary term of 2021 NMFS BO).

(1) Ejecta greater than six inches in any dimension shall be removed from the water or positioned such that it would not become mobilized by expected wave action, including replacement in the payload crater.

(2) If possible, coral fragments greater than six inches in any dimension shall be positioned on the reef such that they would not become mobilized by expected wave action, and in a manner that would enhance coral fragments survival; away from fine sediments with the majority of the living tissue (polyps) facing up.

(3) UES consultation coral fragments that cannot be secured in-place should be relocated to suitable habitat where they are not likely to become mobilized.

g. In the event the payload land impact affects the reef at Illeginni, the Defense Program shall require its personnel to reduce impacts on top shell snails and clams (non-discretionary term of 2021 NMFS BO).

(1) Rescue and reposition any living top shell snails and clams that are buried or trapped by rubble.

(2) Relocate to suitable habitat, any living top shell snails and clams that are in the path of any heavy equipment that must be used in the marine environment.

h. All action-related take of UES-consultation species shall be recorded and reported by the Defense Program through USASMDC (non-discretionary term of 2021 NMFS BO). [Defense Program & USASMDC]

(1) The Defense Program shall assign appropriately qualified personnel to record all suspected incidences of take of any UES-consultation species.

(2) The Defense Program shall utilize digital photography to record any UES-consultation species that is found injured or killed in or near the ocean target areas. As practicable: 1) Photograph all damaged corals and/or other UES-consultation species that may be observed injured or dead; 2) Include a scaling device (such as a ruler) in photographs to aid in the determination of size; and 3) Record the location of the photograph.

(3) In the event the payload impact affects the reef at Illeginni, the Defense Program shall require its personnel to survey the ejecta field for impacted corals, top shell snails, and clams. Also be mindful for any other UES consultation species that may have been affected.

(4) Within 60 days of completing post-test clean-up, the Defense Program shall provide photographs and records through USASMDC to the USAG-KA Environmental Office. Qualified biologists or environmental staff members and NMFS biologists shall review the photographs and records to identify the organisms to the lowest taxonomic level accurately possible to assess impacts on consultation species.

(5) Within 6 months of completion of each fiscal year (April 1–September 30), the Defense Program, through USASMDC, shall provide an annual report for submittal to USFWS, RMIEPA, and NMFS (non-discretionary term of 2005 USFWS BO and 2021 NMFS BO). The report shall identify:

i. The flight test and date;

ii. The target area;

iii. The results of the pre- and post-flight surveys and associated data;

iv. The identity and quantity of affected resources (include photographs and videos as applicable); and

v. The disposition of any relocation efforts.

i. As funds become available, the Defense Program shall conduct additional marine surveys around all of the USAKA islands and in the Mid-Atoll Corridor to develop a

more comprehensive understanding of the distribution and abundance of species and habitats at USAKA (discretionary conservation recommendation from 2021 NMFS BO).

j. As funds become available, the Defense Program shall conduct regular (monthly or quarterly if possible) surveys of the KMISS and the RMI broad ocean area to develop a better understanding of the distribution and abundance of marine mammals and other species in the area (discretionary conservation recommendation from 2015 NMFS BO).

k. As funds become available, the Defense Program shall support development of USAG-KA's capacity and procedures for responding to marine mammal and turtle strandings (discretionary conservation recommendation from 2021 NMFS BO). To provide this capacity, USAG-KA shall:

(1) Acquire required permits and training to perform necropsies and/or to take and transport tissue samples.

(2) Develop professional relations with qualified federal agencies and universities to capitalize on samples and information gained at USAKA.

(3) Develop mechanisms to collect and disseminate the information.

l. If, during the course of the action, the level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of the consultation and review of the reasonable and prudent measures provided and activities causing or contributing to the taking shall immediately cease. The Defense Program, through USASMDC, shall immediately provide an explanation of the causes of the taking, and review with the USFWS or NMFS, as applicable, the need for possible modification of the reasonable and prudent measures. (Non-discretionary term of 2005 USFWS BO and 2021 NMFS BO)

m. Reinitiation of formal consultation with NMFS is required if the amount or extent of anticipated incidental take is exceeded; new information reveals that the action may affect UES-protected marine species or critical habitat in a manner or to an extent not considered in the BOs; the action is subsequently modified in a manner that may affect UES-protected marine species or critical habitat to an extent, or in a manner not considered in the BOs; or a new species is listed or critical habitat designated that may be affected by the action. (Non-discretionary term of 2021 NMFS BO)

1.4 **Material and Waste Management:**

a. Hazardous waste treatment or disposal is prohibited at USAKA except as documented in a Final DEP [UES §3-6.6.5(a)].

b. All activities at USAKA importing activity-specific hazardous materials into USAKA shall submit within 15 days of receiving the material or before actual use, whichever comes first, a separate Hazardous Materials Procedure to the Commander, USAG-KA, for approval (UES §3-6.4.3).

c. Response to releases of oil, fuels and lubricants into the USAKA environment shall be in accordance with the Kwajalein Environmental Emergency Plan (KEEP) (UES §3-6.5.8).

(1) Any accidental spills from support equipment operations would be contained and cleaned up and all waste materials would be transported to Kwajalein Islet for proper disposal.

(2) Vessel and heavy equipment operators would inspect and clean equipment for fuel or fluid leaks prior to use or transport and would not intentionally discharge fuels or waste materials into terrestrial or marine environments.

d. Delivery vehicle and payload debris could consist of batteries and various heavy metal components that include small quantities of Be, chromium and nickel alloys. All waste materials collected by the Defense Program shall be returned to USAKA for proper storage and disposal in accordance with the UES.

e. Debris recovery and site cleanup would be performed for a land impact. To minimize long-term risks to marine life, all visible project-related man-made debris would be recovered during post-flight operations. In all cases, recovery and cleanup would be conducted in a manner to minimize further impacts on biological resources.

(1) All project-related debris, trash, and equipment would be removed from the beach and dunes if not actively being used

(2) No project-related materials or equipment would be stockpiled or stored in the intertidal zone, reef flats, sandy beach and adjacent vegetated areas.

f. Project Activities would incorporate the applicable USFWS "Recommended Standard Best Management Practices" regarding work in aquatic environments. Any necessary dredge and fill activities would be carried out after consultations with UES Appropriate Agencies and USAG-KA. BMPs include the following:

(1) Authorized dredging and filling-related activities that may result in the temporary or permanent loss of aquatic habitats should be designed to avoid indirect, negative impacts to aquatic habitats beyond the planned project area.

(2) Dredging/filling in the marine environment should be scheduled to avoid coral spawning and recruitment periods, and sea turtle nesting and hatching periods.

(3) Turbidity and siltation from project-related work should be minimized and contained within the project area by silt containment devices and curtailing work during flooding or adverse tidal and weather conditions. BMPs should be maintained for the life of the construction period until turbidity and siltation within the project area is stabilized. All project construction-related debris and sediment containment devices should be removed and disposed of at an approved site.

(4) All project-related materials and equipment (dredges, vessels, backhoes, silt curtains, etc.) to be placed in an aquatic environment should be inspected for pollutants including, but not limited to; marine fouling organisms, grease, oil, etc., and cleaned to remove pollutants prior to use. Project related activities should not result in any debris disposal, non-native species introductions, or attraction of non-native pests to the affected or adjacent aquatic or terrestrial habitats.

(5) Project-related materials (fill, revetment rock, pipe, etc.) and equipment should not be stockpiled in, or in close proximity to aquatic habitats and should be protected from erosion (e.g., with filter fabric, etc.), to prevent materials from being carried into waters by wind, rain, or high surf.

(6) Fueling of project-related vehicles and equipment should take place away from the aquatic environment and a contingency plan to control petroleum products accidentally spilled during the project should be developed. The plan should be

retained on site with the person responsible for compliance with the plan. Absorbent pads and containment booms should be stored on-site to facilitate the clean-up of accidental petroleum releases.

(7) All deliberately exposed soil or under-layer materials used in the project near water should be protected from erosion and stabilized as soon as possible with geotextile, filter fabric or native or non-invasive vegetation matting, hydro-seeding, etc.

2.0 MONITORING PROCEDURES

a. Personnel shall conduct a helicopter or fixed-wing aircraft overflight of the impact area and vicinity over the week prior to the flight test and as close to the proposed test launch time as safely practicable. The overflight shall be made within one day of the proposed launch if practicable. Survey data including date, time, location, number and type of organisms observed, or reports of no sightings when animals are not seen, shall be reported to the USAG-KA Environmental Office, the RTS Range Directorate, the Flight Test Operations Director, and USASMDC; USASMDC would distribute survey reports to UES Appropriate Agencies including NMFS, USFWS, and RMIEPA. [Defense Program, USAG-KA, & RTS]

b. During travel to and from Gagan, Illeginni, and KMISS, personnel shall monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators shall adjust their speed based on expected animal densities, and on lighting and turbidity condition. [Defense Program, RTS & USAG-KA]

c. Any marine mammals or sea turtle opportunistic sightings or survey data collected during ship travel, overflights, and deployment of the free-floating sensors in the vicinity of KMISS or Illeginni Islet impact areas (including date, time, survey location, number and type of organisms, or reports of no sightings when animals are not seen) shall be reported to the USAG-KA Environmental Office, the RTS Range Directorate, and the Flight Test Operations Director, and USASMDC. USAG-KA aircraft pilots flying in the vicinity of the impact and test support areas shall also report any opportunistic sightings of marine mammals and sea turtles. USASMDC and the USAG-KA Environmental Office shall maintain records of these observations and USASMDC shall distribute survey reports to RMIEPA, NMFS, and/or USFWS within 6 months of completion of each fiscal year (April 1–September 30). [Defense Program, USAG-KA, & RTS]

d. If cultural or historic remains are discovered during the activities, work shall cease and the USAG-KA Environmental Office shall be notified. The RMI Historic Preservation Office (RMIHPO) shall be notified, and appropriate mitigation measures, developed in consultation with the RMIHPO, shall be implemented to minimize the effects on the resource or to recover as much of the resource as possible (conforming to professional standards for research), as directed by UES §3-7.5.7. The USAG-KA Environmental Office shall notify USASMDC if cultural or historic remains are discovered during the activities, and USASMDC shall alert the UES Appropriate Agencies as soon as possible. [Defense Program & USAG-KA]

e. Post-test overflights of the impact area shall be conducted to survey for dead or injured cetaceans and sea turtles. Although unlikely, any dead or injured marine mammals or

sea turtles sighted shall be reported immediately to USASMDC and the USAG-KA Environmental Office; USASMDC shall as soon as possible, and within 24 hours, inform RMIEPA, NMFS, and USFWS. USAG-KA aircraft pilots otherwise flying in the vicinity of the impact and test support areas shall also report any opportunistic sightings of dead or injured marine mammals or sea turtles through the aforementioned procedures. All survey data including the date, time, location, and number and type of animals found, or reports of no dead or injured animal observations shall be collected and reported to UES Appropriate Agencies via USASMDC. [Defense Program, USAG-KA, &RTS]

f. During post-test recovery and cleanup, should personnel observe highly mobile endangered, threatened, or other species requiring consultation moving into the area, work shall be delayed until such species are out of harm's way or leave the area of their own volition. [Defense Program & RTS]

g. Pre-flight monitoring by qualified personnel will be conducted on Illeginni Islet for sea turtles or sea turtle nests. For at least 8 weeks preceding the launch, Illeginni Islet shall be surveyed weekly by pre-test personnel for sea turtles, sea turtle nesting activity, and sea turtle nests. If possible, personnel will inspect the area within days of the launch. If sea turtles or sea turtle nests are observed near the impact area, observations would be reported to appropriate test and USAG-KA personnel for consideration in approval of the launch, and to RMIEPA, USFWS, and NMFS via USASMDC. [Defense Program, USAG-KA, & RTS]

h. Personnel will report any observations (including location, date, time, species, and number of individuals) of sea turtles or sea turtle nests on Illeginni Islet to USASMDC and the USAG-KA Environmental Office which would maintain records of these observations; USASMDC would distribute sighting report to RMIEPA and USFWS. [Defense Program, USAG-KA, & RTS]

3.0 MINOR DEP MODIFICATIONS

Minor modifications to this DEP may be accomplished under the provisions of UES §2-17.3.6(e).

4.0 NOTIFICATION PROCEDURES

4.1 Emergency Notifications Material and Waste Management

a. Within 24 hours of discovery of an emergency environmental condition, USAG-KA shall notify the public affected or potentially affected by the condition by the most expeditious means available. Within 24 hours of discovery of an emergency environmental condition, USAG-KA shall notify USASMDC who shall notify the UES Appropriate Agencies by the most expeditious means available.

b. Within 10 days following emergency notification, USAG-KA shall submit written notification of the event that contains at a minimum the relevant information described in UES §2-7.2.2 to USASMDC who shall notify the UES Appropriate Agencies.

c. Emergency notifications shall be made for any condition that poses an immediate threat to human health, safety, or a sensitive natural or cultural resource, and any other condition that the Commander, USAG- KA, determines to constitute an emergency condition (UES §2-7.3.1).

4.2 Public Notifications

a. Public notifications shall be made by USAG-KA to advise the public of an activity or action that USAG-KA has taken or is planning as a result of emergency conditions.

b. Public notification made as a result of emergency conditions shall be made in *The Kwajalein Hourglass* and *The Marshall Islands Journal*, posters or bulletins displayed in public places, and announcements on public television.

c. NOTAMs and NOTMARs shall be published and circulated in accordance with established procedures prior to each test.

4.3 Agency Notification

a. In the event that any species or habitat of Special Concern as stated in UES Appendices 3-4A thru 3-4D, are disturbed, transplanted, injured, or killed due to test activities, NMFS, USFWS, and RMIEPA shall be informed by USASMDC within 24 hours. [Defense Program, USASMDC & USAG-KA]

b. If cultural or historic remains or artifacts are discovered during the course of MMIII and GBSD activities, work at the site shall cease and the USAG-KA Environmental Office shall be notified. The RMIHPO shall be notified, and appropriate mitigation measures, developed in consultation with the RMIHPO, shall be implemented to minimize the effects on the resource or to recover as much of the resource as possible (conforming to professional standards for research), as directed by UES §3-7.5.7. [Defense Program & USAG-KA]

c. A post-flight notification for MMIII and GBSD activities will be provided to USASMDC and USAG-KA after each test.

5.0 RECORDS KEEPING

a. The Notice of Proposed Activity (NPA), Environmental Comments and Recommendations, and the DEP permitting MMIII and GBSD activities at USAKA shall be preserved for the duration of the activity plus 10 years or for 10 years after expiration of the DEP, whichever is less. (UES §2-13.2.7)

b. All records associated with the activity shall be maintained for at least 5 years. (UES §2-13.2)

c. Personnel-training records shall be preserved for 10 years beyond the period the employee is engaged in activities potentially affecting the environment at USAKA (UES §2-13.2.1).

d. Survey data and reports associated with pre- and post-test flights and vessel activities, including number and types of species observed, reports of no observations, general locations, times, dates, and other associated information, shall be preserved for the duration of the activity plus 10 years or for 10 years after expiration of the DEP, whichever is less.

6.0 REPORTING PROCEDURES

a. In the event of a test failure, anomalies, or termination, the respective Defense Program's Project Office shall provide a notification statement to the Government of the RMI, via the USAG-KA Host Nation Office and US Embassy, within five days of a test

event which involves a test failure, anomalies, or termination. This notification statement shall include the location, safety, and environmental consequences of the event. USASMDC, in coordination with USAG-KA, shall be responsible for alerting the UES Appropriate Agencies.

b. A written report shall be provided to NMFS, USFWS, and the RMIEPA by USASMDC within 10 days following any emergency notification as per UES§2-7.3.1 of an incident resulting in the disturbance, transplant, injury, or death of any species or habitat of Special Concern as stated in UES Appendices 3-4A thru 3-4D. The report shall provide the type and number of organisms disturbed, transplanted, injured, or killed; their condition; the locations and conditions of the original and new habitats; and the projected chances of recovery if injured.

c. A written report shall be provided by USASMDC to the UES Appropriate Agencies if any of the requirements of the DEP or the UES are violated during the activity covered by this DEP within 30 days of the violation.

d. Within 6 months of completion of each fiscal year (April 1–September 30), the Defense Program, through USASMDC, shall provide an annual report for submittal to RMIEPA, USFWS, and NMFS. The report shall identify:

(1) The flight test and date;
(2) The target area;
(3) The results of the pre- and post-flight surveys and associated data;
(4) The identity and quantity of affected resources (include photographs and videos as applicable); and
(5) The disposition of any relocation efforts.

7.0 RESOLUTION OF NONCOMPLIANT AREAS

Currently there are no known non-compliant MMIII and GBSD testing activities at RTS. With the implementation of the requirements, limitations, and monitoring protocols described in this DEP, MMIII and GBSD testing activities at RTS shall be in full compliance with the current UES Edition.

8.0 A CONSIDERATION OF CLIMATE CHANGE IMPACTS

Background Information: Climate change may be affecting marine ecosystems at Kwajalein Atoll. Climate refers to average weather conditions within a certain range of variability. The term climate change refers to distinct long-term changes in measures of climate, such as temperature, rainfall, snow, or wind patterns lasting for decades or longer. Climate change may result from the following: natural factors, such as changes in the Sun's energy or slow changes in the Earth's orbit around the sun; natural processes within the climate system (e.g., changes in ocean circulation); and human activities that change the atmosphere's makeup (e.g., burning fossil fuels) and the land surface (e.g., cutting down forests, planting trees, building developments in cities and suburbs, etc.), also known as anthropogenic climate change (USEPA 2022). The global mean surface temperature in 2020 was 1.76°F (0.98ºC) warmer than the 20th century average and 2.14˚F (1.19˚C) warmer than the pre-industrial period (1880-1900; NOAA 2021). Anthropogenic release of CO_2 from fossil fuel combustion is considered the largest contributor to global climate change and has resulted in a 43% increase in atmospheric concentrations of greenhouse gases since 1850 (USEPA 2022, USEIA 2022). While there are some projections that US energy-

related emissions will decrease slightly by 2050 (2% lower than 2021 levels), world CO_2 emissions are projected to continue to increase (USEIA 2022). If emissions continue to rise, projected global temperatures will continue to rise as well (NOAA 2021). Sea level has risen approximately 8 to 9 inches (21-24 cm) since 1880 and further increases are expected even if significant reductions in greenhouse gas emissions are made (NOAA 2020).

Climatic impact-drivers are physical climate system conditions (e.g., means, events, extremes) that affect an element of society or ecosystems. Depending on system tolerance, climatic impact-drivers and their changes can be detrimental, beneficial, neutral or a mixture of each across interacting system elements and regions (International Panel on Climate Change [IPCC] 2021). According to the most recent reports on Climate Change, IPCC 2021, the following climatic impact-drivers are projected to be of the most concern to the Pacific Islands before 2050: mean air temperature, atmospheric CO_2 at the surface, ocean acidity, relative sea level, marine heatwave, coastal flooding, coastal erosion, heavy precipitation and pluvial (rain) flood, and extreme heat. Trends in the RMI are consistent with global patterns of warming and sea level rise. At Kwajalein, maximum temperatures increased at a rate of 0.36ºF (0.20ºC) per decade between 1960 and 2011 (PCCSP 2011) and mean air temperatures have increased 1-2ºC in the RMI since the 1950s (The Nature Conservancy n.d.). Sea level in the RMI rose approximately 0.3 inches (0.7 cm) per year between 1993 and 2011 (PCCSP 2011) with tide gauge data indicating a rise of approximately 5-6 inches since between 1968 and 2015 (The Nature Conservancy n.d.). Another consequence of increasing global CO_2 levels that has the potential to impact the environment at Kwajalein Atoll is ocean acidification. Ocean acidification has been slowly increasing in Marshall Islands' waters since the 18th century (PCCSP 2011). Ocean acidification and ocean temperatures are expected to continue to rise in the next several decades (Australian Bureau of Meteorology 2014).

Biological Impacts: Based on expected global and RMI trends, global climate change is expected to continue to impact UES-protected marine species and their habitats, especially on those species that are dependent on shallow coastal reefs and shorelines, such as corals and marine mollusks. Given the small area and low numbers of individuals expected to be adversely affected by the Proposed Action, the possible additive and/or synergistic impacts of climate change combined with the effects of the Proposed Action are not expected to be significant for the corals, mollusks, and fish considered in the 2021 NMFS BO. Climate change-induced elevated water temperatures, altered oceanic chemistry, and rising sea level may be contributing to changes to coral reef ecosystems, and is likely beginning to affect corals and mollusks found in the action area (see NMFS and USFWS 2021). Climate change is a global phenomenon and widespread coral bleaching events have been recorded in the Tropical Pacific (Eakin et al. 2018), so resultant impacts have likely been occurring in the action area. However, scientific data describing climate change impacts in the action area are lacking. Additional surveys of the Illeginni Islet reefs area are planned to gain additional understanding of the environmental conditions in the action area.

Air Quality Impacts: Over the expected lifetime of the Proposed Action, launch vehicle exhaust products and other launch operation emissions are not anticipated to accumulate due to winds dispersing them between flight tests. In terms of upper atmospheric effects, emissions released

may add to the overall global loading of chlorine and other gases that contribute to long-term ozone depletion. However, the amount of emissions released from rocket motors is negligible compared to losses of ozone from other global sources. Because the emissions would represent an extremely small percentage of total loading, they should not significantly contribute to the cumulative impact on stratospheric ozone.

Limitations & Requirements: Launch vehicle exhaust products, and other launch operation emissions, are not anticipated to accumulate due to winds dispersing them between flight tests. MMIII RVs would not impact land, and up to three land impacts may occur from the GBSD RV tests between 2022 and end of fiscal year 2029. In terms of upper atmospheric effects, emissions released over the Broad Ocean Area between VSFB and RTS may add to the overall global loading of chlorine and other gases that contribute to long-term ozone depletion. However, the effects within the Region of Influence at the KMISS range located off the east reef near Gagan Islet, Illeginni Islet, and in the vicinity of Illeginni Islet would not be expected to be significant. The amount of emissions released from rocket motors is negligible compared to losses of ozone from other global sources. Because the emissions from the Proposed Action would represent an extremely small percentage of total loading, they should not significantly contribute to the cumulative impact on stratospheric ozone. Data describing specific, measurable climate change impacts in the Region of Influence are lacking. Additional surveys of the Illeginni Islet reefs area are planned to gain additional understanding of the environmental conditions in the action area. In addition to the uncertainty of the rate, magnitude, and distribution of future climate change and its associated impacts on temporal and spatial scales, the adaptability of species and ecosystems are also unknown. Overall, climate change may be affecting marine ecosystems at Kwajalein Atoll, however, given the global nature of climate change and the current state of the data specific to the Region of Influence, it is not useful at this time to attempt to link the estimated emissions for local actions to any specific climatological change or resulting environmental impact.

9.0 ENVIRONMENTAL COMMENTS AND RECOMMENDATIONS RECEIVED ON THE 2022 DRAFT DEP AND USAG-KA'S RESPONSES

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: The certified pest control technician is on The USAG-KA side of the contract.

USAG-KA RESPONSE: "USAG-KA" added to the list of responsible parties for items 4 and 5 of the Milestone Schedule (page vii).

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: Flights are on the USAG-KA side of the contract, clarification on responsible party is requested.

USAG-KA RESPONSE: "USAG-KA" added to the list of responsible parties in Item Number 7 of the Milestone Schedule (page vii). Retained Defense Program and RTS in list of parties as these organizations are also responsible for ensuring compliance.

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: BMPs in the biological opinions specify USAG-KA Environmental Engineer maintains records, clarification on responsible party is requested

USAG-KA RESPONSE: "USAG-KA" added to the list of responsible parties in Item Number 8 of the Milestone Schedule (page vii). The full recording procedure is specified in Section 2.0.c.

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: Clarification of responsible party is requested, this work has been conducted on the mission side of the contract.

USAG-KA RESPONSE: The responsible parties have been updated to Defense Program, USAG-KA, and RTS in Item Number 15 of the Milestone Schedule (page viii).

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: Clarification of responsibility is needed.

USAG-KA RESPONSE: "USAG-KA" added to responsible parties in Section 1.1.b (page 1).

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: Pest Control is a separate contractor and may need specific direction to complete this task.

USAG-KA RESPONSE: Responsibility for implementation of requirement 1.1.g (page 1) revised to Defense Program, USAG-KA, and RTS.

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: The biological opinion lists reporting requirements for sea turtle and marine mammal observations. Language should be added to the DEP to clarify requirements and responsible party.

USAG-KA RESPONSE: All reporting requirements listed in the Biological Opinion (BO) are listed in DEP Sections 1.3 (pages 5-7) and 6.0 (pages 11-12). The responsible party for implementation of these measures is the Defense Program (DAF) (as specified in the BO). Added "[Defense Program]" to Section 1.3 (page 5) to clarify for those sub items where no specifics were given.

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: This would be an opportunity for opportunistic marine mammal and sea turtle observations.

USAG-KA RESPONSE: Added "Opportunistic sightings of marine mammals and sea turtles should be recorded and reported as per procedures in Section 1.1.b." to 1.1.i (page 2) which applies to all vessel traffic.

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: Clarify the responsible party.

USAG-KA RESPONSE: Section 1.1.o (page 2) revised to indicate that the Defense Program, USAG-KA, and RTS would be responsible for this requirement.

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: USASMDC should receive reports and distribute to USAG-KA and appropriate agencies

USAG-KA RESPONSE: Added USASMDC as receiver and distributor of reports in Section 1.1.p (page 3) and in Section 1.1.b (page 1).

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: RTS environmental staff may better describe responsible party for this action.

USAG-KA RESPONSE: "[Defense Program, USAG-KA, & RTS]" added as responsible parties in Section 1.1.t (formerly 1.1.u, page 3).

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: USASMDC should receive reports and distribute to USAG-KA and appropriate agencies

USAG-KA RESPONSE: "via USASMDC" added to reporting requirements in Section 1.1.t (formerly 1.1.u, page 3).

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: Efforts to be completed by divers or RGNext personnel?

USAG-KA RESPONSE: Revised Section 1.1.x (page 3) to read "the Defense Program shall require its personnel or contractors to…".

USAG-KA/RTS ENVIRONMENTAL CONTRACTOR COMMENT: Clarification of the responsible party is needed. The language in Section 2.0 Monitoring Procedures does not always align with the checklist requirements. With multiple contractors involved it needs to be clear on specific responsibilities.

USAG-KA RESPONSE: Revisions were made to the DEP to clarify responsible parties for Monitoring Procedures. Revised DEP Section 2.0.a, c, e, g, & h (pages 9–10) and the Milestone Schedule Item Numbers 4, 5, 7, 8, 9, 15, 16, 17, 19, & 20 (pages vii-ix).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: This paragraph (and the one below) suggests the MMIII to GBSD transition will occur over 10 years, so it appears another MMIII-GBSD DEP will be needed in 2027, with a GBSD specific DEP anticipated in 2032 (which differs a little bit from what seems to be suggested).

USAG-KA RESPONSE: The period covered in this 2022 DEP is 2022-2027. Additional language was added to clarify that this 2022 DEP would expire after a period of 5 years, thereby requiring that a future GBSD DEP and NCA would be required to cover flight tests occurring after 2027. Per the GBSD EA/OEA and DEP, flight tests are only planned through end of fiscal year 2029. Therefore, the future 2027 DEP and NCA would cover all planned flight tests. Revisions made to Technical Description of Activity (page v).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Should "USAG-KA" be changed here to "USAKA"?

USAG-KA RESPONSE: Changed to USAKA in the Technical Description of Activity (page vi).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Suggest replacing with, "RTS is a tenant of USAG-KA at USAKA, which includes 11 RMI islets leased by the United States, the mid-atoll corridor and surrounding air and water areas at Kwajalein Atoll."

USAG-KA RESPONSE: Suggested changes made in the Technical Description of Activity (page vi).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend removing "continued" from the statement. The NMFS previously expressed concerns that active DEP reporting requirements were not being met. It appears USAKA is seeking to remedy this, but if previous practices/understandings of compliance "continue" as before (which this may be interpreted to suggest), we have not progressed. That is the reason for the recommended change.

USAG-KA RESPONSE: Removed "continued" from the Technical Description of Activity (page vi).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Typo: change "inured" to "injured"

USAG-KA RESPONSE: Revised Milestone Schedule Item Number 9 (page vii) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend adding, "The results of all surveys, including flight dates and times, areas surveyed, numbers and types of organisms observed during each flight (including flight reports of 0 when organisms are not observed), and general locations of observed organisms, shall be consolidated and reported to NMFS and the RMIEPA within 6 months following each test.", or something reasonably similar. NMFS is interested in receiving continuing confirmation these surveys are occurring and, importantly the data associated with each survey.

USAG-KA RESPONSE: Added to Section 1.1.b (page 1) "Results of all surveys including dates, times, surveyed area, number and species of organisms observed (or record of no marine mammal or sea turtle observations), and location of observations shall be consolidated and reported to NMFS and RMIEPA as per reporting requirements in Section 1.3.h(5)."

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend changing "would" to "shall"

USAG-KA RESPONSE: Revised in Section 1.1.l (page 2) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend that the USEPA be included as a recipient of the Be and DU soil concentration records. Might make sense to just send reports to all the UES Appropriate Agencies.

USAG-KA RESPONSE: Added a callout to notify USEPA Region 9 in Section 1.1.m (page 2).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Remove "for" after monitoring. Also, protected species covers UES Appendices 3-4A and C. Is this activity geared to address all UES consultation and coordination species (including birds), or just consultation species, and do species "intruders" need to leave on their own volition, or is flushing intended/desired (if the latter, all species, or just some)?

USAG-KA RESPONSE: Removed "for". This particular requirement addresses UES consultation species (UES Appendix 3-4A). Clarifying text added. Added "until animals leave the work area of their own volition." Revised in DEP Section 1.1.n (page 2).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Following, "collected", Add, "and shall be reported to the NMFS and the RMIEPA, along with dates, times, types of organisms, numbers observed and general locations, within 6 months following each test.", or something reasonably similar. NMFS is interested in receiving continuing confirmation these surveys are occurring and, importantly the data associated with each survey.

USAG-KA RESPONSE: Added "and reported as per procedures in Section 1.1.b" to Section 1.1.o (page 2).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend relocating what is found in t. to follow u and v.

USAG-KA RESPONSE: Revised by relocating Section t as recommended. Section t is now Section 1.1.v (page 3).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Please indicate the timeframe within which this plan will be developed and released.

USAG-KA RESPONSE: Added, "Prior to test" and added sentence to Section 1.2.a (page 4) to include Milestone Schedule Item Number 27.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend changing to, "… with USFWS,
NMFS and RMIEPA offered the opportunity to inspect the impact area, and to provide guidance on mitigations."

USAG-KA RESPONSE: Revised Section 1.1.t (formerly 1.1.u, page 3) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: It isn't clear that take of UES consultation corals and mollusks continues to be authorized for MMIII activities, given subsequent determinations and communications that MMIII impacts at Illeginni would not occur. Presumably, the GBSD biological opinion did not

consider further potential for MMIII take, so there is no additivity, as may be inferred. While historically accurate, this item should include language specifying that the previous take estimates for the MMIII have been superseded (i.e. 0 take for that program), but that the USFWS has authorized the 2005 BO application of take levels for turtle nests and eggs related to GBSD activities.

USAG-KA RESPONSE: Revised Section 1.3.a (page 5) to state "No payload impacts would occur at Illeginni Islet for the MMIII program; therefore, the take estimates in the 2015 BO for MMII have been superseded and no take of top shell snails or coral colonies would occur or is authorized."

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend changing to, "… The flight dates, times, vicinities surveyed, and survey results (sightings including number and types of organisms and their locations, and reports of no sightings when organisms are not seen), shall be reported to ….", or something reasonably similar. NMFS is interested in receiving continual confirmation these surveys are occurring and, importantly the data associated with each survey.

USAG-KA RESPONSE: Revised Section 1.2.c (page 5) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Change "top shell snails" to "mollusks", as additional mollusk species have been added to UES Appendix 3-4A and are known to occur in the shallow lagoon reef area of the projected Illeginni impact zone.

USAG-KA RESPONSE: Revised Section 1.3.e (page 5) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Typo: working through plural use, so recommend changing "its" to "their"

USAG-KA RESPONSE: Revised Section 1.3.f(2) (page 6) to "coral fragments".

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Typo: similar to above, recommend changing "it is" to "they are"

USAG-KA RESPONSE: Revised Section 1.3.f (3) (page 6) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Suggest "USAG-KA and NMFS" be changed to "USAG-KA, RMIEPA and NMFS", as these are RMI resources and they have a regulatory role in marine-based UES consultations.

USAG-KA RESPONSE: Revised Section 1.3.h(5) (page 6) to indicate the annual report would be submitted to USFWS, RMIEPA, and NMFS.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Add, "and associated data" following "surveys", as NMFS is keen to receive the underlying data on flights, dates, times, observations, species, locations, etc. to refine/justify current and future risk assessments related to reentry vehicle type mission activities.

USAG-KA RESPONSE: Revised Section 1.3.h(5)iii (page 6) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Thank you. Let's please work to find some funding to ensure we base future risk assessments on meaningful, site specific data. Sampling using multiple hydrophones over time would be really valuable.

USAG-KA RESPONSE: Thank you for stressing the importance of obtaining valuable site-specific data for the RTS impact areas. The USAF and USASMDC are working with USAG-KA and RTS to determine the feasibility and logistics of such hydrophone surveys.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Reporting should not be contingent on observations of marine mammals being made. Recommend changing to, "… The flight dates, times, vicinities surveyed, and survey results (sightings including number and types of organisms and their locations, and reports of no sightings when organisms are not seen), shall be reported to ….", or something reasonably similar. NMFS is interested in receiving continual confirmation these surveys are occurring and, importantly the data associated with each survey, including from flights with no sightings.

USAG-KA RESPONSE: Revised Section 2.0.a (page 9) to include specified recommendations.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend changing "would" to "shall"

USAG-KA RESPONSE: Revised Section 2.0.c (page 9) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)

COMMENT: Recommend replacing, "report sightings to NMFS and/or USFWS" with "and shall report sightings to the NMFS and the RMIEPA (USFWS and the RMIEPA if the observations are of sea turtles on land), along with dates, times, types of organisms, numbers observed and general locations, within 6 months following each test.", or something reasonably similar. NMFS is interested to receive confirmation at a reasonable frequency that this monitoring is occurring, and is interested in the observation data.

USAG-KA RESPONSE: Revised Section 2.0.c (page 9) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)

COMMENT: Recommend replacing, "…shall be reported through USASMDC to the USAG-KA….", with, "… shall be reported immediately through USASMDC to USAG-KA, who shall, as soon as possible within 24 hours, inform RMIEPA, NMFS and USFWS." Also recommend adding, "In addition, all survey dates, times, survey locations and sighting data shall be reported to RMIEPA and NMFS within 6 months following each test, irrespective of findings." The remaining text relating to opportunistic sightings seems fine, with similar reporting requirements expected if a sighting occurs. Take of marine mammals and of turtles in the water is not anticipated in the BOs, so NMFS will need to be informed quickly if dead organisms appear. If feasible, NMFS may recommend that efforts be made to recover and or examine deceased organisms to help establish cause.

USAG-KA RESPONSE: Revised Section 2.0.e (page 9) as recommended. Reporting requirements for sighting data are included in Section 6.0.d (page 12), including the requirement that reports be submitted within 6 months of the end of each fiscal year.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)

COMMENT: Suggest this be written more specific to highly mobile UES species, perhaps, "During post-test recovery and cleanup, should personnel observe highly mobile endangered, threatened, or other species requiring consultation moving into the area, work shall be delayed until such species leave the area of their own accord and or are out of harm's way. [Defense Program 36 & RTS]"

USAG-KA RESPONSE: Revised Section 2.0.f (page 10) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)

COMMENT: Recommend change, "would" to "shall".

Recommend change, "USFWS and NMFS" to "RMIEPA, USFWS and NMFS".

USAG-KA RESPONSE: Revised Section 2.0.g (page 10) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend, "RMIEPA and USFWS".

USAG-KA RESPONSE: Revised Section 2.0.h (page 10) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend, "… or a sensitive natural or cultural resource…".

USAG-KA RESPONSE: Revised Section 4.1.c (page 10) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend, "… species or habitats of Special Concern…" Note, the 24 hour notification aligns well with language changes recommended under comment 25.

USAG-KA RESPONSE: Revised Section 4.3.a (page 11) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Record Keeping. Recommend adding, "d. Species observation data associated with pre and post test flights and vessel activities, including number and types of species observed (including no observations), general locations, times, dates, etc. shall be preserved for the duration of the activity plus 10 years or for 10 years after expiration of the DEP, whichever is less."

USAG-KA RESPONSE: Revised Section 5.0 (page 11) to add subsection "d" as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend, "… any species or habitats of Special Concern…"

USAG-KA RESPONSE: Revised Section 6.0.b (page 12) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend, " … to USAG-KA, RMIEPA and NMFS."

USAG-KA RESPONSE: Revised Section 6.0.d (page 12) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: The Solomon et al. 2007 references are 15 years old. Recent data and references should be used here.

USAG-KA RESPONSE: More recent climate change data and references have been added to Section 8.0 (page 12).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Brainard et al. 2011 is 11 years old. We have learned and experienced much in the past decade. Such should be reflected and referenced.

USAG-KA RESPONSE: More recent climate change data and references have been added to update Section 8.0 (page 13).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend, "… possible additive and or synergistic …", as the interaction of impacts could be either.

USAG-KA RESPONSE: Revised Section 8.0 (page 13) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Recommend, "… likely beginning to affect corals and mollusks found in the action area (see NMFS and USFWS, 2021)." This report highlights visual-data based observations of general coral decline and macroalgae increase in the Mid-Atoll Corridor that appears associated with climate induced coral bleaching. The reference, "NMFS and USFWS. 2021. 2018 Marine biological inventory report, the Mid-Atoll Corridor at Ronald Reagan Ballistic Missile Defense Test Site, U.S. Army Kwajalein Atoll, Republic of the Marshall Islands. NMFS and USFWS final report prepared for USAG-KA, RMI. Prepared by S. P. Kolinski, R. Schroeder, T. Montgomery and G. Smith, 208 pp." should then be added to the references on page ii, line 11.

USAG-KA RESPONSE: Revised as recommended in Section 8.0 (page 13) and references (page ii).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Change to, "… scientific data describing impacts specific to the action area are lacking…" Also, it may be prudent to indicate that additional surveys are planned for the Illeginni reef sections of the action area; this would provide a means of noting and

acknowledging USAKA's desire to further understand environmental condition and effect in the area.

USAG-KA RESPONSE: Revised Section 8.0 (page 13) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: How negligible? Recommend including some meaningful comparison in a parenthetic at the end of the sentence

USAG-KA RESPONSE: In comparison to global sources, the amounts of air emissions from the GBSD test actions in the USAKA, RMI impact area are negligible. The larger air quality impact has been analyzed in the GBSD EA/OEA at the Proposed Launch Site (VSFB).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Limitations and Requirements. Recommend this entire section be researched and rewritten as it appears to be out of date. The references cited are all 20 or more years old; a vast amount of evidence, experience and understanding has accumulated over the past 20 years. Some of what is stated may hold, but the wording should reflect a general scientific consensus, avoid selective bias, and be mainly based on references produced within the last 5 years.

USAG-KA RESPONSE: Section 8.0 (page 14) revised to include updated sources of information on climate change science.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Thank you for forwarding the Appropriate Agency comments and responses to the NPA. We would prefer and appreciate, in the future, that such be provided as a default in this section of the draft DEPs.

USAG-KA RESPONSE: Comment noted.

USASMDC CONTRACTOR (TELEDYNE BROWN ENGINEERING)
COMMENT: Incorporate the citation for the 2021 GBSC EA/OEA, and add to citations list.

USAG-KA RESPONSE: Citations added in references (page iii) and on page v.

USASMDC CONTRACTOR (TELEDYNE BROWN ENGINEERING)
COMMENT: Wouldn't 5 years be Sept 2022-Sept 2027? Similarly, the last DEP was signed in 2017, not 2018 as written in line 14. In line 19, a new DEP will be required after expiration in 2027. I'd recommend calendar years here for clarity and accuracy.

USAG-KA RESPONSE: The period covered in this 2022 DEP is 2022-2027. Additional language was added to clarify that this 2022 DEP would expire after a period of 5 years, thereby requiring that a future GBSD DEP and NCA would be required to cover flight tests occurring after 2027.

Suggested updates made in Technical Description of Activity (page v), removed fiscal years (FYs) where possible.

USASMDC CONTRACTOR (TELEDYNE BROWN ENGINEERING)
COMMENT: Removal of land impacts happened in 2017.

USAG-KA RESPONSE: Updated the Technical Description of Activity (page v).

COMMENT: I don't think the word induce reflects the intention of this sentence. Perhaps these programs will not undergo significant changes?

USAG-KA RESPONSE: Updated as recommended in the Technical Description of Activity (page v).

USASMDC CONTRACTOR (TELEDYNE BROWN ENGINEERING)
COMMENT: Mid-Atoll Corridor is a proper name and should be capitalized here and throughout document, as needed. The final sentence in this paragraph is awkward would be simpler and more accurate to state "RTS is a tenant of USAG-KA". See/use the definition of RTS provided in the UES.

USAG-KA RESPONSE: Mid-Atoll Corridor capitalized on page vii. Kept "RTS is a tenant of USAG-KA at USAKA" because it is an important distinction of organization versus location that we use regularly in the documents.

USASMDC CONTRACTOR (TELEDYNE BROWN ENGINEERING)
COMMENT: Milestone schedule Number 7: Add an "s" to the word day and add "whichever comes first" to the Due Date to read "Within 15 day*S* of import or before use, *WHICHEVER COMES FIRST*"

USAG-KA RESPONSE: Item Number 6 of the Milestone Schedule (page vii) revised as recommended.

USASMDC CONTRACTOR (TELEDYNE BROWN ENGINEERING)
COMMENT: Milestone schedule Number 7: The timeline for overflights is confusing, stating within the week prior to the test, as close to launch as safely practicable, but the next sentence states that the final flight shall be within one day of the proposed launch. The phrase "final overflight" sounds like there would be more than one, but the requirement only states one overflight. Also, if the flight has to be within one day, why does it say it can be within one week?

The requirement is confusing and should be clear in the Compliance Schedule and in the description of the requirements in Section 1.0.b and 2.0.c.

USAG-KA RESPONSE: Section 1.1.b (page 1) and Section 2.0.a (page 9) revised to state that "The overflight shall be made within one day of the proposed launch if practicable."

USASMDC CONTRACTOR (TELEDYNE BROWN ENGINEERING) COMMENT: Section 1.3 lists the incidental take limits outlined in MMIII and GBSD BOs. Since the issuance of those Opinions, *Pocillopora meandrina* has been removed from the list of consultation species in the UES (RMIEPA concurrence letter dated June 11, 2021). I'd recommend including a sentence to this effect and state how this change may affect take estimates for land impacts at Illeginni for future GBSD flights (take estimates for MMIII won't be exceeded since no MMIII flights will impact at Illeginni).

USAG-KA RESPONSE: This is true for future GBSD flights after the test program but since consultation is complete for the GBSD test program, we do not feel this is the appropriate place to provide information about *P. meandrina* being removed from the list of UES-consultation species. The BA and consultation for GBSD/Sentinel program post-test flights would need to deal with this.

USASMDC CONTRACTOR (TELEDYNE BROWN ENGINEERING) COMMENT: The Compliance Schedule Section 10 describes marine mammal monitoring in the KMISS as being hydrophone monitoring, but section 1.3.j doesn't mention hydrophones. The language should be consistent among sections for clarity.

USAG-KA RESPONSE: The language in Section 1.3 is retained from the Biological Opinions. The wording revision in the Milestone Schedule Item Number 10 was an attempt to elucidate a method for 1.3.j "surveys".

USASMDC CONTRACTOR (TELEDYNE BROWN ENGINEERING) COMMENT: The Limitations and Requirements section only includes citations 20 years or more old, and language should be updated to reflect current scientific consensus. One good source of data, literature, and current status of climate change research, current effects, and impact assessments that could be useful, among others, is the 2021 Annual Intergovernmental Panel on Climate Change reports (www.ipcc.ch).

USAG-KA RESPONSE: Section 8.0 (page 14) revised to include updated sources of information on climate change science.

USASMDC CONTRACTOR (TELEDYNE BROWN ENGINEERING) COMMENT: NOTMAR should be added to list of acronyms in the NPA.

USAG-KA RESPONSE: Replaced NTM with NOTMAR throughout the NPA and updated the acronym list (pages x and 8 of Appendix A).

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: While the DEP points out that the proposed activities will comply with UES requirements, the actual amount of testing and payload contents, and therefore the possible environmental impacts, remain unclear. The Draft DEP should more thoroughly address potential for cumulation of contaminants from long-term weapons testing (and other activities) at USAGKA to impact groundwater and lagoon and ocean systems. Description of procedures for mitigating potential contamination of the groundwater should be more complete (see our previous letters of 19 March 2021; 19 April 2021; 22 February 2022). We also have concerns regarding potential impacts of projectiles and shock waves on wildlife including birds, turtles, fishes and corals.

USAG-KA RESPONSE: Please refer to the GBSD EA/OEA for full explanation of the Proposed Action and possible environmental impact (gbsdtesteaoea.govsupport.us). Specifically, refer to new DEP Appendix D, which contains EA/OEA Sections 3.4.1 and 4.2.4 and Appendix Section E.4. NPA Sections 3.2 (page 17 of Appendix A) and 3.4 (page 18 of Appendix A) were updated with citations of the EA/OEA and the UES. The new DEP Appendix D contains all EA/OEA citations cited throughout the DEP and NPA.

The DEP addresses what measures will be put into place to protect or offset the potential impacts analyzed in the Final GBSD EA/OEA and Final Signed FONSI.

Additionally, UES Section citations for standards regarding water quality, reef protection, and ocean disposal were added to NPA Section 3.2. UES section citations for standards regarding material and waste management were added to NPA Section 3.4.

The EA/OEA and UES citations above were added to the NPA (Section 3.2 on page 16 of Appendix A; Section 3.4 on page 18 of Appendix A) as a result of the 22 February 2022 request to describe the procedures for mitigating potential contamination of the groundwater. See new DEP Appendix D for these EA/OEA citations. The DEP meets the standards required by the UES.

The potential impacts of projectiles and shock waves on wildlife were evaluated in the GBSD EA/OEA, the NMFS BO for GBSD, and the USFWS Letter of Concurrence for GBSD. Stressor analysis for elevated sound (including shock waves) was completed in the GBSD BO for marine consultation species and these sounds levels were considered to "have insignificant effects" on consultation species in the Action Area (see pages 23-30 of DEP Appendix B, GBSD Biological Opinion). The effects of stressors on green sea turtles were evaluated by the USFWS during consultation, with the conclusion that the effects were “discountable” (7 January 2021 Letter of Concurrence, GBSD EA/OEA Appendix A page A-13). The USFWS reviewed the stressor analysis in the GBSD EA/ OEA and concluded that the “proposed actions are expected to impact

relatively small areas of land and sea" in a 22 March 2021 letter (GBSD EA/OEA Appendix A page A-137).

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Eniwetak Island is intended to function as a mitigation site at Kwajalein Atoll to buffer any inadvertent environmental impacts that occur there due to USAGKA activities. Considering increasing potential for cumulative environmental impacts of MMIII and GBSD testing as it continues over the years, it is essential that USAGKA follow through with commitments and ensure that Eniwetak resources are managed in ways that help to achieve mitigation goals and can help to provide ecological security for Kwajalein Atoll as a whole. Essential first steps to enhance Eniwetak as a mitigation site include successful ant eradication on Eniwetak Island to protect nesting black noddies and effective prevention of human disturbance of terrestrial and marine (coral reef) ecosystems there. More specific mitigation goals and specific plans to achieve them should also be more thoroughly developed. The Service is happy to assist in mitigation planning.

USAG-KA RESPONSE: USAG-KA continues to support management of Eniwetak as a conservation area. The DEP currently states that "in accordance with previous consultation with USFWS, the Defense Program shall abide by the 2005 USFWS Biological Opinion (BO) through 2030 and continue to maintain sea turtle nesting habitat on Eniwetak Islet based on the current Eniwetak Conservation Area (ECA) Management Plan developed and followed by USAG-KA". The ECA Management Plan (2017) provides protocols for surveillance, biological monitoring, and maintenance of the ECA to provide for protection of sea turtle and sea bird nesting habitats.

USAG-KA is working towards ant eradication as outlined in the ECA Management Plan (2017). Ant monitoring and control is currently conducted on Eniwetak in accordance with the ECA Management Plan. Pest control routinely monitors for ants, checking 20-30 bait stations monthly for ant control and monitoring. An internal pest control audit of the ECA was conducted in 2016 and no issues with the current ant monitoring and control protocols were identified.

Human disturbance on Eniwetak is controlled through policies and monitoring in place under the ECA. There is currently a policy that no USAG-KA personnel or local residents access Eniwetak or anchor in nearshore waters. "Keep Out" signage is posted in all locations where beach access is possible, and cameras are in place to detect any human activity or water craft landings. A monthly Human Activity Report is prepared to detail any activity.

Considering the low potential for cumulative impacts to nesting sea turtles and seabirds, no additional mitigation measures for GBSD and MMIII were identified during the analysis and coordination processes. Any enhancement of or updated goals for the ECA would be best addressed during evaluation of garrison-wide or RTS range-wide (i.e., programmatic) activities.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Please see attached comment matrix sheets for specific comments and recommendations for the Draft DEP dated April 2022. Additionally, further consideration of compensatory mitigation for potential unintentional impacts on marine species and habitats should be considered, including mitigation plans for Eniwetak terrestrial and marine ecosystems.

USAG-KA RESPONSE: Thank you for your comments.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: The Service supports continued development of the Draft Document of Environmental Protection (DEP-22-SMDC-01.1) associated with development of a new DEP regarding Minuteman III Modification and Fuze Modernization Flight Tests/Ground Based Strategic Deterrent (GBSD) Flight Tests at USAGKA given more specific consideration and planning according to our comments and recommendations. Management of potential cumulative impacts and development of compensatory mitigation plans should be prioritized. Our comments and recommendations are provided in this letter and in the attached Comment Matrix Sheets and should be considered for DEP revisions.

USAG-KA RESPONSE: Thank you for your comments.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: It is stated that this DEP is for a 5 year period (2022-2026) and a future DEP with be required to cover flight tests occurring after FY 2026. It is unclear why, and confusing that later paragraphs discuss plans for tests through 2029. It seems that this would cover a longer period than this DEP is intended for,

USAG-KA RESPONSE: Added text to indicate that the 2022 DEP would expire in 2027.

The current GBSD Program length is 10 years, per the EA/OEA. Therefore, two DEPs will be required for the length of the program since DEPs expire 5 years after signature. Since no changes are expected for the Proposed Action between the 2022 DEP and the future 2027 DEP, there would likely be an NCA/DEP process to cover the tests through end of fiscal year 2029. Revisions made to Technical Description of Activity (page v).

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Timing of flight tests, the nature of each, and timing of reporting on potential impacts of tests is unclear. Please include a general visual timeline of what is described in the text and schedule for reporting on environmental measures and impacts.

USAG-KA RESPONSE: Regarding the timing of the flight tests, please refer to Appendix A of the DEP (see NPA Table 1 on page 2 of Appendix A). This is the most accurate visual timeline of the flight tests currently available.

Regarding the nature of the flight tests, please refer to Appendix A of the DEP (NPA, see Section 1.0 on page 1 of Appendix A). Regarding the timing of reporting, the Milestone Schedule of the DEP (pages vii-ix) has been updated. See the right column labeled "Due Date". Additionally, text was added throughout the DEP regarding timing of reporting.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Please specify total potential RV impacts considering 61 potential test flights. Given this, and potential contaminants included, please provide calculation of total quantities of contaminants (e.g. heavy metals, etc.) that could be introduced to terrestrial or nearshore habitats.

USAG-KA RESPONSE: The information requested in this comment is provided in summary format in the NPA in Sections 1.2 – Description of the Activity, 1.3 – Mitigation and Conservation Measures, Chapter 3 – Environmental Areas Potentially Affected by Proposed Activity, Chapter 4 – Analysis of Effect of Activity on Environmental Areas in Absence of Environmental Controls, and Chapter 5 – Technical Description and Analysis of Environmental Controls Used in Activity, and in full in the GBSD EA/OEA in Sections 2.2.1, 2.2.4, 3.4, 4.2.4, and 4.3.4 (gbsdtesteaoea.govsupport.us).

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Compliance with the UES requires insignificant environmental impact or appropriate mitigation. This is not sufficiently addressed in this document. Eniwetak Island is intended to be a mitigation site. Compensatory mitigation should be addressed and planned in this document to enhance Eniwetak terrestrial and marine species and ecosystems, particularly considering plans for ongoing testing and potential for long term cumulative impacts of Minuteman III Modification and Fuze Modernization Flight Tests/Ground-Based Strategic Defense (GBSD) Flight Tests. For example, ant eradication to protect nesting black noddies, enhanced biosecurity, and enhanced protection from human disturbance (terrestrial and marine) are appropriate first steps.

We also recommend further development of marine and terrestrial protected area to minimize human disturbance at Eniwetak so that the area can provide Security to the larger Kwajalein Atoll ecosystems.

USAG-KA RESPONSE: The evaluation of impacts and development of appropriate mitigation measures were addressed in the GBSD/MMIII Test EA/OEA and subsequent coordination procedures based on that EA. Considering the low potential for impacts, no additional mitigation measures for GBSD and MMIII were identified during the analysis and coordination processes. Any enhancement of or updated goals for the ECA would be best addressed during evaluation of garrison-wide or RTS range-wide (i.e., programmatic) activities.

USAG-KA continues to support management of Eniwetak as a conservation area. The DEP currently states that "in accordance with previous consultation with USFWS, the Defense Program shall abide by the 2005 USFWS Biological Opinion (BO) through 2030 and continue to maintain sea turtle nesting habitat on Eniwetak Islet based on the current Eniwetak Conservation

Area (ECA) Management Plan developed and followed by USAG-KA". The ECA Management Plan (2017) provides protocols for surveillance, biological monitoring, and maintenance of the ECA to provide for protection of sea turtle and sea bird nesting habitats.

USAG-KA is working towards ant eradication as outlined in the ECA Management Plan (2017). Ant monitoring and control is currently conducted on Eniwetak in accordance with the ECA Management Plan. Pest control routinely monitors for ants, checking 20-30 bait stations monthly for ant control and monitoring. An internal pest control audit of the ECA was conducted in 2016 and no issues with the current ant monitoring and control protocols were identified.

Human disturbance on Eniwetak is controlled through policies and monitoring in place under the ECA. There is currently a policy that no USAG-KA personnel or local residents access Eniwetak or anchor in nearshore waters. "Keep Out" signage is posted in all locations where beach access is possible, and cameras are in place to detect any human activity or water craft landings. A monthly Human Activity Report is prepared to detail any activity.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Throughout the document, it is unclear what the reporting protocol is for items that need to be sent to the Appropriate Agencies. For example:

- Section 1.1.u indicates impacts to biological resources would be reported to the Appropriate Agencies but it does not indicate who is responsible for submitting the notice.
- Section 1.2.c indicates any overflight observation of dead/injured marine animals will be reported to the USAG-KA Environmental Office, the RTS Range Directorate, the Kwajalein Test Director, and USASMDC; and USASMDC shall then forward the information to the Appropriate Agencies.
- Section 2.0.c indicates marine mammals and sea turtle observations shall be reported to USAG-KA Environmental Office, the RTS Range Directorate, and the Flight Test Operations Director. The USAG-KA Environmental Engineer would report sightings to NMFS and/or USFWS.
- Section 2.0.d indicates the USAG-KA Environmental Office shall notify the RMIHPO in the event cultural or historic remains are discovered.
- Section 2.0.e indicates post-test overflights of the impact area for injured or dead mammals/sea turtles, shall be reported through USASMDC to USAG-KA Environmental Office who shall then inform NMFS and USFWS.
- Section 2.0.g indicates surveys conducted weekly for at least 8 weeks prior to the test would be reported to the appropriate test and USAG-KA personnel and to the USFWS and NMFS.
- Section 2.0.h indicates personnel will report to the USAG-KA Environmental Engineer any observations of sea turtles or sea turtle nests on Illeginni and the USAG-KA Environmental Engineer will report sightings to USFWS.
- Section 4.1.a indicates that emergency notification will be provided by USAG-KA within 24 hours to the public and the Appropriate Agencies.
- Section 4.1.b indicates that USAG-KA shall submit a written notification within 10 days following emergency notification to the UES Agencies.

- Section 4.3.a requires USAG-KA to notify the NMFS, USFWS, and RMIEPA within 24 hours when UES-protected species are disturbed, transplanted, injured or killed due to test activities.
- Section 6.0.a indicates that USASMDC shall notify the Appropriate Agencies and the RMI gov't of a failure of a test event, anomalies, or termination within the RMI.
- Section 6.0.b discusses a written report to NMFS, USFWS, and the RMIEPA within 10 days following emergency notification but does not indicate who the responsible party is for the submittal.
- Section 6.0.c requires a written report to be provided to the Appropriate Agencies if any of the requirements in the DEP or UES are violated within 30 days of the violation. However, it does not indicate the responsible party for submitting the written report.
- Section 6.0.d requires USASMDC is required to provide the annual report to USAG-KA (???) and NMFS.

Please consider identifying a single organization for submitting the required reports to the UES Appropriate Agencies to avoid confusion and ensure that reports are submitted as required by the DEP.

To facilitate execution of all the reporting requirements, recommend maintaining a single protocol scheme for notifying the Appropriate Agencies per the DEP. Assume all the reporting will either be via USAG-KA Environmental Office or USASMDC.

USAG-KA RESPONSE: Revised as recommended to indicate that USASMDC will be responsible for distributing reports to UES Appropriate Agencies (i.e., NMFS, USFWS, RMIEPA, etc.). All data and reports will be submitted to USASMDC with a copy to USAG-KA Environmental Office.

Compliance Status (page vi) as well as Sections 1.1.t (formerly 1.1.u; page 3), 1.2.c (page 5), 2.0.c (page 9), 2.0.d (page 9), 2.0.e (page 9), 2.0.g (page 10), 2.0.h (page 10), 4.1.a (page 10), 4.1.b (page 10), 4.3.a (page 11), 6.0.a (page 11), 6.0.b (page 12), 6.0.c (page 12), and 6.0.d (page 12) revised to indicate that USASMDC shall distribute survey reports and notifications to UES Appropriate Agencies.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Milestone No. 6, for consistency, suggest revising to reflect the actual condition, "…submit a Hazardous Materials Procedure to Commander, USAKA, for approval."

USAG-KA RESPONSE: Item Number 6 of the Milestone Schedule (page vii) revised as recommended.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: In the description replace "inured" with "injured". Also, the responsible party is listed as "Defense Program, USASMDC, & USAG-KA" while Section 1.1.q indicates "Defense Program & RTS". Please revise as appropriate for consistency.

USAG-KA RESPONSE: Revised Item Number 9 of the Milestone Schedule (page vii) and Section 1.1.q (page 3) as recommended.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Please revise item 10 to be consistent with Section 1.3.j. Item 10 refers to "hydrophone or other surveys" when the Section does not.

USAG-KA RESPONSE: The language in Section 1.3 (pages 5-7) has been retained from the Biological Opinions. The wording in Milestone Schedule Item Number 10 (page viii) was an attempt to elucidate the desired method for 1.3.j "surveys".

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Suggest revising item 14 to reflect "If cultural or historic remains are discovered, then work shall cease and the USAG-KA Environmental Office shall be notified. The RMI Historic Preservation Office will then be notified in accordance with **Section 2.0.d**.

USAG-KA RESPONSE: Revised Item Number 14 of the Milestone Schedule (page viii) as recommended.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Item 15 implies that a weekly survey of the Illeginni islet for sea turtles or sea turtle nesting will be conducted for 8 consecutive weeks prior to the test. Suggest clarifying Section 2.0.h to indicate that weekly surveys will be conducted for 8 consecutive weeks prior to test.

USAG-KA RESPONSE: Revised Section 2.0.g (page 10) as recommended.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Suggest revising item 18 to be consistent with Section 1.1.p. "For land impact, inspect proposed impact area for sea turtles." Section 1.1.p does not reference an inspection for active turtle nests or hauled out sea turtles. Suggest other revisions as appropriate to make sure they are both consistent. Also, suggest indicating that sightings will be reported to USAG-KA Environmental, RTS Range Directors and Kwajalein Test Director.

USAG-KA RESPONSE: Revised Section 1.1.p (page 3) to include "or evidence of active sea turtle nests".

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Revise item 19 to reflect who shall be notified of any injured wildlife, damaged coral or sensitive habitat to be clear how the notifications to the Appropriate Agencies will occur. Similar to other conditions, suggest revising Section 1.1.u to indicate the results of the survey be provided to the USAG-KA Environmental Office and then the USAG-KA Environmental Office will provide notification to the Appropriate Agencies. Once finalized, please revise Item 19 to be consistent on the reporting/notification scheme.

USAG-KA RESPONSE: Item Number 19 references Section 1.1.t (formerly 1.1.u, page 3) so all reporting details are not included in the milestone chart.

Section 1.1.t (formerly 1.1.u, page 3) reporting/notification requirements updated.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Item 20 refers to Sections 1.1.l, 1.1.m, and 1.1.n. Note that 1.1.n indicates the responsible parties are different than the other conditions (Defense Program and RTS) is for monitoring activities during the soil investigation period. Recommend adding this as a separate milestone action item.

USAG-KA RESPONSE: 1.1.n is an "If this, then that" scenario which does not require its own milestone. It is referenced properly in Item Number 20 because RTS would perform the action, not USASMDC.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: The Due Date for item 21 states, "when feasible" but none of the referenced sections do. Suggest removing "when feasible" from the table to adding the wording to Section 1.1.v. and 4.3.a.

USAG-KA RESPONSE: "When feasible" removed from Item Number 21 of the Milestone Schedule (page ix).

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Item 24 indicates the Survey/Impact report to be submitted to USFWS and NMFS, but Section 1.3.h and 6.0.d state "the Defense Program, through 30 USASMDC, shall provide an annual report for submittal to USAG-KA and NMFS. I suspect the intent was for the report to be sent to USFWS and NMFS…..please make consistent as appropriate.

USAG-KA RESPONSE: Revised Item Number 24 of the Milestone Schedule (page ix) to include NMFS, RMIEPA, and USFWS.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: This item involves notification to the Appropriate Agencies and the RMI gov't if a test event fails, has anomalies, or is terminated. It refers to Section 4.0 but there is no such Sections that refer to this condition. Suggest removing the reference to Section 4.0.

USAG-KA RESPONSE: Revised Item Number 25 of the Milestone Schedule (page ix) as recommended.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Item 26 refers to Section 1.3.h for emergency notifications within 10 calendar days of discovery….Section 1.3.h does not include this requirement, please remove reference.

USAG-KA RESPONSE: Item 26 refers to "Report any emergency notification of an incident involving species and habitats of special Concern to NMFS, USFWS, and the RMIEPA" and refers to Section 1.3.h because it details the Incidental Take Terms and Conditions from the Biological Opinion. It is necessary to keep the reference to 1.3.h in Milestone Schedule Item Number 26.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Item 27 requires update of the 2012 MMIII Recovery Plan to include GBSD prior to test. I could not find a DEP requirement/condition for this activity. Please refer to the appropriate Section/Condition or remove it from the Milestone table.

USAG-KA RESPONSE: Added sentence to Section 1.2.a (page 4) to include Milestone Schedule Item Number 27 (page ix).

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Section 6.0.c requires a written report to be provided to the Appropriate Agencies if any of the requirements of the DEP or UES are violated within 30 days of the violation. Any reason, this section/condition was not included in the Milestone table?

USAG-KA RESPONSE: Since this is not a planned or anticipated event, it is not included in the Milestone Schedule.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Section 6.0.d requires an annual report be submitted within 6 months of completion of each fiscal year to USAG-KA (??) and NMFS. Suggest including this in the Milestone table under reporting procedures.

USAG-KA RESPONSE: Updated Sections 6.0.b, c, and d (page 12) to reflect that USASMDC shall distribute the report to UES Appropriate Agencies including RMIEPA, USFWS, and NMFS. This requirement is included in Milestone Schedule Item Number 24 (page ix).

VECTRUS LOGCAP V (USAG-KA)
COMMENT: This condition indicates that within one day after the land impact test at Illeginni, "USAG-KA environmental staff" would survey the islet and the near-shore waters for any injured wildlife, damaged coral, or damage to sensitive habitats (i.e., reef habitat). This activity would be more appropriate for USAKA RTS Environmental Staff since they scope is to support these types of activities. Any impacts would be reported to the USAG-KA Environmental Engineer who would then report to the RMIEPA, USFWS, and NMFS for guidance.

USAG-KA RESPONSE: Revised Section 1.1.t (formerly 1.1.u, page 3) to indicate that Defense Program, USAG-KA and RTS Environmental Staff would support this requirement.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Section indicates that "Hazardous waste treatment is prohibited at USAKA [UES § 3-6.6.5(a)." Please revise to be consistent with the referenced section; "No hazardous waste may be treated or disposed of at USAKA except as documented in a final DEP [Section 3-6.5.7(a)(1)].

USAG-KA RESPONSE: Added "except as documented in a final DEP" to Section 1.4.a (page 7).

Kept reference to UES Section 3-6.6.5(a) because it encompasses UES Sections 3-6.5.7(a)(1) and 3-6.5.7(b)(4).

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Section 2.0.a includes overflight of the KMISS vicinity over the week prior to the flight test and as close to the proposed test launch time as safely practicable. Was this condition meant to include the Illeginni vicinity in addition to the KMISS vicinity? If so, please revise as appropriate.

USAG-KA RESPONSE: Revised Section 2.0.a (page 9) to include all impact locations.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Recommend removing "announcement on Kwajalein Range Services Newsline" since it no longer exists.

USAG-KA RESPONSE: Revised Section 4.2.b (page 11) as recommended.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Section 10.0 is the Environmental Comments and Recommendations received on the 2022 Draft Notice of Proposed Activity and USAG-KA's Responses and it indicates "Reserved". This section should have been included to reflect the responses to the NPA and how they were addressed in the NPA to be consistent with the sections in the Draft DEP. Please include the response to comments.

USAG-KA RESPONSE: Apologies, Section 10.0 (page 49) was completed in the June 2022 version that was sent to the UES Agencies for review.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Suggest including the last requirement in Section 1.1.b which requires "The final overflight shall be made within one day of the proposed launch." Possibly revise the "Due Date" column to include the requirement within one day of proposed launch.

USAG-KA RESPONSE: Revised Item Number 7 of the Milestone Schedule (page vii) to include "(within 24 hours if practicable)".

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Suggest revising to "Monitor for and record opportunistic sightings of Marine mammals and sea turtles." For consistency with condition. Also, recommend modifying 1.1.0 to replace "collected" with "reported".

USAG-KA RESPONSE: Revised Item Number 8 of the Milestone Schedule (page vii) to include recording but did not remove reporting requirement. Replaced "collected" with "recorded" in Section 1.1.o (page 2) but did not remove reported, as reporting is a requirement.

VECTRUS LOGCAP V (USAG-KA)
COMMENT: Suggest revising as follows: "Conduct serach for black-naped tern nests and chicks prior to any pre-test equipment mobilization. Flag discovered nests with a stake 3 feet (1 meter) from nest to prevent disturbance." In Section 1.1.r, please revise "chick" to "chicks" and revise to reflect "Any discovered nests in the action area will be flagged with a stake 3 feet (1 meter)…"

USAG-KA RESPONSE: Revised Item Number 16 of the Milestone Schedule (page viii) and Section 1.1.r (page 3) as recommended.

REPUBLIC OF THE MARSHALL ISLANDS ENVIRONMENTAL PROTECTION AUTHORITY (RMIEPA)
COMMENT: General requirements and limitations - Following any credible reports from local RMI communities outside of the leased area of debris impacts, including in or proximate to the broad ocean area, USAG-KA representatives shall be invited by RMIEPA to assess reports and/or meet with local representatives, pursuant to UES Section 2.5 ("USAG-KA Responsibilities).

RMIEPA draws attention to the following provision in Section 2.5: "USAKA activities within the RMI may include potential environmental effects that are outside of USAKA and that may need site-specific environmental studies. RMIEPA shall assist with facilitating appropriate access to and providing relevant environmental information for areas within the RMI and outside of USAKA for the purpose of environmental studies."

USAG-KA RESPONSE: Added Section 1.1.z (page 4): "USAG-KA is responsible for UES compliance for all USAKA areas and activities (USASMDC 2021). USAKA activities within the RMI may include potential environmental effects that are outside of USAKA and that may need site-specific environmental studies (USASMDC 2021). In accordance with UES Section 2.5, following any credible reports from local RMI communities outside of the leased area of debris impacts, including in or proximate to the Broad Ocean Area, USAG-KA representatives shall be invited by RMIEPA to assess reports and/or meet with local representatives."

REPUBLIC OF THE MARSHALL ISLANDS ENVIRONMENTAL PROTECTION AUTHORITY (RMIEPA)
COMMENT: Incidental Take Terms and Conditions – Please provide clarity on the estimated 324 humphead wrasse incidental taken estimate, including methodology and if this is considered a "low abundance" fish

USAG-KA RESPONSE: These details are provided in the referenced NMFS 2021 Biological Opinion which is included as Appendix B to the DEP.

REPUBLIC OF THE MARSHALL ISLANDS ENVIRONMENTAL PROTECTION AUTHORITY (RMIEPA)
COMMENT: Incidental Take Terms and Conditions – RMIEPA notes the use of "as funds become available" in relation to additional surveys and capacity. Please comment regarding further details in relation to specific budgetary allocations, cost estimates and specific US DoD to secure adequate funds, including individual points of contact. Please provide a timebound means by which Appropriate Agencies will be informed regarding funding status. US responsibility and implementation in the UES and Compact is not contingent upon funding.

USAG-KA RESPONSE: The conservation recommendations listed in Section 1.3 i (page 6) and k (page 7) are discretionary agency activities listed in "Section 11 Conservation Recommendations" of the GBSD BO. They are not included in the non-discretionary "Section 10.4 Terms and Conditions" of the GBSD BO, and implementation is not required for USAKA to remain in compliance with the BO, the UES, or the Compact. The activities listed in Section 1.3.j (page 7) are discretionary actions listed in the conservation recommendations of the 2015 BO (and elsewhere requested by NMFS) and are not listed in the GBSD BO. The DEP sections referenced have been revised to clarify discretionary vs non-discretionary measures.

The DAF has committed to investigating the feasibility of these additional surveys, the cost of these surveys, and the potential for funding of these surveys. USASMDC understands the importance of the conservation recommendations and expects that feasibility and funding decisions will be made by the end of calendar year 2023; however, no specific additional information is available at this time regarding the timeline for when feasibility or funding decisions might be made. USASMDC will coordinate with DAF during all feasibility investigations and will inform and update RMIEPA of the status of those investigations.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Document states" The Department of the Air Force (DAF), supported by the U.S. Army Space and Missile Defense Command (USASMDC), will prepare the EA/OEA in accordance with the National Environmental Policy Act (NEPA), as implemented by the Council on Environmental Quality Regulations; and DAF and U.S. Army regulations for implementing NEPA." When will this occur? Has it already occurred? Please provide an approximate schedule

USAG-KA RESPONSE: Updated language to reflect past tense and added dates to the NPA. In Section 1.0 of the NPA (see page 1 of Appendix A), added citation for GBSD EA/OEA to NPA. See gbsdtesteaoea.govsupport.us for copies of the Final documents.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Remove reference to "other heavy metals" and identify each one in the document. Include heavy metals in batteries (Si) List which high explosives will be used instead of saying "high explosives".

USAG-KA RESPONSE: Section 3.4 of the NPA (see page 18 of Appendix A) updated to say, "RV debris may contain small amounts of non-fissile hazardous materials: batteries, high explosives, asbestos, depleted uranium (DU), and other heavy metals. The individual Mark 12A RVs contain one silver zinc battery (approximately 1.6 pounds), while the Mark 21 RV contains one silver zinc and one thermal battery (total battery weight of approximately 2.4 pounds). All test RVs typically include 0.29 to 22 ounces of asbestos; approximately 0.035 to 0.353 ounces each of beryllium (Be), cadmium (Cd), and chromium (Cr); approximately 4.8 ounces of lead (Pb); and less than 187 pounds of DU. In general, only two test RVs per year contain high explosives (USAF 2004, 2013, 2020)."

Section 5.4 of the NPA (see page 27 of Appendix A) states, "At impact, the RV generally disintegrates, releasing small quantities of heavy metals including Be, cadmium, chromium, lead, DU, and asbestos."

The term "high explosives" cannot be further defined in this document for security purposes.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: States soil testing would only occur for Be and DU. Add testing would occur for all heavy metals

USAG-KA RESPONSE: Updated language in Section 3.4, as requested. Please also refer to the DEP Sections 1.1.l and 1.1.m (page 2) and also Section 1.3 of the NPA (see page 11 of Appendix A).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: States "For additional information regarding the potential impacts from disturbing existing contamination on Illeginni 9 Islet, refer to the GBSD EA/OEA (Sections 3.4.1.2.3, page 3-93; 4.2.4.1, page 4-97; 4.2.4.1.2, page 4-109)."

Appears there are errors here – Based on the Draft Ground Based Strategic Deterrent Test Program Environmental Assessment / Overseas Environmental Assessment, Section 3.4.1.2.3 regards Noise, not existing contamination; p. 3-93 regards biological resources, not contamination, p. 4-97 does not talk about contamination, Section 4.2.4.1 is not specific to contamination and is a large section so reference is unclear, and p. 4-109 talks about Vandenberg

SFB, not existing contamination on Illeginni. Section 4.2.4.1.2 talks about noise – so it seems all of these references are incorrect. Please cut and paste these discussions into this document – it is not appropriate to refer back to a NEPA document here – all relevant info should be contained in the DEP and NPA appendix. Remove references to the GBSD EA's. This is another reason why a programmatic joint document is needed, as previously recommended. Then individual documents can refer back to that program document.

USAG-KA RESPONSE: Commenter was viewing the Draft EA; the sections listed in the DEP are from the updated Final EA. The requested sections of the Final GBSD EA have been included in a new DEP Appendix D. GBSD EA sections added to Appendix D include Section 3.4.1.2.3 (pages 3-93 to 3-94 of Appendix D) and Section 4.2.4.1 (pages 4-97 to 4-114 of Appendix D) which is inclusive of Section 4.2.4.1.2 (pages 4-109 to 4-114 of Appendix D).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: References RTS Kwajalein site as an active range. Indicate if a formal Operational Range Assessment has occurred for this range, pursuant to DoD Directive 4715.11 which requires DoD components to assess the potential for munitions constituents (MCs) to migrate off-range from range operations. If so, append to the DEP. If not, we recommend this be prepared to document ongoing munitions fate and transport in a more organized manner than is occuring piecemeal in these various EAs, NPAs and DEPs. If no ORA will occur, a discussion of fate and transport for each munition constituent should be included. If there were a programmatic impact assessment document as recommended, such discussions would only need to occur once in that document and the individual flight test documents could tier from that one.

USAG-KA RESPONSE: Comment noted. USASMDC has requested a copy of the ORA. We will provide upon receipt to be included as an appendix, if available.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Thank you for providing some soil testing results. It is unclear why only Be and DU are included. Please put actual numbers as opposed to ""…within compliance with USEPA Region 9 Preliminary Remediation Goals as outlined in the UES." Unclear why duplicate result is in footnote 3, but not the table.

USAG-KA RESPONSE: Updated Table 4 of the NPA (Section 4.4, see page 21 of Appendix A) to include complete records of Robison et al., 2005, 2006, 2010, 2013 and FE-2 post-test sampling.

The field duplicate is not the official result, as determined by the Program. It is provided as a footnote here for transparency because of its irregularity.

Added Table 3 for Groundwater sample results to Section 4.2 (page 20 of Appendix A).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Document indicates that DAF and USAG-KA collect soil and groundwater samples at various locations around the impact site after each land-impact test. Since there have been a number of such tests, there should be a larger amount of data to include in an appendix at the very least. Again it doesn't identify all of the heavy metals tested for, just Be and DU There should be an ongoing monitoring of test results which cannot occur if the data is not included. It is important in order to see trends and to assess whether levels are accumulating.

USAG-KA RESPONSE: Please see updated Tables 3 and 4 in NPA Sections 4.2 (page 20 of Appendix A) and 4.4 (page 21 of Appendix A). Moving forward, all relevant soil and groundwater testing information will be shared with the UES Appropriate Agencies, as required in DEP Sections 1.1.l, 1.1.m, and 1.1.n.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: States testing will occur for soil samples to ensure that the concentrations of Be, U, and other metals do not exceed established UES standards. If standards are exceeded, follow Section 1.1 l, m, and n.

These sections talk about testing exceeding UES standards triggering a soil investigation in section l., but section m only addresses Be and DU, including the sharing of data for only Be and DU with agencies, not including EPA. Why are results of other heavy metals tests not being shared? Can EPA receive a copy of investigation results? If the document says all heavy metals will be tested for, include the full list in these commitments.

USAG-KA RESPONSE: In Section 1.1.m (page 2): Updated Section 1.1.l and Section 1.1.m (page 2). Added full list of metals to be included in testing, as well as a callout to notify USEPA Region 9

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Where are the sampling protocols identified? Section 1.0, l states that for post-test land sampling, Coordination shall be initiated with the Defense Program, US Army Space and Missile Defense Command (USASMDC), RMI Environmental Protection Authority (RMIEPA), and the other appropriate UES agencies to determine the scope and methods/procedures to be followed during the investigation (italics ours)…. . This is confusing – after the test results are known coordination on sampling and testing protocols will occur? Does this mean such protocols for additional sampling and testing/characterization? In general there should be consistent sampling and testing protocols attached to the DEP. The results report from the FE-2 post-test soil sampling stated that there were no quality control samples collected for one of the sampling events, for example, so we recommend a consistent sampling methodology with quality control assured and to avoid confusion, documented in the DEP. Please specify if the coordination post-test result is for a more comprehensive investigation, which, if so, is appropriate.

USAG-KA RESPONSE: All compliance requirements, coordination procedures, and environmental standards for soil sampling in the UES will be followed. Added callouts on page 2 to UES, 16th ed., 2021, Section 3-6.5.8.

As stated in Section 1.1.l, "Following a land-impact test, the Department of the Air Force and USAG-KA shall collect soil and groundwater samples at various locations around the impact site and test the samples for Beryllium (Be), Depleted Uranium (DU) as Uranium (U), and other heavy metals (not limited to, but including: Arsenic, Barium, Cadmium, Chromium, Lead; see UES Table 2-22.1 and Table 3-6B.1). Field Duplicate (QA/QC) samples will be taken due to past heterogeneous sample results. **Testing results exceeding the US Army at Kwajalein Atoll (USAKA) Environmental Standards and Procedures (UES) standards shall trigger an immediate investigation of the soil on Illeginni Islet, as detailed in the UES Section 3-6.5.8.** Coordination shall be initiated with the Defense Program, USASMDC, RMIEPA, and the other UES Appropriate Agencies to determine the scope and methods/procedures to be followed during the investigation and any subsequent soil removal or other remediation activities." As the commentor noted, if required, the coordination for the post test result would be for a more comprehensive investigation (this is a UES requirement).

Added statement to DEP Section 1.1.l (page 2) that field duplicate (QA/QC) samples will be included in the post-impact sampling.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA) COMMENT: Item l also indicates that only after post-testing hits exceeding standards would coordination begin on "any subsequent soil removal or other remediation activities". The potential pollutants are known therefore there should be some knowledge regarding what potential remediation approaches/technologies are available and would be feasible. There is no need for this to be revisited later – having the options known will facilitate more timely action. Please identify which remediation approaches could be used for the probable pollutants and make the necessary commitments to remediation. Include time commitments for remediation, such as would commence as soon as practicable not to exceed one year, for example.

USAG-KA RESPONSE: Thank you for the comment. Documents of Environmental Protection (DEPs) are not required under the UES to include remediation plans. USAG-KA does not anticipate exceedances in this area. In the unlikely event that exceedances occur, USAG-KA is committed to following the prohibitions in UES Section 3-6.5.8 and will follow procedures required therein.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA) COMMENT: "Testing results exceeding the UES standards shall trigger an immediate investigation of the soil on Illeginni Islet, as detailed in the UES." Include a time period for this "immediate investigation" (i.e. within XX days? Weeks?)

USAG-KA RESPONSE: Reference to the UES is purposeful here because the length of time and level of investigation is dependent on the standards set forth in the UES. Added citation for UES Section 3-6.5.8 to Section 1.1.l (page 2).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: States "Recover any floating debris from the test vehicle and properly dispose of it". Attach a time period for this – debris will be harder to find as time passes, so haste must be conveyed.

USAG-KA RESPONSE: A time limit is provided in the right-hand column of the Milestone Schedule (pages vii-ix). Added "after test" to Section 1.2.b (page 4).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Avoidance of flows to the lagoon has not been discussed, despite the statement that the intent of this section to explain how point source discharges will be avoided. Briefly describe the mechanisms to be used.

USAG-KA RESPONSE: The discussion of potential contaminants in dust control and evaporation residue are in NPA Sections 4.1, 4.2, 5.1, and 5.2. The following text was added to NPA Section 5.1 (page 22 of Appendix A) and 5.2 (page 23 of Appendix A): "Personnel will be judicious and not overwater, to ensure the freshwater would evaporate in place and not flow into the lagoon. This will prevent possible contamination from entering the marine environment."

Added a definition of point-source discharge to Section 7.0 of the NPA (Appendix A page 27). As described in Section 7.0 of the NPA, there are no point-source discharges associated with the MMIII/GBSD activities.

Regarding "washing", see DEP Section 1.1 g: "Prior to returning the test support equipment and materials to the US, the equipment shall be washed, and a certified Pest Control Technician shall inspect the equipment again to ensure that it does not contain any insects, animals, plants, or seeds that might have been picked up during fielding." The minor amount of liquid used would be used to remove insects, animals, plants or seeds, and would not constitute a point-source discharge. The potential for this action to introduce negligible levels of contaminants has been analyzed throughout the EA/OEA.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Consistency is needed between the NPA and DEP for time periods for which certain actions will occur. The DEP info appears better, so perhaps correct the time periods in the NPA since it is located in the appendix and thus is part of the DEP. For example, the NPA says biologists would survey for injured wildlife within 4 days (pdf 35 of NPA) but is within 1 day in the DEP. Correct the NPA in this case. For KMISS Requirements and Limitations Section 1.2,c - it states that surveys will occur as soon as safely practical – suggest adding a not to exceed value – for example not to exceed 24 hours for injured wildlife. Attempt to insert a not to exceed time period for responses that are "when feasible", or "as close to launch as safely practicable" . For emergency notifications for a condition that poses an immediate threat to human health and safety, more urgency should be conveyed, such as notifications would occur immediately but not to exceed 24 hours, instead of "within 24 hours". Also – identify the most rapid communication vehicle – identifying emergency conditions in a printed publication does not appear to offer the

quickest response. Identify the communication vehicle for the quickest response for emergency situations and ensure that is prominent in the DEP and known to all essential agency personnel.

USAG-KA RESPONSE: The NPA time periods for biological surveys and reporting have been updated to reflect the time periods presented in the DEP. Revisions made to the NPA in Appendix A (see Sections 1.3 [page 11], 5.3 [pages 23 and 24], and 14.1 [page 33] in Appendix A).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Reporting procedures – add another item about maintaining statistics from multiple tests, for example to compile data from annual reports into an ongoing database for reference to inform future tests and DEPs.

USAG-KA RESPONSE: An item has been added to Section 5.0,"d" (page 11) to indicate that survey data and reports should be preserved for the duration of the activity plus 10 years.

Compiled data to support future tests and DEPs would be best accomplished through programmatic analysis of USAG-KA and RTS activities, as data from multiple defense programs would be involved, and are outside the scope of this DEP.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: The statement that Population estimates for marine mammal species are not available for the Kwajalein Atoll waters is concerning since understanding the affected environment is vital and the basis for impact assessment. Additionally, several mitigation commitments involve vessel operators adjusting speed based on expected animal densities. How are vessel operators determining this without the proper baseline knowledge for distribution and abundance of species? Such baseline info could be located in a programmatic impact assessment document as suggested multiple times and wold not need to be repeated. Urgency is needed for these studies or the mitigation commitments would be ineffective. If there is some knowledge of animal densities for use in the interim by vessel operators, indicate this and how operators are being informed. If knowledge is insufficient, slower speed should be used in all areas near the atoll as practicable.

USAG-KA RESPONSE: Analysis on the likelihood of vessel strikes was described by NMFS in the GBSD BO (see page 38 in Appendix B) and vessel activities were considered "not likely to adversely affect" marine consultation species given the currently listed BMPs. Further changes to these requirements are not recommended by NMFS. Other DEP requirements for collection of information on marine species sightings and additional biological surveys are included in the DEP and will help inform future analysis of impacts to protected species.

USAG-KA and cooperating agencies are working towards developing and implementing a programmatic consultation approach that would batch multiple activities over a period of time.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Climate change discussion, limitations and requirements is very out of date. The most recent citation is from 2002, with others dated 2001, 2000, and two dated 1998. Statements like "information regarding the magnitude of future climate change is speculative and fraught with uncertainties" is no longer true as the IPCC reports have increased knowledge over the years. Please rewrite this section with more updated statements.

USAG-KA RESPONSE: Section 8.0 (page 14) revised to include more recent studies and sources of climate change information.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Very high noise levels are documented. It is not clear where the closest human residential receptor is located. Sound traveling over water is amplified. Please identify the closest receptor (not staff or project related) that would not have hearing protection so understanding regarding potential impacts from noise levels can be estimated.

USAG-KA RESPONSE: Added the following text to 1.1.c: "During terminal flight and impact at USAKA, each test RV has the potential to affect land areas with sonic booms. There are no residences at Illeginni Islet or Gagan Islet. Gagan Islet is located at least 3 nautical miles (5.6 kilometers) west of the KMISS, where the test RVs would be targeting. The closest non-DoD receptors would be at Roi-Namur which is at least 6.8 miles from the KMISS area and 33 miles from Illeginni Islet. Range evacuation procedures during flight tests prevent residents or personnel from being subjected to noise-related impacts."

Additionally, the noise levels projected for the GBSD Proposed Action are provided in detail for personnel, public, and biological receptors in the GBSD EA/OEA (gbsdtesteaoea.govsupport.us). Please refer to EA/OEA Sections 3.4.1.3, 4.2.4.1.3, 4.3.4, Appendix E Section E.4, and Appendix G.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Comment response to EPA's first comment regarding the need for a program-level impact assessment for targeting USAG-KA and Illeginni Islet. A joint programmatic impact assessment (NEPA document and/or DEP) would be a good option for both the resource agencies and DoD. The response states that a Prog BO is being pursued, but no response to the programmatic NEPA/DEP is included. The separate table of responses received called Master Consolidated comments May 2022 has instead as a response - ***TBD [Requested input from SMDC.]*** Please update the response based on input from USSMDC.

USAG-KA RESPONSE: Comment response was updated in the June 2022 Draft DEP Section 10.0 (page 64) for review by the UES Agencies: "USASMDC and NMFS are working towards developing and implementing a programmatic consultation approach that would batch multiple RTS tests over a period of time with similar impact areas. The Programmatic Biological Assessment (PBA) for mission activities at USAKA will evaluate effects cumulatively resulting in satisfactory avoidance and minimization of risks of protected species. The intent of the PBA is

to streamline the Endangered Species Act (ESA) and UES consultation process and reduce administrative burden. Missions that do not meet the specific description and criteria of the action, including all applicable conservation measures as written in the PBA, will require separate consultation with NOAA. Concurrently, USAG-KA is evaluating the development of a programmatic consultation approach for routine Garrison activities to include marine transportation associated with RTS tests."

Regarding a programmatic NEPA/DEP, USAG-KA and USASMDC are currently in discussions regarding the appropriate environmental compliance documents necessary for ongoing activities.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: General comment – it is confusing that there are multiple versions of the DEP, for example a draft dated May 2022, and a draft dated June 2022. What is the difference in these documents if any? If there is no difference, please refrain from creating so many versions as it only adds to the confusion. Also some quality control in document submittal is needed. Please double check file names to ensure the file is as named.

USAG-KA RESPONSE: Apologies for the confusion. The differences between the May 2022 and June 2022 drafts were a result of UES Agency requests during the 30-day comment period. The June 2022 version incorporated NPA comments (Section 10.0 on page 49), but no Draft DEP updates. The comment period was extended from May 26, 2022 to June 15, 2022 to accommodate the document changes.

Quality Control methods are always used, but additional measures will be taken to ensure fewer draft versions are released to the UES Agencies during comment periods.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Recommend adjusting FY range to that of the DEP applicability.

USAG-KA RESPONSE: Removed Fiscal Years (FY) where possible. Revisions made to Technical Description of Activity (page v).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Add DAF to acronyms

USAG-KA RESPONSE: Updated in Abbreviations and Acronyms (page xii) and in the Technical Description of Activity (page vi).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Spell out first occurrence of DAF and add to list of acronyms. Is there a reason why DAF (presumably Department of the Air Force) and USAF (US Air Force) are used for the same entity?

USAG-KA RESPONSE: Added DAF to acronyms list (page xii). The Department of the Air Force (DAF) is different from the United States Air Force (USAF) in that DAF encompasses the USAF + US Space Force. The Air Force client requested this usage, and the definitions are explained in the Final EA/OEA and Signed FONSI (gbsdtesteaoea.govsupport.us). Revised in Abbreviations and Acronyms (page xii) and in the Technical Description of Activity (page vi).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend adding statement specifying whether contracting action(s) or adequate government staffing action(s) would be required

USAG-KA RESPONSE: Since these are the terms and conditions of the BO, contracting and staffing information is not included here. The Defense Program will ultimately be responsible for contracting and staffing actions necessary for implementing this requirement.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend adding the year of the Biological Opinions (2017/2021)

USAG-KA RESPONSE: The years of the Biological Opinions are provided at the beginning of Section 1.3 (page 5). Section 1.3.m applies to any and all Biological Opinions issued.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Rewrite USAKA as USAG-KA

USAG-KA RESPONSE: USAKA is the geographic location, but USAG-KA is the organization. In Section 1.4.b (page 7), changed to say, "All activities at USAKA importing activity-specific hazardous materials into USAKA shall submit within 15 days of receiving the material or before actual use, whichever comes first, a separate Hazardous Materials Procedure to the Commander, USAG-KA, for approval…"

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend specifying what personnel (i.e.: Defense personnel, USAG-KA personnel, etc.). In general, the responsibilities for monitoring/reporting lack clarity.

USAG-KA RESPONSE: The responsible parties for the survey requirements in Section 2.0.a (page 9) have been updated to the Defense Program, USAG-KA, and RTS. USASMDC would be responsible for distribution of reports to UES Appropriate Agencies.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend replacing Environmental Engineer by Environmental Office

USAG-KA RESPONSE: Revised Section 2.0.c (page 9) as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Rewrite "were out of harm's way" as "are out harm's way"

USAG-KA RESPONSE: Revised Section 2.0.f (page 10) as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Recommend specifying what personnel (i.e.: Defense personnel, USAG-KA personnel, etc.)

USAG-KA RESPONSE: Revised Section 2.0.h (page 10) to clarify responsible parties for data collection and reporting.

10.0 ENVIRONMENTAL COMMENTS AND RECOMMENDATIONS RECEIVED ON THE 2022 DRAFT NOTICE OF PROPOSED ACTIVITY AND USAG-KA'S RESPONSES

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: According to the UES, RTS is considered a tenant of USAG-KA at USAKA. The geographical place of the U.S. utilized 11 islets, mid-atoll corridor and surrounding air and water areas at Kwajalein Atoll is appropriately termed USAKA, not USAG-KA. The use of "RTS, USAG-KA, RMI" seems off. Would "RTS/USAG-KA (as host), USAKA, RMI" be better? Suggest correction or clarification of the use of this terminology throughout the document, lest we begin to lose track more generally.

USAG-KA RESPONSE: Revisions made to Appendix A (NPA) Sections 1.1 (page 2), 1.3 (page 12), 3.1 (page 15), 9.0 (page 28), 11.0 (page 29), 15.0 (page 33), and 16.0 (page 34). Changed text throughout to reflect that USAG-KA means facilities, infrastructure, and operations at USAKA; USAKA is the geographical areas within Kwajalein Atoll and including tenants (USAG-KA, RTS, etc.).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: The map labeling seems to deviate from terminology defined in the UES with respect to the use of USAG-KA versus USAKA. USAKA is typically used when referencing the spatial area of Kwajalein Atoll including the 11 islets, mid-atoll corridor and surrounding air and water areas (see UES 16th ed. definitions). According to the UES, USAG-KA hosts tenants and activities and covers facilities, infrastructure and operations at USAKA. USAKA is comprised of the islets, MAC, etc. and includes USAG-KA and all tenants including RTS. Suggest the labeling be changed to USAKA, and that such be checked and corrected throughout the document.

USAG-KA RESPONSE: NPA Figure 3 (page 5 of Appendix A). Labels changed to USAKA, as suggested.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: The way this is phrased suggests the discretionary recommendation made in 2005 to work to eradicate rodents from Eniwetak and or Gellinam has, to date, never been implemented. If this is so, and as it has been 16-plus years since the recommendation was made, why include it here now (it appears wholly ingenuous)? I may be wrong, but I thought some things had been accomplished over the years on this front. If so, those actions should be summarized and clarification on their augmentation should be provided. If not, perhaps some explanation should be provided. If the newly suggested commitment to this is not credible, strongly suggest leaving it out of this NPA.

USAG-KA RESPONSE: Section 1.3 (page 11 of Appendix A). This measure has been removed from the NPA.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Similar to item 3 above, if the DAF has not conducted a risk analysis of sea turtle exposure to DU and Be at Illeginni since the recommendation was made in 2005 (16-plus years ago), why would anyone now believe such will be completed associated with this NPA? The lack of action on this particular analysis, which appears suggested in the wording, should be explained along with how and why things will differ moving forward, if such is intended. If not intended, recommend removing the suggestion that it "may" be. Is turtle nesting needed to do the study, and if so, is the absence of noted nests at Illeginni the reason this remains in play? Are there active study plans and UES regulatory items (BO or LOC) that exist that may be referenced as evidence of ongoing intention?

USAG-KA RESPONSE: Section 1.3 (page 11 of Appendix A). This measure has been removed from the NPA.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: The language here appears outdated and again raises questions of credibility. NMFS would be very interested, and has continuously pressed for additional hydrophone data off Illeginni. However, USAKA has not, for years, demonstrated notable movement forward in collecting such additional data (off Illeginni or Gagan KMISS). The limited existing data from the single deployed hydrophone was analyzed years ago; it is not clear what further of it "will be" analyzed. See also Page 13 lines 13-18. Please explain.

USAG-KA RESPONSE: Revision made to NPA Section 1.3 (page 11 of Appendix A). The wording of this sentence was changed a bit. This measure will remain in the NPA and DEP. Given the importance of marine mammal data for USAKA, this measure has been added to the DAF mitigation implementation schedule in the DEP to facilitate discussion with DAF about implementing these hydrophone studies in the near future.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: The NMFS has requested but has not received evidence (of which I am aware) that this overflight and mammal/turtle reporting conservation recommendation has ever been implemented, despite its long-term persistence within environmental documents related to re-entry vehicle missions at USAKA. NMFS requested past records of overflights (and marine vessel trips) and related sightings/no sightings as evidence of implementation, and importantly as a source of data to inform future UES consultation risk analyses. It is not a conservation measure, and there is no measure of its intended mitigation effect, if this recommendation isn't implemented. The absence of past records raises concerns regarding NPA (and likely DEP) credibility. See also Page 21 lines 35-37; Page 22 lines 1-7 and 21-22.

USAG-KA RESPONSE: Revised DEP Item number 24 (page ix). USASMDC will send NMFS the survey report for FE-2: "Illeginni Environmental and Biological Activity Survey and Sampling Report for FE-2 Pre and Post Test Activity". This measure has been added to a mitigation schedule in the DEP to facilitate compliance for the future MMIII and GBSD tests.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: NMFS would need to be involved; we are the primary agency in the US regarding marine species in the water. Also, recommend including the RMIEPA.

USAG-KA RESPONSE: Revised in NPA Section 1.3 (page 11 of Appendix A) as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Potential typo, "recovery plants" = "recovery plans"?

USAG-KA RESPONSE: Recommended changes made to NPA Section 1.3 (page 13 of Appendix A).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: It is not clear what is being used to substantiate the contention that cetaceans around KMISS are "sometimes seasonal in occurrence because of unique migration patterns". What seasons, when "sometimes", what migrations? Are there measurements that exist specific to the populations that show up around USAKA? If so, we suggest referencing such and please share that information with NMFS so it may be examined and applied in future efforts (vessel/overflight records, other?). If not, is this just assumed, or is it extrapolated from some other region and just lacking appropriate reference? Please provide a source and basis for the statement. If measures do exist, please relate whether the "sometimes seasonal" characterization is likely a reflection of the timing and nature of the measurement, the organisms, or both.

USAG-KA RESPONSE: NPA Section 3.3. (page 17 of the Appendix A). Measures for the RMI do not exist to our knowledge. Added citation for description of the varying migration patterns of cetaceans in the Pacific Islands Region:
Miller, C. 2007. Current State of Knowledge of Cetacean Threats, Diversity, and Habitats in the Pacific Islands Region. A Report by the Whale and Dolphin Conservation Society.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: The timing and densities of migrations could very well be estimated/assessed with a small multi-year study using hydrophones in the area. NMFS has repeatedly recommended this be done to better inform on species impact risks and allow for time specific mitigations, if warranted. The KMISS hydrophone array itself may be used for such purposes (discussed with Navy installer during refurbishing; it was suggested that just a few additional pieces of shoreline hardware would be needed to allow for such). The sentence structuring here is somewhat mis-informative; it seems to suggest there is no ability to gain useful prediction due to the mobile and migratory nature of the animals. However, there is a wealth of evidence that suggests marine mammal migrations tend to be patterned, measurable and predictable. Reasonable pattern and density estimates may be made if simple efforts are put in place to passively collect data using hydrophones. The sentence provided should be modified/augmented and appropriately referenced to state that there are straightforward means to achieve useful levels of predictability, along with the reasons why USAKA will or will not choose to pursue those means prior to or during this proposed action.

USAG-KA RESPONSE: Sentence on timing and densities removed from NPA Section 3.3 (page 17 of Appendix A). Given the importance of marine mammal data for USAKA, this measure has been added to the DAF mitigation implementation schedule in the DEP (item 10 page vii) to facilitate discussion with DAF about implementing these hydrophone studies in the near future.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: The preceding wording in this paragraph is a little confusing as the section is labeled terrestrial but the wording within includes nearshore waters. Please note, the RMIEPA and NMFS are responsible for UES procedures related to sea turtle impacts in USAKA waters, including those nearshore, and would need to be informed and provided with the stated report if the impacts are to sea turtles in the water. If the impacts are to sea turtles on land, such a report should be sent to the RMIEPA and USFWS.

USAG-KA RESPONSE: NPA Section 5.3 (page 23 of Appendix A) revised for clarity and as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: "…this DEP" is referenced, but this is an NPA.

USAG-KA RESPONSE: NPA Section 5.4 (page 27 of Appendix A). Changed text to say "this project's DEP".

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: The wording here is confusing. The discontinuation of MMIII landings on Illeginni Islet isn't a change from present-day, but it is indicated as such, and this is a joint MMIII and GBSD NPA with 1 to 3 Illeginni impacts expected into 2030, which is a change from present-day. We note the reasons for not reinitiating consultation with the USFWS are provided in Section 13, they are not made clear here.

USAG-KA RESPONSE: NPA Section 9.0 (page 28 of Appendix A). Revised wording here.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: It isn't clear why this 2020 BA isn't referenced under the Page ii Line 53 references section. Also, the NMFS 2021 BO does not appear under the Page ii references.

USAG-KA RESPONSE: Citations for these added to the NPA References section (pages ii and iii) and Section 9.0 (page 28 of Appendix A).

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Typo: "nest" to "nests".

USAG-KA RESPONSE: NPA Section 9.0 (page 28 of Appendix A). Recommended changes made.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: Perhaps modify the statement to, "No migratory birds or other wildlife resources on land are expected to be harmed…" to avoid contradiction with the 2021 BO findings indicating likely adverse effects to marine-based UES consultation species that are summarized later in this section.

USAG-KA RESPONSE: "terrestrial" and "marine" added in key locations in NPA Section 13.0 (page 29 of Appendix A) to clarify.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: It may be worthwhile, when discussing or referring to critical habitat at USAKA, to denote it specifically as "RMI designated critical habitat". Most readers think of critical habitat as being designated by the U.S. under the U.S. ESA, which it is, but the ESA and critical habitat designations do not apply in foreign countries or international waters.

USAG-KA RESPONSE: NPA Section 13.0 (page 30 of Appendix A). Revised as recommended.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: The current MMIII project may be non-compliant with DEP Section 1.4 f (4). The NMFS does not appear to be receiving annual reports regarding pre and post-slight surveys. We have requested records (29 March 2021) related to the overflight and vessel surveys but have not received an indication that such exist, raising questions as to whether the overflights and monitoring during marine vessel maneuvers is occurring.

USAG-KA RESPONSE: USASMDC will send NMFS the survey report for FE-2: "Illeginni Environmental and Biological Activity Survey and Sampling Report for FE-2 Pre and Post Test Activity". A schedule/checklist of requirements has been added to the DEP (pages vii – ix) to facilitate DAF compliance with BO and UES requirements.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: The Draft NPA should more thoroughly address potential for gradual accumulation of contaminants from long-term weapons testing (and other activities) at USAGKA, which have the potential to impact groundwater and lagoon and ocean systems. Descriptions of procedures for mitigating potential contamination of the groundwater should be more complete (see our previous letters of 19 March 2021 and 19 April 2021). We also have concerns regarding potential physical impacts of projectiles and shock waves to wildlife, including birds, turtles, fishes and corals. Detailed comments are listed in the attached sheets.

USAG-KA RESPONSE: Comment noted.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Please see attached comment matrix sheets for specific comments and recommendations for the Draft NPA dated November 2021. Additionally, further consideration of compensatory mitigation for potential unintentional impacts on marine species and habitats should be considered.

USAG-KA RESPONSE: Comment noted.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: The Service supports continued development of the Draft Notice for Proposed Activities (NPA-21-TBD) associated with development of a new DEP regarding Minuteman III Modification and Fuze Modernization Flight Tests/Ground Based Strategic Deterrent (GBSD) Flight Tests at USAGKA. Comments and recommendations in this letter and in the attached Comment Matrix Sheets should be considered for future drafts.

USAG-KA RESPONSE: Comment noted.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Parentheses not closed "…documents (USAF 2004, 2006, 2013, 2020), …".

USAG-KA RESPONSE: NPA Section 1.0 (page 1 of Appendix A). Revised as recommended.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Note: It is indicated in several parts of the document that USAG-KA should continue to work with NMFS staff to conduct marine surveys throughout the atoll to develop more comprehensive understanding of distribution and abundance of species and habitats. While this is generally indicated in direct reference to comments made by NMFS on past documents, USFWS typically contributes to these surveys and would like our role in future surveys to be noted where appropriate.

USAG-KA RESPONSE: NPA Section 1.3 (pages 12 and 13 of Appendix A). Revised as recommended.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Note: NMFS recommends permits and training to perform necropsies and/or take tissue samples and to develop professional relations with qualified federal agencies and universities to capitalize on samples and information gained at USAG-KA. We recommend consulting USGS Honolulu Field Station for this purpose, as they possess requisite expertise.

USAG-KA RESPONSE: NPA Section 1.3 (page 13 of Appendix A). Added USGS as recommended.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Note: It is indicated here that water used to dampen contaminated dust could reach the lagoon/sea, but on page 21 lines 1-3, it is said that waters will not be allowed to flow to the lagoon/ocean. Please provide clarity on the means of controlling the flow of this water and what conditions would determine whether or not it reaches natural basins, and how this will be contained/controlled. Additionally, please provide further explanation of how these contaminants are expected to cumulate in groundwaters. If this is not expected, why? How will this be prevented considering consistent deposit of contaminants over the long-term?

Are means for removal of water contaminants planned for should they occur at levels unsafe to wildlife or habitats?

USAG-KA RESPONSE: NPA Sections 1.2 (page 9), 4.1 and 4.2 (page 19 of Appendix A). Additional text added.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Frequent monitoring of groundwater will be essential both 1) after any ground impacts and also 2) regularly due to unknown time of accumulation, retention, solubility and dispersal of contaminants in soil and water over the years. This is only partially addressed in the

BA (pg. 20, last point under "Hazardous Materials Measures" and in the last paragraph on pg. 35). It should be included in the NPA.

USAG-KA RESPONSE: The following text from the GBSD EA/OEA was added to Section 5.2 (page 23 of Appendix A), "Following a land-impact test, DAF and USAG-KA would collect soil and groundwater samples at various locations around the impact site and test the samples for beryllium, depleted uranium, and other metals. Testing results that exceed UES criteria would require a soil investigation as detailed in the UES and may require subsequent soil removal or other remediation."

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Construction of a berm would have a limited positive effect on ejecta because of the arc trajectory with many fragments going over the berm. Berm could affect turtle nesting at upper boundary of beach.

USAG-KA RESPONSE: This was a NMFS suggestion, there are no plans to do this for testing. This was a discretionary conservation recommendation from NMFS; there are no plans to do this for testing, therefore, it was not carried forward into the DEP.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Mark all Black-naped tern (BNTE) nests found with flagged stakes 3 feet away from nest to prevent inadvertent damage. Actual direction away from nest is not important as long as the direction is consistent for all nests, because the nests are cryptic.

USAG-KA RESPONSE: NPA Section 5.3 (page 23 of Appendix A). Revised as recommended.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: For injured wildlife, contact should be made with Hawaii Wildlife Center, Kapaau HI 96755 808-844-5000. Director Linda Elliott.

USAG-KA RESPONSE: NPA Section 5.3 (page 23 of Appendix A). Revised as recommended.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Sound of 240 dB is lethal. Sound pressure reduction occurs with a 6 dB reduction with a doubling of distance (inverse square law) Any animal within 200 meters will be subjected to 200+ dB which is still lethal. This means ALL birds in the short grass area surrounding the helipad will be killed and many black terns nesting in the littoral forest will be killed or permanently injured. All great-crested terns roosting on offshore orange balls will be killed.

USAG-KA RESPONSE: Based on bird surveys during past missile testing events, no bird mortality was observed, and bird activity returned to normal after the test.
Citation: Foster and Work. 2011. U.S. Army at Kwajalein Atoll trip Report for Advanced Hypersonic Weapons Demonstration Test. U.S. Fish and Wildlife Service, Pacific Islands Office and U.S. Geological Survey. November 14-18, 2011.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Same comment as #[28]: mark nests of BNTE.

USAG-KA RESPONSE: NPA Section 13.0 (page 30 of Appendix A). Revised as recommended.

AMENTUM ENVIRONMENTAL COMMENT: First bullet incorrectly provides the current version of the Eniwetak Conservation Area Management Plan which was revised in August 2017. Recommend updating it to reflect current version.

USAG-KA RESPONSE: Request a copy of that document be sent to KFS, LLC for Administrative Record. Please email a PDF to mccartyh@kfs-llc.com. NPA References section (page ii of Appendix A) updated with the current version of the plan.

AMENTUM ENVIRONMENTAL COMMENT: 9th bullet refers to the USAKA 2006, Historic Preservation Plan. The current HPP was revised and issued in July 2020. Recommend updating to reflect current revision.

USAG-KA RESPONSE: Request a copy of that document be sent to KFS, LLC for Administrative Record. Please email a PDF to mccartyh@kfs-llc.com. NPA References section (page v of Appendix A) updated with the current version of the plan.

AMENTUM ENVIRONMENTAL COMMENT: 10th bullet refers to an outdated Dredging and Filling DEP. Recommend revising it to refer to the existing Dredge and Fill DEP-16-001.0 which became effective on 22 December 2017.

USAG-KA RESPONSE: Request a copy of that document be sent to KFS, LLC for Administrative Record. Please email a PDF to mccartyh@kfs-llc.com. NPA References section (page iv of Appendix A) updated with the current version of the document.

AMENTUM ENVIRONMENTAL COMMENT: This sentence references the outdated ECA Management Plan. Recommend referring to the revised plan as referenced in the first comment.

USAG-KA RESPONSE: NPA Section 1.3 (page 10 of Appendix A). Requested changes made.

AMENTUM ENVIRONMENTAL COMMENT: It is important to note that rats were not found at the ECA and thus, there have been no activities to eradicate rats at the ECA. The focus then turned to the control of ants at the ECA instead per the current ECA Management Plan.

USAG-KA RESPONSE: Section 1.3 of the NPA (page 11 of Appendix A). This measure was removed from the NPA.

AMENTUM ENVIRONMENTAL
COMMENT: Please revise to reflect the current Dredge and Fill DEP in effect (DEP-16-001.0). It is also important to note that the Dredge and Fill Project Description Sheet 2 may be required

that includes USAG-KA Environmental Approval and a 30-day review by the UES Agencies. The paragraph assumes the dredge or fill activity would require a Project Description Sheet 1 (less than 25 cubic yards of movement and no special conditions). Recommend revising to reflect possible options.

USAG-KA RESPONSE: NPA Section 5.2 (page 22 of Appendix A). Requested changes made.

AMENTUM ENVIRONMENTAL COMMENT: Section indicates that water used to minimize dust after impact would be directed toward the water catchment area. Where is the water catchment area on Illeginni? Wasn't aware there was one.

USAG-KA RESPONSE: NPA Sections 1.2 (page 9), 4.1 and 4.2 (page 19 of Appendix A). Explanatory text added. See Comment #25.

AMENTUM ENVIRONMENTAL COMMENT: This sections references UES Section 3-5.5(a)(3) which doesn't exist. Please correct the reference.

USAG-KA RESPONSE: NPA Section 11.0 (page 29 of Appendix A). Revised text.

AMENTUM ENVIRONMENTAL COMMENT: Please remove the reference to the Kwajalein Range Services Newsline since it no longer exists.

USAG-KA RESPONSE: NPA Section 14.2 (page 33 of Appendix A). Requested changes made.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Spell-out acronym at first occurrence (apparently reversed with line 37). In addition, the United States Air Force is also represented by its more common acronym USAF in other parts of the document. Is there a reason for using both DAF and USAF ?

USAG-KA RESPONSE: NPA Section 1.0 (page 1 of Appendix A). Edited first use of DAF. DAF is the newer term for the combined Air Force and Space Force. Because the Air Force and Global Strike Command and Space Launch Delta 30 of the United States Space Force prepared the EA/OEA, DAF is used for the GBSD Test Program. Some programs and various agencies may still use US Air Force (USAF).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Spell-out acronym at first occurrence (apparently reversed with line 34).

USAG-KA RESPONSE: NPA Section 1.0 (page 1 of Appendix A). Requested changes made.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Specify whether USAKA or SMDC/RTS is not meant rather than USAG-KA. The unclear use of USAG- KA appears in various parts of this document.

USAG-KA RESPONSE: See comment #1. Changed text throughout to reflect that USAG-KA means facilities, infrastructure, and operations at USAKA; USAKA is the geographical areas within Kwajalein Atoll and including tenants (USAG-KA, RTS, etc.). Revisions made to NPA Sections 1.1 (page 2), 1.3 (page 12), 3.1 (page 15), 9.0 (page 28), 11.0 (page 29), 15.0 (page 33), and 16.0 (page 34 of Appendix A).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Specify whether USAKA or SMDC/RTS is not meant rather than USAG-KA. The unclear use of USAG- KA appears in various parts of this document.

USAG-KA RESPONSE: See comment #1. Changed text throughout to reflect that USAG-KA means facilities, infrastructure, and operations at USAKA; USAKA is the geographical areas within Kwajalein Atoll and including tenants (USAG-KA, RTS, etc.). Revisions made to NPA Sections 1.1 (page 2), 1.3 (page 12), 3.1 (page 15), 9.0 (page 28), 11.0 (page 29), 15.0 (page 33), and 16.0 (page 34 of Appendix A).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Recommend adding "in accordance with Section 3.6 of the UES.

USAG-KA RESPONSE: NPA Section 1.3 (page 11 of Appendix A). Requested changes made.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Specify whether USAKA or SMDC/RTS is not meant rather than USAG-KA. The unclear use of USAG- KA appears in various parts of this document.

USAG-KA RESPONSE: See comment #1. Changed text throughout to reflect that USAG-KA means facilities, infrastructure, and operations at USAKA; USAKA is the geographical areas within Kwajalein Atoll and including tenants (USAG-KA, RTS, etc.). Revisions made to NPA Sections 1.1 (page 2), 1.3 (page 12), 3.1 (page 15), 9.0 (page 28), 11.0 (page 29), 15.0 (page 33), and 16.0 (page 34 of Appendix A).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Specify whether USAKA or SMDC/RTS is not meant rather than USAG-KA. The unclear use of USAG- KA appears in various parts of this document.

USAG-KA RESPONSE: See comment #1. Changed text throughout to reflect that USAG-KA means facilities, infrastructure, and operations at USAKA; USAKA is the geographical areas within Kwajalein Atoll and including tenants (USAG-KA, RTS, etc.). Revisions made to NPA Sections 1.1 (page 2), 1.3 (page 12), 3.1 (page 15), 9.0 (page 28), 11.0 (page 29), 15.0 (page 33), and 16.0 (page 34 of Appendix A).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Specify whether USAKA or SMDC/RTS is not meant rather than USAG-KA. The unclear use of USAG- KA appears in various parts of this document.

USAG-KA RESPONSE: See comment #1. Changed text throughout to reflect that USAG-KA means facilities, infrastructure, and operations at USAKA; USAKA is the geographical areas within Kwajalein Atoll and including tenants (USAG-KA, RTS, etc.). Revisions made to NPA Sections 1.1 (page 2), 1.3 (page 12), 3.1 (page 15), 9.0 (page 28), 11.0 (page 29), 15.0 (page 33), and 16.0 (page 34 of Appendix A).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Suggest rewriting "directly south of" as "in a southern direction from".

USAG-KA RESPONSE: See NPA Figure 3 of Appendix A.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Recommend adding or referring to a list of the hazardous materials contained in the RV besides Be and DU.

USAG-KA RESPONSE: Information added to NPA Section 3.4 (page 18 of Appendix A) and citation added to NPA Section 3.1 (page 15 of Appendix A).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Recommend adding "at Vandenberg Air Force Base (or VSFB) after "Emissions" or 'Launches".

USAG-KA RESPONSE: NPA Table 2 Title (page 16 of Appendix A). Requested changes made.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Recommend adding or referring to a list of the hazardous materials contained in the RV besides Be and DU.

USAG-KA RESPONSE: Cited Section 3.4 and added additional explanatory text to section 3.2 (page 16 of Appendix A).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KWAJALEIN ATOLL
COMMENT: Move period from after "programs" to after "(USAFGSC 2015) on line 15.

USAG-KA RESPONSE: NPA Section 3.3 (page 17 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Move period from after "KMISS" to after "(USAFGSC 2015) on line 17.

USAG-KA RESPONSE: NPA Section 3.3 (page 17 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Move period from after "moment" to after "(USAFGSC 2015).

USAG-KA RESPONSE: This citation applies to the whole paragraph, not just the sentence.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Re-write …sea turtles. However," as "sea turtles; however,"

USAG-KA RESPONSE: NPA Section 3.3 (page 17 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Re-write "the impact" as "the impacts".

USAG-KA RESPONSE: NPA Section 3.3 (page 18 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Shouldn't this statement belong in the "Environmental controls" section?

USAG-KA RESPONSE: NPA Section 3.3 (page 18 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Suggest re-writing "Only small amounts of hazardous wastes are expected…and will be managed…" as "These occurrences are unlikely and rare, only small amounts of hazardous wastes, if any, are expected…and would be managed…"

USAG-KA RESPONSE: NPA Section 3.4 (page 18 of Appendix A). Recommended changes made.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Shouldn't the statement starting with "Any potentially hazardous wastes…" belong in the "Environmental controls" section?

USAG-KA RESPONSE: NPA Section 5.4 (page 26 of Appendix A). Recommended changes made.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend adding or referring to a list of the hazardous materials contained in the RV.

USAG-KA RESPONSE: Revised as recommended. See comment #'s 50, 52. Revised as recommended in Section 3.1 (page 15), 3.2 (page 16), and 3.4 (page 18 of Appendix A).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend adding a statement explaining how or why "no impacts will be expected.

USAG-KA RESPONSE: NPA Section 4.2 (page 19 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Last statement, refer to section 5.1 for the possible use of water as dust control.

USAG-KA RESPONSE: NPA Section 4.1 (page 19 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend adding "or promptly cleaned-up" after "prevented".

USAG-KA RESPONSE: NPA Section 4.4 (page 21 of Appendix A). Recommended changes made.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend adding "temporarily" before "stabilized".

USAG-KA RESPONSE: NPA Section 5.1 (page 22 of Appendix A). Recommended changes made.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend re-writing "testing" as "testing events" or "tests".

USAG-KA RESPONSE: NPA Section 5.1 (page 22 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend re-writing "vicinity from" as "areas affected by".

USAG-KA RESPONSE: NPA Section 5.1 (page 22 of Appendix A). Recommended changes made.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend adding "or minimize" after "avoid".

USAG-KA RESPONSE: NPA Section 5.2 (page 22 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend addressing the potential effect/impacts on coral formations between 10-ft and 20-ft depth.

USAG-KA RESPONSE: These potential impacts at Illeginni Islet are addressed in the Endangered Species and Wildlife Resources, NPA Section 5.3 on pages 24 and 26 of Appendix A.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend adding "implement and" before "comply".

USAG-KA RESPONSE: NPA Section 5.3 (page 23 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Specify whether USAKA or SMDC/RTS is not meant rather than USAG-KA. The unclear use of USAG- KA appears in various parts of this document.

USAG-KA RESPONSE: USAG-KA is intended here as these are actions the Garrison would take.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Recommend adding "UES coordination and" before "consultation".

USAG-KA RESPONSE: NPA Section 5.3 (page 24 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Specify whether any other combustion residual could be present.

USAG-KA RESPONSE: NPA Section 5.3 (page 25 of Appendix A). Specified as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Specify in what circumstances would this apply. For example, in the case of an air burst over sea surface, the RV would be disintegrated before splashing into the water surface.

USAG-KA RESPONSE: We are not able to specify in this document, what would happen to the RV in this instance.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Suggest rewriting "substantially" as "considerably".

USAG-KA RESPONSE: NPA Section 5.3 (page 26 of Appendix A). Revised as recommended.

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA COMMENT: Specify whether USAKA or SMDC/RTS is not meant rather than USAG-KA. The unclear use of USAG- KA appears in various parts of this document.

USAG-KA RESPONSE: See comment #1. Changed text throughout to reflect that USAG-KA means facilities, infrastructure, and operations at USAKA; USAKA is the geographical areas within Kwajalein Atoll and including tenants (USAG-KA, RTS, etc.). Revisions made to NPA Sections 1.1 (page 2), 1.3 (page 12), 3.1 (page 15), 9.0 (page 28), 11.0 (page 29), 15.0 (page 33), and 16.0 (page 34 of Appendix A).

US ARMY ENVIRONMENTAL COMMAND, FORWARD ESM – USAG-KA
COMMENT: Verify/confirm the validity of "Kwajalein Range Service Newsline".

USAG-KA RESPONSE: See Comment #40. Revised NPA Section 14.2 (page 33 of Appendix A).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Overarching message: Need for a program-level assessment for Kwajalein Atoll and Illeginni USEPA R9 has commented previously on the need for a programmatic impact assessment approach with regard to DoD flight test actions targeting USAG-KA and Illeginni Islet. A joint programmatic impact assessment (NEPA document and/or DEP) would be a good option for both the resource agencies and DoD. A programmatic evaluation would identify a clear and comprehensive baseline of existing conditions which would not have to be repeated in each project-specific document and contain an assessment of cumulative impacts to Illeginni Islet and nearby waters. This would remedy the piecemeal approach that project-specific NEPA EAs and DEPS have taken, avoid duplicative paperwork, and going forward, allow for simpler and more focused project-specific analyses, tiered to the programmatic impact assessment. Despite perceived logistical difficulties inherent with having different lead Department of Defense agencies, time schedules, and funding sources, a program solely addressing Illeginni and nearby impacts could be implemented by a single entity coordinated through the U.S. Army Space and Missile Defense Command.

• USEPA R9 strongly recommends that coordination begin to develop a Kwajalein/Illeginni Islet sustainability program to promote sustainability for both environmental resources and for future use of the DoD asset, consistent with DoD's sustainable ranges initiative (https://www.denix.osd.mil/sri/index.html). The program could be referenced in relevant future NEPA documents to help support future FONSIs and SEPs, and offer a coordinated tracking vehicle for environmental sampling and testing results, modeling efforts, associated studies, and conservation measures identified in multiple biological opinions.

USAG-KA RESPONSE: USASMDC and NMFS are working towards developing and implementing a programmatic consultation approach that would batch multiple RTS tests over a period of time with similar impact areas. The Programmatic Biological Assessment (PBA) for mission activities at USAKA will evaluate effects cumulatively resulting in satisfactory avoidance and minimization of risks of protected species. The intent of the PBA is to streamline the Endangered Species Act (ESA) and UES consultation process and reduce administrative burden. Missions that do not meet the specific description and criteria of the action, including all applicable conservation measures as written in the PBA, will require separate consultation with NOAA. Concurrently, USAG-KA is evaluating the development of a programmatic consultation approach for routine Garrison activities to include marine transportation associated with RTS tests.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Confusing and potentially contradictory info regarding how many landings/targets for Illeginni Islet are possible. Because the document explicitly states that it is the landings on

Illeginni that are prompting the creation of this new DEP (p. 3 – "Because of the proposed Ground-Based Strategic Deterrent (GBSD) land impacts on Illeginni, a new DEP is being prepared thus requiring this NPA and subsequent companion DEP for the MMIII/GBSD Flight Tests at USAG-KA"), it should be very clear how many landings and RVs will impact it.
• USEPA R9 recommends modifying Table 1 to include the number of targets and RVs that could impact Illeginni Islet.

USAG-KA RESPONSE: The last paragraph of Page 2 (Section 1.0) and the third full paragraph of page 7 of the NPA (Appendix A) states the number of RV impacts on Illeginni Islet: "one to three test RVs in total are planned to impact land on the western end of Illeginni Islet." NPA Table 1 cannot be modified to add the number of tests involving RV impact at Illeginni Islet as the fiscal year of the test(s) involving Illeginni Islet is not available at this time.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA) COMMENT: The DEP states that "small quantities of heavy metals including Be, cadmium, chromium, lead, DU, and asbestos" are released upon impact of the RV's and that residual concentration of Be and DU have been detected in the soils on the western end of Illeginni Islet. It states that these levels are within UES compliance levels" without identifying what these levels are. In addition to contaminants from future tests, existing contamination on Illeginni, as identified in the February 2021 Environmental Assessment, includes Be, tungsten, and depleted uranium that would be disturbed at the impact sites, and this impact is not identified in the DEP, nor is the known history of tungsten contamination in soil and groundwater.

• USEPA R9 recommends including a compiled table of results from soil testing, with compliance levels identified, in the DEP.

USAG-KA RESPONSE: The DEP is meant to document mitigation measures for the GBSD flight tests. Past history of the Illeginni soil sampling is described in detail in the GBSD EA/OEA; however, because it is not specific to the GBSD program, it does not belong in the GBSD DEP. In response to the EPA's request, the requested table was added to the NPA (which is included as an Appendix to the DEP) in Section 4.4 (page 21 of Appendix A).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA) COMMENT: It is not clear what actions will be taken to monitor the levels of contamination over the course of the actions through 2029 for the GBSD program nor how the results will be reported. The Environmental Assessment for the GBSD indicated in Section 4.2.4.1.1.1 Mitigation Measures, Flight Test Mitigation Measures – USAG-KA that "The following measures would be implemented as part of the Proposed Action and would be included in the Document of Environmental Protection for GBSD Test Program activities at Kwajalein Atoll" and included: "Following a land-impact test, the USAF and USAG-KA would collect soil and groundwater samples at various locations around the impact site and test the samples for beryllium, depleted uranium, and other metals. Testing results that exceed UES criteria would require a soil investigation as detailed in the UES and may require subsequent soil removal or other remediation." The mitigation measure identified above is not identified in this NPA for the

DEP. It is not clear whether the other mitigation measures listed in Section 4.2.4.1.1.1 are included in the DEP.

• USEPA R9 recommends including all mitigation measures identified in pages 4-94 through 4-98 of the Ground Based Strategic Deterrent Test Program, Environmental Assessment / Overseas Environmental Assessment, February 2021, in the DEP as stated would occur.

USAG-KA RESPONSE: The DEP states in Milestone Schedule item number 20 (page ix), "Test soil samples to ensure that the concentrations of Be, U, and other metals do not exceed established UES standards. (Section 1.1.l, m) If standards are exceeded, follow requirements in Sections 1.1.l, m, & n." The NPA summarizes the actions of the GBSD program; however, mitigation measures are focused on in the DEP. The requested information is not required in the NPA; however, it is required in the DEP, and has been met with DEP Sections 1.1 l, m, and n (page 2). The DEP includes all mitigation measures identified in the EA/OEA (June 2021).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA) COMMENT: USEPA R9 recommends discussion of impacts from disturbing existing contamination on Illeginni from the GBSD test weapon impacts and ejecta and its potential to add to the contamination.

USAG-KA RESPONSE: This information is provided in the GBSD EA/OEA, not the NPA. A reference to the GBSD EA/OEA was added to NPA Appendix A Sections 3.2 (page 17) and 3.4 (page 18).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA) COMMENT: USEPA R9 recommends the DEP identify the soil testing, committed to in the EA, that will occur after each impact on Illeginni Islet for the GBSD program and how these results will be communicated. The DEP should clearly identify the process whereby soils will be prevented from accumulating significant levels of pollutants.

USAG-KA RESPONSE: See DEP Milestone Schedule Item number 20 (page ix); DEP Section 1.1.l, m, n (page 2).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA) COMMENT: The NPA is confusing with regard to identifying point source versus nonpoint sources. It states that there would be no point-source discharges (p. 35), but then states that stormwater is a point source (p. 36). Also, page 19 states that "excavated material would be screened, and the collected RV debris washed before packaging for shipment back to Kwajalein Islet and the United States." It also states that water for dust control would be directed into catchments and allowed to evaporate (p. 31), without acknowledging that this water could be contaminated.

• USEPA R9 recommends clarifying the point and nonpoint source terminology in the DEP; and the stormwater discharges that could occur from the actions and how pollutants in stormwater will be prevented from entering the lagoon. Describe the washing process and where the wash

water would be discharged, and discuss the fate of contaminants in dust control evaporation residue.

USAG-KA RESPONSE: As described in Section 7.0 of the NPA (page 27 of Appendix A), there are no point-source discharges associated with the MMIII/GBSD activities. Stormwater is not discussed in the GBSD NPA. There are no stormwater point-source discharges associated with MMIII/GBSD activities. Regarding "washing", see DEP Section 1.1.g (page 1): "Prior to returning the test support equipment and materials to the US, the equipment shall be washed, and a certified Pest Control Technician shall inspect the equipment again to ensure that it does not contain any insects, animals, plants, or seeds that might have been picked up during fielding." The minor amount of liquid used would be used to remove insects, animals, plants or seeds, and would not constitute a point-source discharge. The potential for this action to introduce negligible levels of contaminants has been analyzed throughout the EA/OEA. Sentence regarding freshwater for dust control added to NPA Section 1.2 (page 9 of Appendix A). The discussion of potential contaminants in dust control and evaporation residue are in NPA Sections 4.1 (Appendix A, page 19), 4.2 (page 19), 5.1 (page 22), and 5.2 (page 23).

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: No evaluation of impacts to environmental justice populations is included in the NPA. While we understand no unauthorized personnel will be present at Illeginni, as previously commented, it is possible that an exposure route to nearby populations at Ebeye and elsewhere could existing via subsistence fishing.

• USEPA R9 recommends discussion of potential impacts to subsistence fishers at the atoll be included in the DEP. Indicate whether additional fish studies are planned. We recommend determining whether lead or tungsten is present in fish that have Illeginni Islet waters in their range and that are sought by the local fishing population. We note that the fish study finalized in 2017 did not appear to test for lead or tungsten and we recommend ascertaining whether these contaminants are accumulating in fish tissue and organs consumed by the local population.

USAG-KA RESPONSE: The impacts of the proposed action on Environmental Justice, including fish and subsistence fishing, were evaluated in the GBSD EA/OEA. See GBSD EA/OEA Appendix G (Section G.1.1) for a discussion of EO 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (including Subsistence Fishing). The EA/OEA identified no human health or environmental effects by the Proposed Action that would result in disproportionately high or adverse effect on minority or low-income populations, including on subsistence fishing. USEPA R9's recommendation for future fish studies is noted.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: The NPA does not sufficiently disclose GHG and other air emissions and does not explain its conclusions. Additionally, the statement that GHG emissions would be temporary does not recognize that their presence in the atmosphere is not temporary in any human timeframe.

• USEPA R9 recommends adding an estimate of CO2eq emissions to Table 2 (Table 2 currently states "N/A", which is not correct) and add emission estimates for Tn, Be and U. In the statement on page 29 that minor quantities of emissions would be within the UES air quality standards, provide the standard quantity for those pollutants and the basis for this determination.

USAG-KA RESPONSE: 1. The "N/A" stated in Table 2 for CO_2e should read "Unknown". Due to the age of the Minuteman Launch Vehicle Program at Vandenberg Space Force Base (1965) and the MMIII Launch Vehicle (1970s), GHGs emissions were and are not tracked. From Vandenberg Space Force Base the actual vehicle launch is considered a "Mobile Source" and the local permitting authority does not require the reporting of CO2e for mobile source.

2. The estimated emissions for tungsten (W), Be and U in air as it relates to the MMIII and GBSD programs in the RMI are unknown. A sampling and analysis of materials from Illeginni were done in 2017 by Lawrence Livermore National Laboratory and a number of air monitoring filters were also collected as part of this exercise. These data will be reported as they become available.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Mitigation and Conservation Measures from Biological Opinions
For Section 1.3 - Mitigation and Conservation Measures – the listing of actions under the different BO's is not very helpful since its not apparent which, if any, have been implemented.

• USEPA R9 recommends a table be created that includes all the recommendations in all the BO's and that a column indicate for each one whether it has been implemented, the estimated date for completion, or whether there are no plans for implementation. This table should be updated for each new DEP and BO for these actions. See also comment above regarding need for program-level assessment.

USAG-KA RESPONSE: A schedule/checklist of requirements has been added to the DEP (Milestones Schedule Pages vii-ix) to facilitate DAF compliance with BO and UES requirements. The PDT does not have a complete list of which measures have been implemented for MMIII in order to include a column in the table indicating if the measures have been implemented. Additionally, any measures specified in the GBSD BO would not have been implemented yet. The NPA and DEP are focused on future implementation of mitigation and conservation measures for the Proposed Action.

US ENVIRONMENTAL PROTECTION AGENCY, REGION 9 (USEPA)
COMMENT: Ocean and Reef: Page 18 states that "a Landing Craft Utility (LCU) vessel, will be temporarily placed in ocean waters no less than 10 ft (3 m) deep" and that no anchors will be used to maintain raft positions. The NPA does not indicate whether the LCU itself will use anchors and if so, the impacts that would be expected for the totality of the tests.

USAG-KA RESPONSE: No anchoring of the LCU is expected for the Proposed Action. Revised NPA Section 1.2 (page 8 of Appendix A) to clarify.

APPENDIX A

Minuteman III Modification and Fuze Modernization Flight Tests / Ground-Based Strategic Defense Flight Tests
Notice of Proposed Activity
July 2022

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NOTICE OF PROPOSED ACTIVITY (NPA)

ACTIVITY:

MINUTEMAN III MODIFICATION AND FUZE MODERNIZATION FLIGHT TESTS / GROUND-BASED STRATEGIC DEFENSE (GBSD) FLIGHT TESTS

CONTROL NUMBER NPA-22-SMDC-01.1

July 2022

U.S. ARMY GARRISON KWAJALEIN ATOLL

IN THE

REPUBLIC OF THE MARSHALL ISLANDS

Prepared by:

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NOTICE OF PROPOSED ACTIVITY

ACTIVITY: MINUTEMAN III MODIFICATION AND FUZE MODERNIZATION FLIGHT TESTS / GROUND-BASED STRATEGIC DEFENSE (GBSD) FLIGHT TESTS CONTROL NUMBER NPA-22-SMDC-01.1

DATE SUBMITTED: 18 July 2022

The Compact of Free Association between the Republic of the Marshall Islands (RMI) and the United States (US) requires all US Government activities at US Army Garrison-Kwajalein Atoll (USAG-KA) controlled sites (known as US Army Kwajalein Atoll [USAKA]), where Ronald Reagan Ballistic Missile Defense Test Site (RTS) is a tenant organization, to conform to specific compliance requirements, coordination procedures, and environmental standards identified in the USAKA Environmental Standards and Procedures (UES) (USASMDC 2021). As specified in Section 2-2 of the UES, these standards also apply to all USAG-KA and RTS activities occurring elsewhere within the RMI, including the territorial waters of the RMI.

In 2005, a Notice of Proposed Activity (NPA) and companion Document of Environmental Protection (DEP) (USAKA 2005) went into effect for the Minuteman III (MMIII) Modification Flight Tests at RTS. In 2017, a renewed DEP and companion Notice of Continued Activity (NCA) went into effect at RTS for the MMIII Intercontinental Ballistic Missile (ICBM) Modification and Fuze Modernization. As part of these MMIII Modification Flight Tests and the Fuze Modernization program, the possibility of up to five land impacts at Illeginni Islet were removed for the remaining life of the program. The UES requires renewal of DEPs for continuing activities, and new DEPs for new activities. Because of the proposed Ground-Based Strategic Deterrent (GBSD) land impacts on Illeginni, a new DEP is being prepared thus requiring this NPA and subsequent companion DEP for the MMIII/GBSD Flight Tests at USAKA. Upon issuance, the new DEP will cover a 5-year period.

The flight testing activities for MMIII have not changed substantially over the years, with the exception of the removal of the requirement for land impacts in 2016, and neither the MMIII program nor the Fuze Modernization activities will induce significant changes. Additionally, currently there are no requirements and thus no plans for MMIII land impacts at Illeginni Islet from MMIII flight testing as of November 2021.

The GBSD weapon system addressed in this NPA has been officially named Sentinel, and represents the continual modernization of the United States' land-based nuclear arsenal with replacement of the aging MMIII. The proposed GBSD Test Program involves the development and testing of a new ICBM weapon system that would eventually replace the aging MMIII weapon system. Implementation of the test program would include facility construction or

modifications at Hill Air Force Base (HAFB), Vandenberg Space Force Base (VSFB), and Dugway Proving Ground (DPG). In addition, GBSD flight test activities would be conducted from VSFB and include target impacts at USAKA sites in the RMI. Target locations would include the Kwajalein Missile Impact Scoring System (KMISS), offshore of Illeginni Islet, and land impact on Illeginni Islet. Such testing at the KMISS would be conducted in the same manner as for the ongoing MMIII flight tests, while testing in the vicinity of Illeginni Islet would be conducted similarly to what was previously done under the MMIII program (USAF 2004, USAF 2015). The Department of the Air Force (DAF) currently plans only one flight test with impact on land at Illeginni Islet for the GBSD Test Program, but up to three total land reentry vehicle (RV) impacts may be possible through the end of fiscal year 2029.

Because deployment of the new GBSD weapon system cannot occur until it has been adequately tested and proven sufficiently mature for operational use, both GBSD and MMIII flight test activities and related operations would overlap at HAFB, VSFB, and USAKA. Such testing would overlap for up to 10 years or until decisions are made to remove the MMIII weapon system from active status.

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TYPE OF ACTIVITY

This NPA addresses a proposed MMIII ICBM and Fuze Modernization program and GBSD flight tests.

LOCATION OF ACTIVITY

The KMISS range located off the east reef near Gagan Islet, RTS, RMI, the RV impact site at Illeginni Islet, and in the vicinity of Illeginni Islet. RTS is a tenant of USAG-KA at USAKA, the Mid-Atoll Corridor and surrounding air and water areas at Kwajalein Atoll.

COMPLIANCE STATUS

The MMIII and Fuze Modernization program flight testing activities at USAKA are in compliance with the UES. The testing activities and potential effects on endangered and threatened species will be monitored by the United States DAF and USAG-KA and reported to the Appropriate Agencies in accordance with the associated DEP to ensure continued compliance.

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Acronyms and Abbreviations

AHW	Advanced Hypersonic Weapon
BA	Biological Assessment
Be	Beryllium
BO	Biological Opinion
BOA	Broad Ocean Area
CONUS	Continental United States
DAF	Department of the Air Force
dB	Decibel(s)
DEP	Document of Environmental Protection
DOD	Department of Defense
DPG	Dugway Proving Ground
DPS	Distinct Population Segment
DU	Depleted Uranium
EA/OEA	Environmental Assessment / Overseas Environmental Assessment
ECR	Environmental Comments and Recommendations
EOD	Explosive Ordnance Disposal
ESA	Endangered Species Act
ft	Feet
GBSD	Ground Based Strategic Deterrent
HAFB	Hill Air Force Base
HAP	Hazardous Air Pollutant
ICBM	Intercontinental Ballistic Missile
KEEP	Kwajalein Environmental Emergency Plan
Kg	Kilogram(s)
KMISS	Kwajalein Missile Impact Scoring System
kg	Kilogram
km	Kilometer
km^2	Square Kilometer
lb	Pounds
LCU	Landing Craft Utility
LIDSS	Lawrence Livermore National Laboratory Independent Diagnostics Scoring System
LLNL	Lawrence Livermore National Laboratory
m	Meter
MAC	Mid-Atoll Corridor
mi	Mile
MMIII	Minuteman III
NCA	Notice of Continuing Activity

NMFS	National Marine Fisheries Service
nmi	Nautical Mile
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NPA	Notice of Proposed Activity
PTS	Permanent Threshold Shift
RMI	Republic of the Marshall Islands
RMIEPA	Republic of the Marshall Islands Environmental Protection Authority
RS	Reentry System
RSL	Regional Screening Level
RTS	Ronald Reagan Ballistic Missile Defense Test Site
RV	Reentry Vehicle
SOSBI	Species of Significant Biological Importance
tpy	Tons Per Year
TT	Thrust Termination
TTS	Temporary Threshold Shift
U	Uranium
UES	USAKA Environmental Standards and Procedures
US	United States
USAF	United States Air Force
USAFGSC	United States Air Force Global Strike Command
USAG-KA	United States Army Garrison-Kwajalein Atoll
USAKA	United States Army Kwajalein Atoll
USASMDC	United States Army Space and Missile Defense Command
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
VSFB	Vandenberg Space Force Base
$\mu g/m^3$	Micrograms per Cubic Meter

1.0 Technical Description of Proposed Activity

This Notice of Proposed Activity (NPA) documents the Environmental Assessment / Overseas Environmental Assessment (EA/OEA) of the Minuteman III (MMIII) Modification and Fuze Modernization Flight Tests / Ground Based Strategic Deterrent (GBSD) Test Program. The Department of Defense (DOD) is extending the life of the existing force of MMIII Intercontinental Ballistic Missiles (ICBMs) and including a Fuze Modernization program using the same missile platform and infrastructure support. As a life-extension action, the MMIII weapon system will continue through year 2030 with up to four annual MMIII flight tests, and additionally up to four Fuze Modernization flight tests over a 4-year period. All flight tests will be from Vandenberg Space Force Base (VSFB), California, to the Kwajalein Missile Impact Scoring System (KMISS), Ronald Reagan Ballistic Missile Defense Test Site (RTS) at the United States Army Kwajalein Atoll (USAKA) in the Republic of the Marshall Islands (RMI). Flight tests are necessary to ensure the safety, accuracy, and reliability of the MMIII and Fuze Modernization systems. The proposed GBSD Test Program involves the development and testing of a new ICBM weapon system that would eventually replace the aging MMIII weapon system. Implementation of the test program would include facility construction or modifications at Hill Air Force Base (HAFB), VSFB, and Dugway Proving Ground (DPG). Such tests would include conducting missile launches from VSFB with flights over the Pacific Ocean in the Western Test Range. Testing flights would terminate at the Kwajalein Atoll in the RMI. Because deployment of the new GBSD weapon system cannot occur until it has been adequately tested and proven sufficiently mature for operational use, both GBSD and MMIII flight test activities and related operations would overlap at HAFB, VSFB, and USAKA. Such testing would overlap for up to 10 years or until decisions are made to remove the MMIII weapon system from active status. The proximity and overlapping aspects of these two test programs require that the MMIII test program be incorporated as part of the Proposed Action of the GBSD Test Program.

The Proposed Action entails ongoing MMIII annual missile flight tests with the weapon system remaining generally unchanged from the Proposed Action analyzed in prior environmental documents (USAF 2004, 2006, 2013, 2020), as well as GBSD weapon system developmental and operational program testing after completion of the EA/OEA. The Mitigated Finding of No Significant Impact (FONSI) was signed on June 11, 2021 by the Department of the Air Force (DAF). The Mitigated FONSI detailed the required monitoring and mitigation measures required to prevent a significant impact on the natural or human environment. See **Table 1** for the number of planned GBSD and MMIII Flight Tests from VSFB. The MMIII flight tests involve four to six reentry vehicle (RV) impacts per year, with an additional four RV impacts over 4 years for the Fuze Modernization program, at USAKA. Under the GBSD Test Program, up to approximately nine test RV impacts per year would be conducted at USAKA starting in 2024 and continuing until end of fiscal year 2029. The DAF, supported by the U.S. Army Space and Missile Defense Command (USASMDC), prepared the GBSD EA/OEA (USAF 2021) in accordance with the National Environmental Policy Act (NEPA), as implemented by the Council on Environmental Quality Regulations; and DAF and U.S. Army regulations for implementing NEPA.

Table 1. Proposed Number of GBSD and Minuteman III Flight Tests from VSFB by Fiscal Year

Test Program	2021	2022	2023	2024	2025	2026	2027	2028	2029
GBSD	0	0	0	4	4	5	6	5	4
Minuteman III	4	5	3	4	4	4	3	3	3
Total Flight Tests	4	5	3	8	8	9	9	8	7

1.1 Location of Activity

The locations analyzed in the EA/OEA are HAFB, Utah; VSFB, California; DPG, Utah; the Broad Ocean Area (BOA) in the Pacific; and RTS, USAKA, RMI. **Figure 1** shows a representative missile flight path and the booster drop zones for a MMIII and Fuze Modernization and GBSD test missile launched from VSFB towards RTS. **Figure 2** shows a representative flight path and hazard areas for MMIII and Fuze Modernization and GBSD Flight Tests in the Marshall Islands. This NPA addresses three possible impact locations: KMISS, offshore in the vicinity of Illeginni Islet, and Illeginni Islet.

MMIII and Fuze Modernization flight tests only target the vicinity of the KMISS area east of Gagan Islet for RV impacts (**Figure 3**). All RV impacts will occur in deep ocean waters adjacent to the atoll for the remaining life of the MMIII system and within the 5-year cycle of the GBSD Test Program Document of Environmental Protection (DEP).

It is expected that most GBSD test RVs would be targeted at the KMISS ocean area just east of Gagan Islet, or within deep ocean waters in the vicinity of Illeginni Islet on the western side of Kwajalein Atoll (see **Figure 3**). While most test RVs in the vicinity of Illeginni Islet would impact in ocean waters approximately 2,600 feet (ft; 792 meters [m]) offshore, one to three test RVs in total are planned to impact land on the western end of Illeginni Islet.

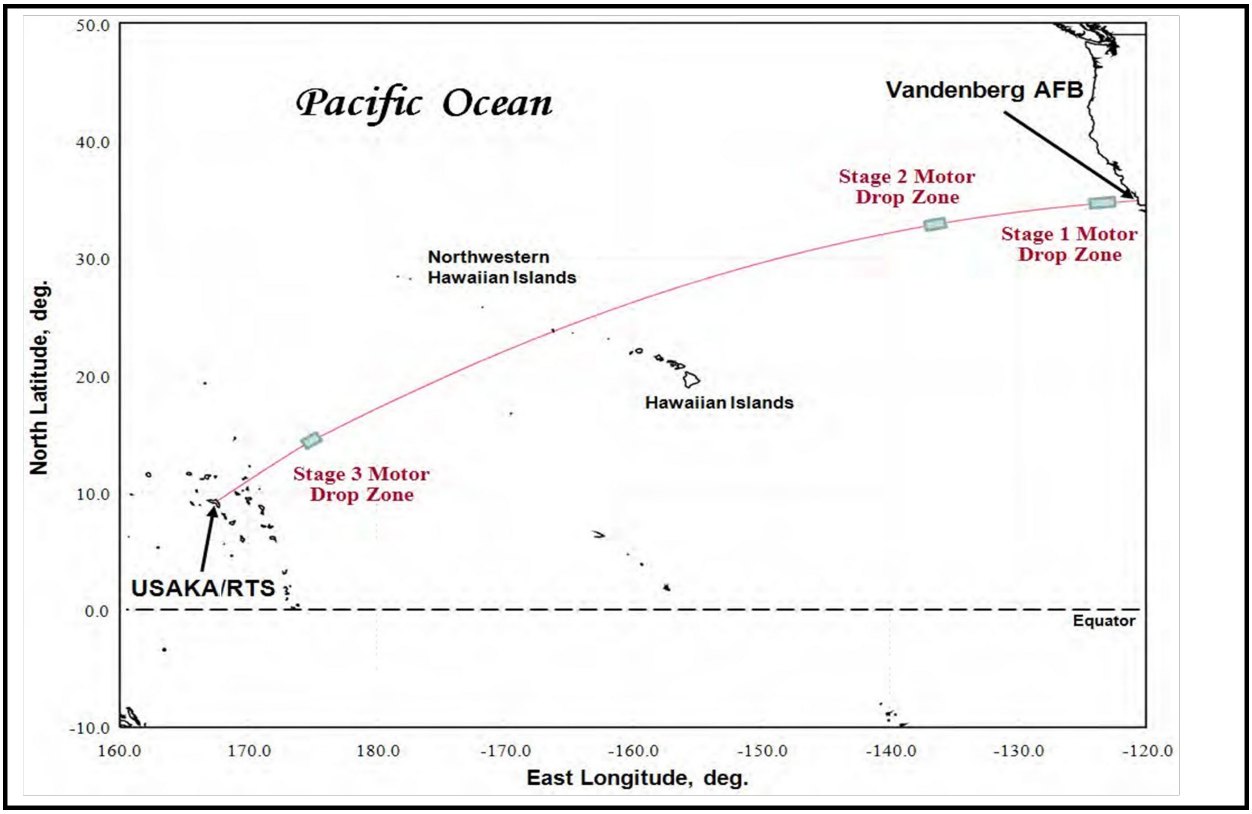

Figure 1. Representative Over-Ocean Flight Path and Motor Drop Zones for Minuteman III and Fuze Modernization and GBSD Flight Tests

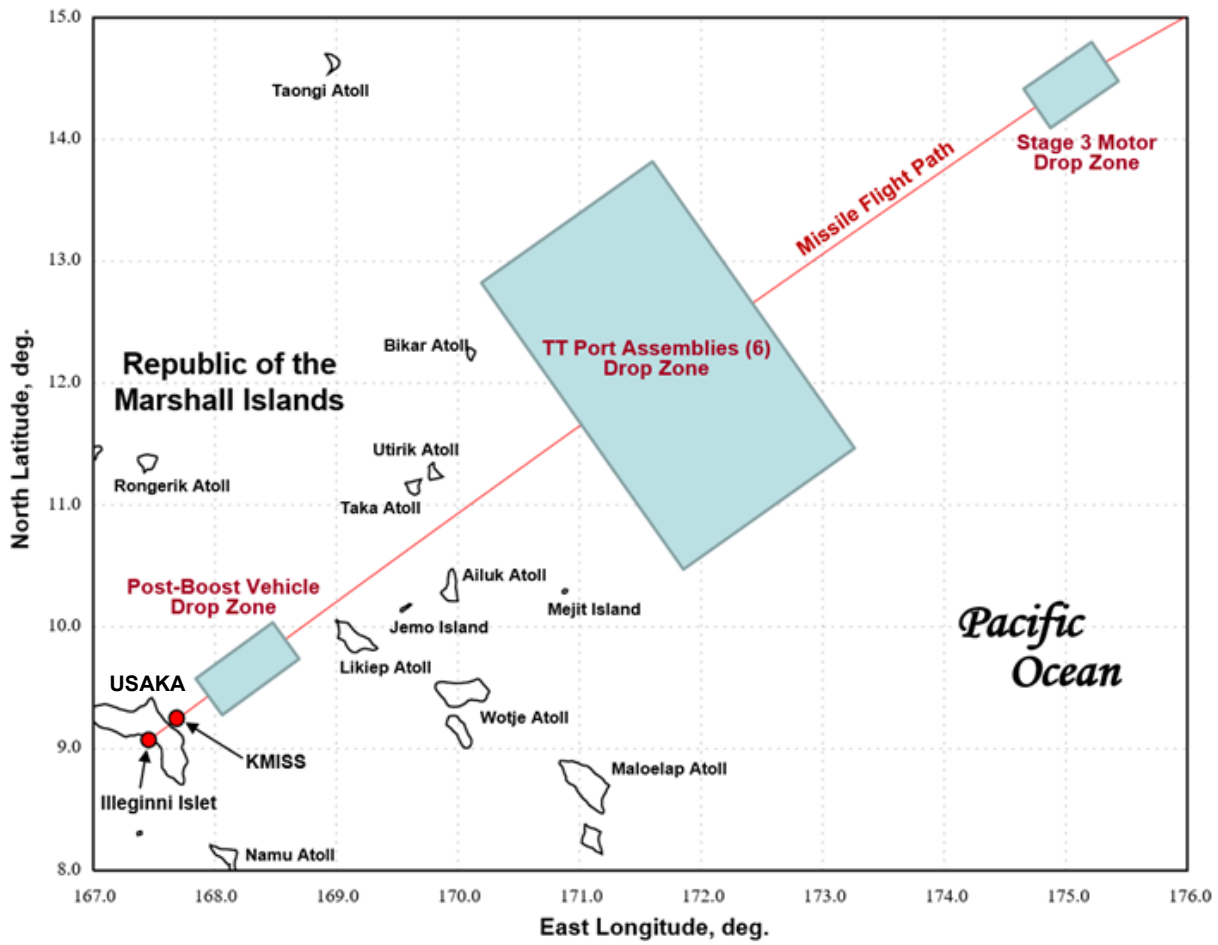

Figure 2. Representative Flight Path and Hazard Areas for Minuteman III and Fuze Modernization and GBSD Flight Tests in the Marshall Islands

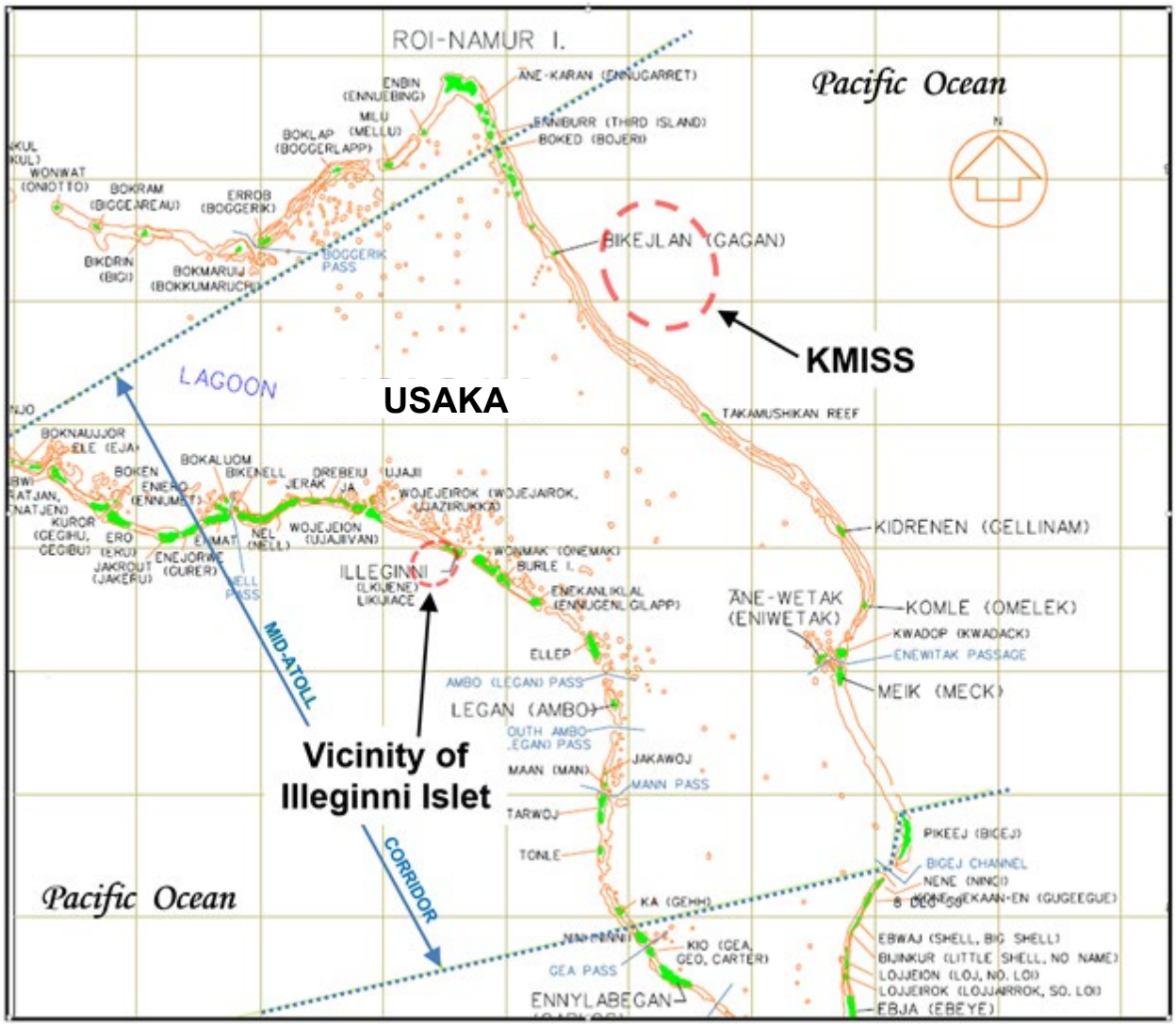

Figure 3. General Target Areas for Reentry Vehicle Impacts at USAKA

1.2 Description of the Activity

The MMIII and GBSD ICBMs consists of five major sections: the three-stage solid propellant booster, the propulsion system rocket engine, the missile guidance set, the Model or MOD 7 instrumentation wafer (flight test configuration only), and the reentry system. The missile is approximately 59.9 ft [18.3 m] long with a maximum diameter of 5.5 ft (1.7 m) and weighs approximately 79,400 pounds (lb) [36,000 kilograms (kg)].

The payload section on top of the MMIII and GBSD missile is referred to as the reentry system (RS). Inside the RS, the Support Payload Bulkhead provides a structural support base for one to three RVs (**Figure 4**), and carries the electronics needed to activate and deploy the RVs in flight.

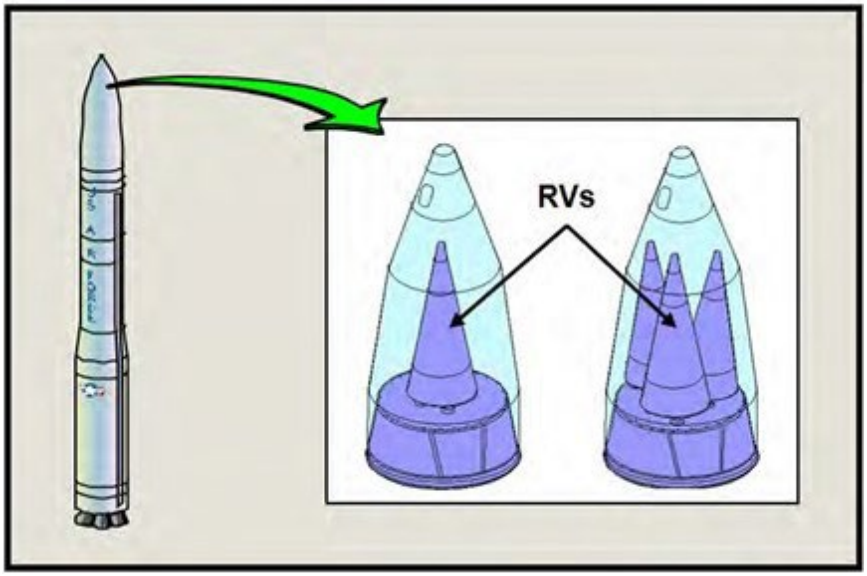

Figure 4. Minuteman III and GBSD Reentry System

In its current configuration, the MMIII RS employs either the Mark 12A or Mark 21 RV. For the MMIII and GBSD flight tests conducted annually from VSFB to USAKA, the operational RVs are replaced with one to three test RVs (one Mark 21 or up to three Mark 12A RVs), and for the Fuze Modernization flight tests, the Mark 21 fuzes will be replaced with modified arming and fuzing assemblies and ultimately the Mark 21 Fuze replacement system. The test RVs do not contain any fissile materials; however, they do contain varying quantities of hazardous materials, including batteries, high explosives, asbestos, beryllium (Be), depleted uranium (DU), and other heavy metals. All test RVs typically include 0.29 to 22 ounces (8.2 to 624 grams) of asbestos; approximately 0.035 to 0.353 ounces (1 to 10 grams) each of Be, cadmium, and chromium; approximately 4.8 ounces (136 grams) of lead; and an unspecified quantity of DU. In general, only one test RV per year contains high explosives.

To provide electrical power to the MMIII and GBSD subsystems, several different types of batteries are carried on board the motors, the RS, and other sections of the missile. These include multiple silver-zinc batteries, a single lithium carbon monofluoride battery, and a single lithium silicon/iron disulfide (thermal) battery. Approximately 15 batteries are carried on each MMIII and GBSD flight test missile (depending on the RS configuration used); each weighing from 1 to 21 lb (0.5 to 9.5 kg). The individual Mark 12A RVs contain one silver zinc battery (weighing approximately 1.6 lb [0.7 kg]), while the Mark 21 RV contains one silver zinc and one thermal battery (for a total battery weight of approximately 2.4 lb [1.1 kg]).

Figure 1 shows a representative missile flight path and the booster drop zones for an MMIII and Fuze Modernization and GBSD test missile launched from VSFB towards RTS. Following motor burnout and separation, the spent first-stage motor will splash down in the Pacific Ocean approximately 95 to 140 nautical miles (nmi) (176 to 259 kilometers [km]) off the California coast. Following in sequence, the spent second-stage motor will splash down approximately 785

to 835 nmi (1,454 to 1,546 km) off the coast. As the missile travels along a flight path well north of the Hawaiian Islands, it will reach an apogee several hundred miles in altitude. Prior to this point, the third-stage motor will have separated from the post-boost vehicle. The spent third-stage motor will travel on a ballistic course and break into several pieces during reentry prior to splashing down in the open ocean. The third-stage debris pattern location is determined during the mission design and targeting process such that the third-stage debris will impact safely in the open ocean. The third-stage debris splash-down points vary from approximately 50 to 600 nmi (93 to 1,111 km) northeast of the Marshall Islands in the open ocean, as the post-boost vehicle maneuvers the RV(s) toward designated target point(s) in the vicinity of USAKA.

There are six Thrust Termination (TT) port assemblies in the forward end of the MMIII and GBSD third-stage motor; they are blown out upon achieving a desired missile velocity. The TT port assemblies will fly downrange of the third-stage debris by a distance varying from approximately 110 to 280 nmi (204 to 519 km) (**Figure 2**), depending on the mission reentry angle and the third-stage chamber pressure at the time of TT. Each of the six TT port assemblies contains three components that may survive reentry: the port itself, the port cover, and the charge retainer. Each of the TT port components is less than 1 ft (0.3 m) in diameter, has a mass of less than 1 lb (0.5 kg), and has low ballistic coefficients (approximately 1.9 to 6.3 pounds per square foot [0.09 to 0.30 kilopascals]). Thus, the kinetic energy of each component at impact likewise is very small and will vary between approximately 9.7 and 22.2 foot-pounds (13.1 and 30.1 joules).

MMIII and Fuze Modernization flight tests target the KMISS area east of Gagan Islet for RV impacts (**Figure 4**). The MMIII flight tests involve four to six RV impacts per year, with an additional four RV impacts over 4 years for the Fuze Modernization program, at USAKA. All RV impacts will occur in the ocean waters adjacent to the atoll for the remaining life of the MMIII system and within the 5-year cycle of the modified DEP. The last MMIII RV impact on Illeginni Islet occurred in 2012, and no more land impacts are planned for the life of MMIII testing.

For GBSD flight tests conducted at USAKA, test RVs are expected to impact in deep ocean waters and, in a few instances, on land. Under the GBSD Test Program, up to approximately nine test RV impacts per year would be conducted at USAKA starting in 2024 and continuing through end of fiscal year 2029. It is expected that most test RVs would be targeted at the KMISS ocean area just east of Gagan Islet or within deep ocean waters in the vicinity of Illeginni Islet on the western side of Kwajalein Atoll (see **Figure 3**). Such testing at the KMISS would be conducted in the same manner as for the ongoing MMIII flight tests, while testing in the vicinity of Illeginni Islet would be conducted similarly to what was previously done under the MMIII program (USAF 2004, USAF 2020, USAG-KA 2017). While most test RVs in the vicinity of Illeginni Islet would impact in ocean waters approximately 2,600 ft (792 m) offshore, one to three test RVs in total are planned to impact land on the western end of Illeginni Islet.

Pre-Test Activities. RTS and United States Army Garrison Kwajalein Atoll (USAG-KA) support the MMIII and GBSD missions by providing tracking, sensing, and other technical and logistical support. An extensive array of missile tracking radars and optical sensors are located on several of the islets. Depending on mission requirements, other auxiliary sea-based, aircraft-based, and

satellite-based sensors (optical and radar systems) may be involved in tracking the missile and collecting data. Test support is provided primarily by existing Government personnel and contractors based at USAKA.

Existing optical and electronic sensors and system support equipment are already in place on Gagan Islet and in the KMISS offshore ocean waters. Fixed underwater sensors are located a minimum of 3 nmi (5.5 km) offshore at depths ranging from 7,000 to 12,000 ft (2,134 to 3,658 m). The system is used to score the precision of in-water impacts by RVs and other projectiles. The KMISS system was refurbished beginning in 2014, as analyzed under the *KMISS Refurbishment Environmental Assessmen*t (USASMDC/USAFGSC 2014) and permitted under the *DEP, KMISS Refurbishment*, DEP-14-001.0 (USAKA 2014c). Additionally, up to 17 Lawrence Livermore National Laboratory (LLNL) Independent Diagnostic Scoring System (LIDSS) rafts with onboard optical and/or acoustical sensors are deployed from a Landing Craft Utility (LCU) vessel, temporarily placed in ocean waters no less than 10 ft (3 m) deep and maintain position in the water using onboard battery-powered trolling motors. No anchors will be used to maintain raft positions or for LCU operations.

Terminal Flight and Impact Activities. Towards the terminal end of each MMIII and Fuze Modernization and GBSD flight, beyond the third-stage motor drop zone, the post-boost vehicle fragments impact in a predetermined area of the BOA northeast of USAKA (**Figure 3**). The MMIII and GBSD flights have no more than 12 RVs per year and the Fuze Modernization flights have only one RV on each of four test flights. The one to three RVs on each flight continue traveling at hypersonic velocities towards the KMISS area. Individual flight tests conducted at the KMISS site can involve up to three RV impacts. The RVs impact in deep ocean waters at least 3 nmi (5.5 km) offshore of Gagan Islet. Individual flight tests conducted on Illeginni Islet include one RV impact.

For most tests, the RVs remain intact until impact in water. Approximately once or twice a year, however, a single test RV will contain a conventional explosive charge for purposes of conducting a high-fidelity test. During such tests, the RV may detonate upon contact with deep ocean waters. The RV may also detonate at some altitude (airburst) over deep ocean waters. During such airburst tests, the resulting debris impacts in a focused area of the ocean. Trade winds typically blowing from the east/northeast quickly disperse any RV-related dust. The energy associated with an explosive detonation is 10 times less than the energy associated with a conventional RV impact. (USAFGSC 2015)

To ensure the safe conduct of the MMIII and Fuze Modernization and GBSD flight tests, a Mid-Atoll Corridor (MAC) has been established across the Kwajalein Atoll (**Figure 3**). A number of strict precautions are taken to protect personnel from any impacts in the MAC. Such precautions may consist of evacuating nonessential personnel and sheltering all other personnel remaining within the MAC. Notices to Airmen (NOTAMs) and Notices to Mariners (NOTMAR) are published and circulated in accordance with established procedures to provide warning to personnel, including the indigenous population of the Marshall Islands, concerning any potential hazard areas that should be avoided. Public notices also are published in the local newspaper and are broadcast on television. Visual sweeps of hazard areas are accomplished starting 4 days prior

to each flight test to assist in the clearance of non-critical personnel. Only mission-essential personnel are permitted in hazard areas.

Post-Test Activities. After an MMIII or Fuze Modernization or GBSD flight test impacting at the KMISS site, the ocean waters are inspected for debris when the mission is anomalous. No post-test cleanup or recovery activities are anticipated for MMIII or Fuze Modernization or GBSD flight tests conducted at the KMISS site. For nominal (i.e., according to plan) missions, RVs that impact in the deep ocean waters are not recovered. USAG-KA, RTS, DAF, and LLNL personnel would recover the free-floating sensor rafts using an LCU vessel.

For land or near-shore RV impacts, assessment or cleanup activities would occur after unexploded ordinance personnel from the range inspect the impact area and other personnel stabilize fugitive dust and disturbed soil by wetting/washing the site. Freshwater used to minimize fugitive dust following impacts would not be allowed to flow to the lagoon or ocean and would evaporate in place. Personnel working in the impact area would wear proper personal protective equipment, as necessary. Once the site is cleared for safe entry, test support personnel would conduct an impact assessment of the site, and initiate cleanup and recovery operations. Debris from those test RVs that impact on land would be recovered. Post-test recovery operations on Illeginni Islet would require the manual cleanup and removal of any visible RV debris, including hazardous materials. Excavated material would be screened, and the collected RV debris washed before packaging for shipment back to Kwajalein Islet and the United States. Craters formed by the RV impacts would be backfilled using a backhoe/loader and repairs would be made to any structures on the islet, as necessary.

If a test RV were to strike the shallow waters or reef flats adjacent to Illeginni, RV recovery/cleanup operations, within 500 to 1,000 ft (152 to 304 m) of the Illeginni shoreline, would be conducted similarly to land operations when tide conditions and water depth permit. A backhoe would be used to excavate the crater. Excavated material would be screened for debris and the crater most likely back-filled with coral ejected around the rim of the crater. For any RVs that impact in deeper waters, a dive team would be brought in to conduct an underwater search. Using a ship for recovery operations, a remotely operated vehicle would first be used to locate the debris field on the bottom. Divers in scuba gear would then be able to recover the debris manually. In general, RV debris recovery operations would not be attempted in waters deeper than 100 ft (30 m).

1.3 Mitigation and Conservation Measures

The DAF has developed and implemented mitigation and conservation measures to minimize the impacts of the MMIII flight tests on the environment. Many of these mitigation and conservation measures have evolved over time through consultation with the National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS) for the MMIII flight tests and other similar DAF activities in the Action Area, such as the Conventional Strike Missile program.

The 2005 consultation for the MMIII flight test program resulted in 2005 biological opinion (BO) prepared by USFWS. This BO contained nondiscretionary and discretionary conservation

measures and nondiscretionary reasonable and prudent measures, with implementing terms and conditions aimed at minimizing effects on the green sea turtle (*Chelonia mydas*). The measures in the BO were captured in the 2005 MMIII DEP and are described below with current information about implementation status and methods.

Most of the conservation measures in the 2005 BO concerned the establishment of a sea turtle nesting preserve at Eniwetak Islet within USAKA. The DAF, in coordination with the RMI and USFWS, agreed to support establishment of the preserve, to initiate consultation with the RMI to establish protocols to ensure that unauthorized personnel will not have access to Eniwetak, to inspect the beaches at Eniwetak Islet monthly for sea turtle nesting success during peak nesting periods (May to November), and to maintain nesting beaches at Eniwetak Islet by removing marine debris or other hazards that may impede female haul-out, nesting, egg incubation, and hatchling migration to the ocean (USFWS 2005). Since preparation of the 2005 BO, the sea turtle nesting preserve at Eniwetak has been established and the other measures have been met. The DAF plans to continue to fund and support the preserve through 2030. The Eniwetak Conservation Area Management Plan (Kwajalein Range Services 2017) contains a detailed description of the conservation activities that the DAF supports in maintaining the preserve.

The remaining conservation measure directed USAG-KA to inspect beach areas for active nests at Illeginni Islet before each RV impact (USFWS 2005). In October 2016, the USAF made a request that "the possibility of up to five land impacts at Illeginni Islet for the remaining life of the MM III system…requirement be removed as we no longer target the Illeginni Islet." The DAF currently plans only one flight test with impact on land at Illeginni Islet for the GBSD Test Program, but up to three total land RV impacts may be possible through end of fiscal year 2029.

The 2005 BO included an incidental take statement for green turtles. Incidental take may occur in the form of harm to or harassment of the breeding success or loss of up to three green turtle nests or injury or loss of up to 300 eggs or hatchlings per year as a result of project-related RV impacts and cleanup activities (USFWS 2005). Since completion of the BO in 2005, no incidental takes have been identified, and the last MMIII RV impact on Illeginni Islet occurred in 2012. Re-initiation of USFWS consultation would occur if:

- The amount or extent of incidental take of nesting green turtles is exceeded by a MMIII/GBSD action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take shall cease, pending re-initiation of consultation.
- New information reveals effects of a MMIII/GBSD action that may affect listed species or critical habitat in a manner or to an extent not considered in the BO.
- A MMIII/GBSD action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in the BO.
- A new species is listed, or critical habitat designated that may be affected by a MMIII/GBSD action.

In addition, the DAF and USAG-KA will inspect all project-related cargo and vehicles transiting between islets in the Kwajalein Atoll to prevent the further spread of rodents for the duration of the flight-test program (USAF 2015).

USFWS recommended the following future studies that will be considered to address data gaps: additional field surveys to determine species presence, compiling images of RV impact and recovery sites, and coral sampling for uranium uptake. The possibility of using hydrophones for future marine mammal studies at KMISS will be considered.

Other relevant mitigation and conservation measures are as follows (USAKA 2005; USAF 2015):

- USAG-KA personnel would conduct a helicopter or fixed-wing aircraft overflight of the impact vicinity during the week preceding a flight test and as close to launch as safely practical to survey for marine mammals and sea turtles. Observations of marine mammals or sea turtles (or reports of no observations) in the vicinity would be reported to the USAG-KA Environmental Office and USASMDC.
- Vessel operations would not involve any intentional discharges of fuel, toxic wastes, or plastics and other solid wastes that could harm marine life.
- To avoid impacts on coral heads, sensor rafts would not be located in waters less than 10 ft (3 m) deep.
- During ocean travel to and from impact and test support areas, ship personnel would monitor for marine mammals and sea turtles to avoid potential ship strikes and would record any opportunistic observations. Vessel operators would also adjust their speed based on expected animal densities, and on lighting and turbidity conditions.
- If the DAF conducts land impacts, field screening and soil testing for Be, DU, and other heavy metals would need to be done to determine the distribution of these substances following any land impact. Testing results that exceed UES criteria would require remediating and removing soil.
- Site recovery and cleanup would be performed for shallow water impacts in accordance with Section 3.6 of the UES. To minimize long-term risks to marine life, all visible project-related debris would be recovered during post-test operations, including debris in shallow lagoon or ocean waters by range divers. In all cases, recovery and cleanup would be conducted in a manner to minimize further impacts on biological resources.
- Should any missile components or debris impact areas of sensitive biological resources (i.e., coral reef), a NMFS, USFWS, and RMIEPA biologist or qualified personnel would be allowed to provide guidance and/or assistance in recovery operations to minimize impacts on such resources. To the greatest extent practicable, when moving or operating heavy equipment on the reef during post-test clean up, protected marine species including invertebrates will be avoided or effects to them will be minimized. This may include movement of these organisms out of the area likely to be affected.
- Post-test overflights of the impact area would be conducted to survey for dead or injured cetaceans and sea turtles. Although unlikely, any dead or injured marine mammals or sea

turtles sighted would be reported to the USAG-KA Environmental Office, who would then inform NMFS and USFWS. USAG-KA aircraft pilots otherwise flying in the vicinity of the impact and test support areas would also report any opportunistic sightings of dead or injured marine mammals or sea turtles.

- Within 1 day following testing, NMFS and USFWS biologists would be allowed to assist USAG-KA in recovering and rehabilitating any injured sea turtles found.
- During post-test recovery and cleanup, should USAG-KA personnel observe endangered, threatened, or other species requiring consultation moving into the area, work would be delayed until such species were out of harm's way or leave the area.
- In all cases, recovery and cleanup operations would be conducted in a manner to minimize further harm to biological resources.

The 2015 consultation with NMFS for the MMIII flight test program resulted in a 2015 BO prepared by NMFS. Incidental take may occur in the form of loss of up to 117 top shell snails or loss of up to 49,645 colonies within the 15 species of UES consultation corals as a result of project-related payload impacts. NMFS determined the level of anticipated take for the MMIII flight test program is not likely to result in the jeopardy of any of the UES consultation species expected to be taken. This BO contained nondiscretionary conservation measures and nondiscretionary reasonable and prudent measures, with implementing terms and conditions aimed at minimizing effects on corals and top shell snails. These are captured in the 2015 MMIII DEP renewal.

Additionally, NMFS recommended additional studies and capabilities development for USAG-KA as follows:

- DAF continue to work with NMFS and USFWS staff to conduct additional marine surveys around Illeginni Islet to develop a comprehensive understanding of the distribution and abundance of species there.
- DAF continue to work with NMFS and USFWS staff to conduct marine surveys at additional sites around all the USAKA islets and in the MAC to develop a more comprehensive understanding of the distribution and abundance of species and habitats at USAKA.
- DAF conduct regular (monthly or quarterly if possible) surveys of the KMISS, the ocean target area off Illeginni, and the RMI broad ocean area to develop a better understanding of the distribution and abundance of marine mammals and other species in the area.
- DAF adapt the KMISS to support acoustic monitoring for marine mammals in the target area for marine mammal monitoring.
- USAG-KA develop capacity and procedures for responding to marine mammal and turtle strandings.

- Acquire required permits and training to perform necropsies and/or to take and transport tissue samples.
- Develop professional relations with qualified federal agencies (including the U.S. Geological Survey Honolulu Field Station) and universities to capitalize on samples and information gained at USAG-KA.
- Develop mechanisms to collect and disseminate the information.

The 2021 consultation with NMFS for the GBSD program resulted in a 2021 BO prepared by NMFS. Incidental take may occur in the form of harassment, injury, or mortality of up to 9 top shell snails (*Tectus niloticus*), 219 clams within two UES consultation giant clam species, 324 humphead wrasses (*Cheilinus undulatus*), and 14,277 colonies within 6 species of UES consultation corals as a result of project-related payload impacts. NMFS determined the level of anticipated take for the GBSD flight test program is not likely to jeopardize the continued existence of any of the UES consultation species considered in their BO. This BO contained nondiscretionary conservation measures and nondiscretionary reasonable and prudent measures, with implementing terms and conditions aimed at minimizing effects on UES consultation corals and mollusks.

Additionally, NMFS recommended discretionary conservation measures to minimize or avoid effects on UES-protected marine species, to help implement recovery plans, or develop information as follows:

- DAF continue to work with NMFS and USFWS staff to conduct additional marine surveys around Illeginni Islet to develop a comprehensive understanding of the distribution and abundance of species that are there.
- Consider constructing a berm, artificial Hesco Bastion ("Concertainer"), or Bremer wall, around the perimeter of the island above the beach line at the impact site to reduce the amount of potential ejecta material which can enter the ocean from an impacting projectile.
- Equip personnel with metal detectors for recovery of projectile materials in the nearshore environment, if not already doing so and attempt to quantify the amount of recovered materials to determine the amount of tungsten that remains in the nearby environment.
- DAF continue to work with NMFS and USFWS staff to conduct marine surveys at additional sites around all the USAKA islets and in the MAC to develop a more comprehensive understanding of the distribution and abundance of species and habitats at USAKA.
- USAG-KA develop capacity and procedures for responding to marine mammal and turtle strandings.
    - Acquire required permits and training to perform necropsies and/or to take and transport tissue samples.

- Develop professional relations with qualified federal agencies and universities to capitalize on samples and information gained at USAG-KA.
- Develop mechanisms to collect and disseminate the information.

2.0 Description of Activity Environmental Setting

2.1 Environmental Setting of the Activity

Kwajalein Atoll is located in the western chain of the RMI in the West Central Pacific Ocean. The atoll is dotted with a string of approximately 100 islets that enclose the world's largest lagoon (1,100 square miles (square mi) [2,849 square km]). Kwajalein Atoll is located 2,300 mi (3,700 km) west/southwest of Hawaii. Lagoon depths are typically 120 to 180 feet (37 to 55 m). The reefs and islets of the atoll consist of coral rock and sediments lying atop submarine volcanoes that were active over 150 million years ago. As the volcanoes gradually subsided, coral reefs slowly grew upward to the ocean surface. The land surfaces of the Marshall Islands formed some 2,000 to 5,000 years ago, a period when sea levels rose and dropped, exposing the reef islets that create the lagoon. The islands are dynamic structures that continue to move, grow, and retreat in response to changing seas and vegetation, and have been modified by human habitation since shortly after their emergence above sea level, with particularly rapid change in recent years. (USAKA 2006)

Gagan Islet is located on the northeast side of the Kwajalein Atoll and is bounded on the south and west by the lagoon and on the north and east by the Pacific Ocean. The KMISS is a deep ocean sensor array located approximately 3.2 to 8.6 nmi (5.9 km to 15.9 km) east of Gagan Islet. The array consists of hydrophones located at deep ocean depths between 7,000 and 12,000 ft (2,134 to 3,658 m). Built in 1996, the array has been degrading since 2002 and refurbishment was completed in 2015. (USASMDC/USAFGSC 2014)

Illeginni Islet is located approximately 21 mi (34 km) directly south of Roi-Namur Island, the northernmost part in the atoll, and 30 mi (49 km) to the northwest of Kwajalein, the largest island and southernmost part of the atoll. Illeginni Islet is a 31-acre (0.125 km^2) islet on the southwest side of the atoll. Illeginni Islet runs roughly west-northwest to east-southeast; it is approximately 2,790 ft (850 m) long and averages about 574 ft (175 m) across. The northwestern end is a narrow finger that extends into several sandbars, while the southeastern end has a hook-shaped harbor on the north side. Illeginni Islet consists of managed vegetation surrounding buildings and facilities and four relatively large patches of littoral forest. After 1975, most facilities, including the Spartan and Sprint missile launch facilities, were abandoned-in-place.

3.0 Environmental Areas Potentially Affected by Proposed Activity

(Intent: Addresses all areas with the potential to be affected by the activity. States only those areas possibly affected. Does not discuss how the area will be protected. Environmental areas addressed in the UES: air quality, water quality and reef protection, drinking water quality, endangered species and wildlife resources, ocean disposal, material and waste management, and cultural resources. Because the GBSD program test RVs would target the KMISS and Illeginni Islet, and there are no freshwater resources present, drinking water quality is not analyzed in detail. Cultural resources are not analyzed in detail: RV impacts within the KMISS, or in the ocean waters south and west of Illeginni Islet, would have no impacts on archaeological or architectural resources and Illeginni Islet has no substantive archaeological resources.)

3.1 Air Quality, Greenhouse Gases, and Climate Change

MMIII and Fuze Modernization and GBSD RVs contain varying quantities of hazardous materials, including Be and DU (See **Section 3.4**). Both Be and DU can present toxicity health concerns, primarily when inhaled as hazardous air pollutants (HAPs). Although DU also has some radioactive properties, it is not a radiological health concern. Long-term environmental sampling and monitoring of RV impact areas have shown that air concentrations of Be and uranium (U) have not exceeded UES standards. Following several MMIII RV tests at Illeginni Islet, air concentrations of Be did not exceed 1×10^{-5} micrograms per cubic meter ($\mu g/m^3$). Additionally, air concentrations of U at Illeginni Islet did not exceed 8.0×10^{-5} $\mu g/m^3$ or 2.7×10^{-17} microcuries per milliliter (as derived from U-238). Such concentrations are at or near background levels, and thus present no health-related concerns. (Robison et al. 2013) Although there may be a temporary elevation in airborne Be and DU levels, the pollutants would be blown out to sea.

As of October 2016, the USAFGSC requested that land impacts at Illeginni Islet be removed from consideration because MMIII flight testing would no longer target Illeginni Islet. While most test RVs in the vicinity of Illeginni Islet would impact in ocean waters approximately 2,600 ft (792 m) offshore, one to three test RVs in total are planned to impact land on the western end of Illeginni Islet.

Per **Table 1**, between 2021 and end of fiscal year 2029 there could be up to 33 MMIII test flights and up to 28 GBSD test flights, for a total of 61 test flights over a 9-year period. See **Table 2** for a total estimate of MMIII/Fuze Modernization and GBSD launch emissions at Vandenberg Space Force Base. Per **Figure 1** and **Figure 2**, the RVs would target the KMISS ocean area just east of Gagan Islet, within deep ocean waters in the vicinity of Illeginni Islet, and occasionally Illeginni Islet. Negligible emissions would occur within USAKA from the MMIII/Fuze Modernization and GBSD flight test RVs. Although this limited amount of emissions would not contribute significantly to global warming, any emission of GHG represents a minute increase that could have incremental effects on the global atmosphere.

Table 2. Estimated Emissions for Minuteman III and GBSD Launches at VSFB from FY 2021-FY 2029 (tpy)

Year	Number of Flights	VOC	SO_x	NO_x	CO	PM_{10}	$PM_{2.5}$	Pb	NH_3	CO_2e
2021	4	0.52	0.012	1.28	2.8	7.4	5.2	N/A	N/A	N/A
2022	5	0.65	0.015	1.6	3.5	9.25	6.5	N/A	N/A	N/A
2023	3	0.39	0.009	0.96	2.13	5.55	3.9	N/A	N/A	N/A
2024	8	1.04	0.024	2.56	5.6	14.8	10.4	N/A	N/A	N/A
2025	8	1.04	0.024	2.56	5.6	14.8	10.4	N/A	N/A	N/A
2026	9	1.17	0.027	2.88	6.3	16.65	11.7	N/A	N/A	N/A
2027	9	1.17	0.027	2.88	6.3	16.65	11.7	N/A	N/A	N/A
2028	8	1.04	0.024	2.56	5.6	14.8	10.4	N/A	N/A	N/A
2029	7	0.91	0.021	2.24	4.9	12.95	9.1	N/A	N/A	N/A

Acronyms and abbreviations: CO = carbon monoxide, CO_2e = carbon dioxide equivalent, FY = fiscal year, NH_3 = ammonia, NO_x = nitrogen oxides, Pb = lead, $PM_{2.5}$ = particulate matter with a diameter of generally 2.5 microns or less, PM_{10} = particulate matter with a diameter of generally 10 microns or less, SO_x = sulfur oxides, tpy = tons per year, VOC = volatile organic compound

3.2 Water Quality, Reef Protection, and Ocean Disposal

MMIII and Fuze Modernization and GBSD RVs will impact in the ocean at the KMISS site near Gagan Islet, in the vicinity of Illeginni Islet approximately 2,600 ft (792 m) offshore, and on Illeginni Islet. Turbidity may be temporarily increased. Some RV debris, including small amounts of Be and DU and other contaminants may be released into the ocean area (See **Section 3.4**). NASA conducted a thorough study of the seawater quality effects of missile components deposited in ocean waters (U.S. Navy 2017). NASA concluded that the release of hazardous materials from missiles into seawater would not be significant. The materials would be rapidly diluted and, except in the immediate vicinity of the debris, would not be found at concentrations that produce adverse effects. The payload materials are insoluble and the depth of the Pacific Ocean at the KMISS impact site is thousands of feet where light does not penetrate, levels of oxygen that might interact with materials at the surface are too low for that to occur, and water temperature differences from the upper water layers hamper any mixing between them. Any area on the ocean bottom affected by the slow dissolution of the payload debris would be relatively small, due to the size of the payload debris pieces as compared relative to the volume of surrounding seawater. Therefore, adverse water quality effects from the payload are expected to be minimal to insignificant. There are no plans to monitor deep water impacts in the BOA, where no mixing with upper layers of water occurs.

Vessel operations would not involve intentional discharges of fuel, toxic wastes, or plastics or other solid wastes that could harm marine life. Illeginni Islet has no surface water, and groundwater is limited in quantity. Groundwater on the islet is saline and non-potable.

The MMIII/Fuze Modernization program flight testing activities at USAKA are in compliance with the UES for ocean disposal. The Proposed Activities are well within the limits of current operations and permits at USAG-KA, including ocean disposal requirements. For additional

details regarding Ocean Disposal and Hazardous Materials and Wastes, see **Section 3.4**. For additional information regarding the potential impacts from disturbing existing contamination on Illeginni Islet, refer to the GBSD EA/OEA (See Appendix D for EA/OEA Sections 3.4.1.2.3, page 3-93; 4.2.4.1, page 4-97; 4.2.4.1.2, page 4-109). For UES standards regarding water quality and reef protection see UES Sections 1-5.4, and 3-2. For UES standards regarding Ocean Disposal see UES Sections 1-5.7, and 3-5.

3.3 Endangered Species and Wildlife Resources

The surrounding ocean waters of the KMISS are home to a number of threatened and endangered species, and other protected species. There are 16 cetacean (whale and dolphin), 2 sea turtle, 7 fish, 22 coral, and 5 mollusk species requiring consultation that could potentially be affected by the MMIII and Fuze Modernization and GBSD flight tests. There is no designated critical habitat for any of these species present within project areas evaluated for these programs (USAFGSC 2015). Cetaceans, sea turtles, and fish may be found in deeper offshore waters. Many of the cetacean species occurring in the RMI have the potential to occur near the KMISS (USAFGSC 2015).

Within the KMISS impact area, adult corals and mollusks do not occur, while cetaceans, sea turtles, and fish may be encountered. Sixteen species of cetaceans may occur in the deep ocean waters near USAKA KMISS. These species are sometimes seasonal in occurrence because of unique migration patterns (Miller 2007). Four Endangered Species Act (ESA)-listed cetaceans have the potential to occur in the KMISS area. (USAFGSC 2015)

On Illeginni Islet, habitats include many human modified habitats such as a helipad, roads, buildings, towers, and a dredged harbor, as well as several biologically significant terrestrial and marine habitats. Biologically significant terrestrial habitats on Illeginni Islet consist of disturbed vegetation near the helipad and around buildings, several patches of native vegetation including herbaceous vegetation and littoral forest, and shoreline habitat. While no vegetation species with special status occur on Illeginni Islet, several migratory birds use Illeginni for foraging, roosting, and/or breeding. Biological inventories conducted on the islet by USFWS and NMFS have identified at least 14 migratory bird species that are protected under the Migratory Bird Treaty Act and therefore receive protection under the UES as coordination species. Black noddies (*Anous tenuirostris minutus*), white terns (*Gygis alba*), and black-naped terns (*Sterna sumatrana*) are known to nest on Illeginni Islet. Of these, only black-naped terns are known to nest in the impact area. The lagoon-side shoreline on the western end of Illeginni Islet has been documented as suitable haul-out and nesting habitat for green sea turtles; however, no sea turtle nests or nesting activity has been recorded on Illeginni Islet in over 20 years. Green turtles are listed as an endangered species under the ESA and are protected under the UES as consultation species.

The marine environment surrounding Illeginni Islet includes reef flat, reef crest, and reef slope habitats on both the lagoon and ocean sides of the islet that support a diversity of coral, other invertebrates, fish, and sea turtles. The harbor also includes habitats that support diverse coral assemblages as well as a dense seagrass bed. Further offshore, the deep waters of the MAC and ocean surrounding Kwajalein Atoll support a variety of fish and marine mammals. The marine habitats surrounding Illeginni Islet support many species which require consultation or

coordination under the UES including many species of coral, mollusk, and fish. Consultation species which have been observed or may occur in the shallow waters surrounding Illeginni Islet include 2 sea turtle species, 4 species of fish, 5 mollusk species, and 22 coral species.

Site preparation, placement of portable camera stands, the impacts of the MMIII and Fuze Modernization and GBSD RVs, and post-impact clean-up could affect protected species and habitats, both terrestrial and marine. Noise, airborne vibration, and underwater shock waves from the RV impacts would predictably startle birds and other wildlife resources on land or water and could affect behavior and hearing sensitivity.

3.4 Material and Waste Management

RV debris may contain small amounts of non-fissile hazardous materials: batteries, high explosives, asbestos, depleted uranium (DU), and other heavy metals. The individual Mark 12A RVs (up to three per RV) contain one silver zinc battery (approximately 1.6 pounds), while the Mark 21 RV (one per RV) contains one silver zinc and one thermal battery (total battery weight of approximately 2.4 pounds) (**Figure 4**). All test RVs typically include 0.29 to 22 ounces of asbestos; approximately 0.035 to 0.353 ounces each of beryllium (Be), cadmium (Cd), and chromium (Cr); approximately 4.8 ounces of lead (Pb); and less than 187 pounds of DU. In general, only two test RVs per year contain high explosives (USAF 2004, 2013, 2020). Ocean waters at KMISS could receive contamination from hazardous materials due to accidental spills of fuels and lubricants from vehicles or ships used during the placement of equipment, debris clean-up, and post-impact monitoring activities. These occurrences are unlikely and rare. Only small amounts of hazardous wastes, if any, are expected to be generated and would be managed on Illeginni Islet. Any potentially hazardous wastes will be gathered, sampled, and properly containerized. Containers will be relocated to the Hazardous Waste Storage Facility on Kwajalein Island until appropriate disposal/treatment can be completed. For additional information regarding the potential impacts from disturbing existing contamination on Illeginni Islet, refer to the GBSD EA/OEA (See Appendix D for EA/OEA Sections 3.4.1.2.3, page 3-93; 4.2.4.1, page 4-97; 4.2.4.1.2, page 4-109). For UES standards regarding Material and Waste Management, see UES Sections 1-5.8, and 3-6 (especially 3-6.4.1).

4.0 Analysis of Effect of Activity on Environmental Areas in Absence of Environmental Controls

(Intent: Referring to each of the areas in Section 3, provides the consequences of not having environmental controls for that area.)

4.1 Air Quality

In the absence of controls, no impacts to air quality will be expected from KMISS impacts because emissions are anticipated to disperse with the prevailing winds.

In the absence of controls, based on the current environmental setting of Illeginni Islet, no impacts to air quality are anticipated. Debris and dust associated with impact of the GBSD RV would be minimal, due to the nature of the environment (asphalt helipad or crushed coral) that is

proposed for the impact target. Winds for the region are predominantly out of the east with an average wind speed of about 14.5 mi per hour (23.3 km per hour). Dust caused by impact will be quickly swept from the area, over the west end of the island and open waters. Freshwater used to minimize fugitive dust following impacts would not be allowed to flow to the lagoon or ocean and would evaporate in place.

Terminal impact may volatize minor quantities of some contaminants; however, it is anticipated that any emissions associated with impact will be within the UES air quality standards. There would be no change to air emission at Illeginni Islet from the Proposed Action (See **Section 5.1**).

4.2 Water Quality and Reef Protection

Based on the composition of existing Minuteman III RVs, the maximum potential concentrations would be far below toxic concentrations for humans and based on similar past actions at Illeginni Islet such as Minuteman III, AHW, FE-1, FE-2, and ARRW, this Proposed Activity would not be expected to reach the above screening criteria (Robison, 2005, 2006, 2010, 2013; RGNext, 2020). Although the groundwater at Illeginni Islet shows tungsten levels above the MCL, the groundwater is not potable under the UES standards. Tungsten is not included in the Minuteman III or GBSD weapon system and is not analyzed further for environmental consequences in the EA/OEA. With the reasonably foreseeable land use at Illeginni Islet as an active range and with the groundwater being not potable, further risk-based analysis and remediation planning is not required at this time. See **Table 3** for a compiled list of results from past groundwater testing at Illeginni Islet.

In the absence of environmental controls, no water quality impacts will be expected from MMIII/GBSD RV impacts at KMISS or in the vicinity of Illeginni Islet approximately 2,600 ft (792 m) offshore. NASA conducted a thorough study of the seawater quality effects of missile components deposited in ocean waters (U.S. Navy 2017). NASA concluded that the release of hazardous materials from missiles into seawater would not be significant. The materials would be rapidly diluted and, except in the immediate vicinity of the debris, would not be found at concentrations that produce adverse effects.

Illeginni Islet has no surface water; groundwater is very limited in quantity with no pathways to public or private consumption, is saline, and non-potable. In the unlikely event of an accidental release of a hazardous material or petroleum product at the impact site, emergency response personnel would comply with the UES KEEP. On Illeginni Islet, no direct discharge of materials to surface and/or marine waters will occur during terminal impact. Freshwater used to minimize fugitive dust following impacts would not be allowed to flow to the lagoon or ocean and would evaporate in place.

Table 3. Results of Past Illeginni Groundwater Tests

Illeginni Groundwater Samples	Beryllium (Be)		Tungsten (W)		Depleted Uranium (DU)	
EPA Maximum Contaminant Level (MCL)	4 µg/L		-		30 µg/L	
EPA Regional Screening Levels (RSL)	-		0.016 mg/L (16 µg/L)		-	
RGNext 2020	Pre-test: undetected	Post-test: undetected	Pre-test: 990 µg/L[1]	Post-test: 63 µg/L	Pre-test: 5.4 µg/L[2]	Post-test: 5.0 µg/L[3]
U.S. Navy 2019	undetected		Crater: 0.65 mg/L (range of 0.64 to 0.67 mg/L)	Surroundings: 7 detections (out of 9 samples) ranged from 55 µg/L to 1,200 µg/L	3 detections (out of 9 samples) < 30 µg/L	

mg/L – milligrams per liter
µg/L – micrograms per liter

1 Most conservative (highest) of 7 detections (out of 9 samples).
2 Most conservative (highest) of 12 detections (out of 12 samples).
3 Most conservative (highest) of 3 detections (out of 3 samples).

4.3 Endangered Species and Wildlife Resources

In the absence of environmental controls, the test and clean-up activities could result in impacts to fish, corals, sea turtles, migratory birds, and loss of habitat for sea turtles, and seabirds and shorebirds. Without monitoring during vessel movements, impacts could result to marine mammals or sea turtles near KMISS.

On Illeginni Islet, terrestrial organisms and habitats may be impacted by disturbance from pre- and post-test human activity and equipment operation, direct contact from vehicle components, introduction of hazardous chemicals, and elevated sound pressure levels. Nesting, roosting, and foraging birds might be temporarily disturbed by human activities and equipment operation and also by elevated sound pressure levels. Any seabirds located within the impact zone on Illeginni Islet may also be subject to the effects of direct contact from vehicle components. Sea turtles that are hauling out or nesting and sea turtle nests have the potential to be disturbed by human activity, equipment operation, introduction of hazardous chemicals, and elevated sound pressure levels. Little disturbance to native vegetation is planned or expected from human activity, equipment operation, or direct contact from GBSD test components. Marine species such as corals, mollusks, and reef-associated fish in the shallow waters offshore of the Illeginni Islet impact site might be impacted by direct contact from test or impact debris and by shock waves.

4.4 Material and Waste Management

If not removed, MMIII and Fuze Modernization and GBSD RV impact debris could impair the terrestrial areas and the shallow marine environment. If not prevented or promptly cleaned-up, spills of equipment fuels, lubricants, and hazardous materials could contaminate the land, groundwater, and reef or ocean waters, and pose a health threat to wildlife resources and personnel. Residual concentration of Be and DU detected in the soils on the western end of Illeginni Islet are within UES compliance levels. See **Table 4** for a compiled list of results from past soil testing at Illeginni Islet.

Table 4. Results of Past Illeginni Soil Tests

Illeginni Soil Samples	Beryllium (Be) RSL		Tungsten (W) RSL		Depleted Uranium (DU)	
Compliance Goals[1]	160 mg/kg		-		47 mg/kg	
EPA Regional Screening Levels (RSL)	1.1 mg/kg		63 mg/kg for residential areas; 930 mg/kg for industrial areas		1.8 mg/kg	
RGNext 2020	undetected[2]		undetected[2]		7 (out of 24) samples ranged between 1.8 mg/kg and 4.3 mg/kg.	
U.S. Navy 2019	0.089 mg/kg[3]		3.0 mg/kg		23 samples ranged between 0.72 mg/kg and 5.1 mg/kg	
Robison et al 2013	Crater: <0.0027 µg/g	Surroundings: 2.1 ± 0.58 µg/g	-	-	Crater: 1.9 ± 0.17 µg/g	Surroundings: 22 ± 8.8 µg/g
Robison et al 2010	2.3 ± 0.5 mg/kg[4]		-		37 ± 19 mg/kg[5]	
Robison et al 2006	1.6 ± 0.32 µg/g		-		24 ± 6.1 µg/g	
Robison et al 2005	0.027 ± 0.11 µg/g		-		1.6 ± 0.41 µg/g	

mg/kg – milligram per kilogram
1 Compliance Goals set by the UES (2021). Where UES Compliance Goals were not specified, EPA RSLs were used as Compliance Goals instead.
2 Above Method Detection Limit, but below Limit of Quantification
3 A duplicate sample detected 1.9 mg/kg of Be. This large discrepancy may be due to the heterogeneous nature of the soil matrix (gravelly sand).
4 Most conservative (highest) value of 5 values. Samples taken south of the helipad, within a predetermined 0.5-acre plot.
5 Most conservative (highest) value of 5 values. Samples taken west of the helipad, within a predetermined 0.5-acre plot.

5.0 Technical Description and Analysis of Environmental Controls Used in Activity

(Intent: Presents the methods to be employed to protect the areas discussed in Section 3 and 4.)

5.1 Air Quality

Pre-test preparations and support would include the use of mobile and non-road sources of air emissions. Emission sources could include a combination of vessels, aircraft, trucks, backhoes, and/or portable power generators. Emission of criteria pollutants and greenhouse gases from these sources would be minor and temporary. There should not be any exceedance of UES air quality standards, no new permanent stationary sources of emissions, and therefore no required changes to the DEP for air emissions [*DEP: Air Emissions from Major, Synthetic Minor, and Industrial Boiler Stationary Sources,* DEP-11-001.0, USAKA 2013a]. Equipment setup on Gagan Islet and Illeginni Islet, if any, should require little or no soil excavation; thus, there should be no fugitive dust inhalation concerns.

Following impact, disturbed soil and debris will be temporarily stabilized by wetting the impact area with freshwater brought to Illeginni Islet by vessel. Personnel will be judicious and not overwater, to ensure the freshwater would evaporate in place and not flow into the lagoon. This will prevent possible contamination from entering the marine environment. Personnel will use appropriate personal protective equipment. Direct air measurements of previous testing events have provided sufficient information to conclude that there will be no potential hazardous air pollutants-related health effects in the areas affected by residual Be or DU. Long-term air sampling following such tests has shown that Be and DU concentrations in air downwind of impact areas are essentially indistinguishable from preexisting concentrations of Be and DU in air at other atoll locations (Robison et al. 2005, 2006, 2013).

5.2 Water Quality and Reef Protection

For inadvertent MMIII and Fuze Modernization and GBSD RV impacts on the reef that result in craters being formed, recovery and cleanup operations in shallow waters could require the movement of a backhoe or other equipment out onto the reef flats to the impact site. The action of driving heavy equipment and personnel on foot could further harm or kill protected mollusks, sponges, and hard corals along the reef. To minimize adverse effects, LLNL, USAG-KA, and/or RTS personnel would coordinate with USFWS and NMFS to determine access corridors to the crater site to avoid or minimize accidental impacts to protected and sensitive biological resources. Any dredging or filling activities would require a project description sheet (*DEP: Dredging and Filling*, DEP-16-001.0, Figures 1 and 2, USAKA 2017) to be submitted to the USAG-KA Environmental Engineer. Dredge and Fill Project Description Sheet 1 (less than 25 cubic yards of movement and no special conditions) would be expected for this Proposed Action; however, Dredge and Fill Project Description Sheet 2 may be required (if greater than 25 cubic yards of movement) and would include USAG-KA Environmental Approval and a 30-day review by the UES Agencies. For deeper waters in the ocean or lagoon, a ship with divers is used. Because craters form only in shallow waters less than 10 ft (3.0 m) deep, and no other damage to coral formations has been observed below 20 ft (6.1 m) (USAF 2004), RV impacts

and post-test recovery operations in the deeper waters of the atoll lagoon and on the ocean side are much less damaging. In all cases, recovery and cleanup operations would be conducted in a manner to minimize any further impacts.

On Illeginni Islet, freshwater used to minimize dust after impact and during post-test operations would not be allowed to flow to the lagoon or ocean but would evaporate after completion of cleanup operations. Personnel will be judicious and not overwater, to ensure the freshwater would evaporate in place and not flow into the lagoon. This will prevent possible contamination from entering the marine environment. In the event of an accidental discharge (fuels, oils, etc.) during test flight operations or post-test cleanup activities, ground personnel would comply with the UES Kwajalein Environmental Emergency Plan (KEEP) controlling the spill site and cleanup. Following a land-impact test, DAF and USAG-KA would collect soil and groundwater samples at various locations around the impact site and test the samples for beryllium, depleted uranium, and other metals. Testing results that exceed UES criteria would require a soil investigation as detailed in the UES and may require subsequent soil removal or other remediation. No short- or long-term impacts to surface or groundwater from materials associated with either the GBSD RV impact or accidental spills are anticipated.

5.3 Endangered Species and Wildlife Resources

General

Actions would be taken to minimize disturbance to sensitive resources, such as posting signs designating sensitive areas on Illeginni Islet and providing all personnel with information on the need to protect sensitive species. Prior to their arrival, personnel would be briefed on the need to respect and protect sensitive islet resources and to avoid harassment of sensitive species. Onsite supervisors would ensure that personnel implement and comply with the protection objectives. Personnel would be instructed to stay on existing roads and paths where possible, avoid areas designated as avian nesting or roosting habitat, and to avoid all contact with any nest that may be encountered. Operational and emergency lighting would be shielded and pointed down to minimize the potential for impacts to migratory birds and sea turtles.

Terrestrial and Nearshore Waters

After a GBSD RV impact at Illeginni Islet, the DAF and biologists would survey the impact area and the near-shore waters for any injured wildlife or damage to sensitive habitats as soon as feasible and within one day after a land impact test. If any wildlife were discovered injured, the Hawaii Wildlife Center would be contacted to aid in recovery or rehabilitation. In addition, USFWS and/or NMFS biologists would be offered the opportunity to provide guidance to USAG-KA in the recovery and rehabilitation of any injured migratory birds or sea turtles found. During inspections, biologists would assess any sea turtle mortality. The DAF would submit a report to USASMDC and USAG-KA at the end of each calendar year involving shallow water impacts that describes any sea turtle take that may have occurred. The USASMDC would then forward the report to the USFWS Pacific Islands Fish and Wildlife Office (for terrestrial impacts), the NMFS Pacific Islands Regional Office (for marine impacts), and the RMIEPA.

To minimize impacts to nesting birds, prior to equipment mobilization at Illeginni Islet, searches will be conducted for black-naped tern nests. Any discovered black-naped tern nests would be flagged at a stake 3 ft (1 meter) from the nest to prevent inadvertent damage or disturbance. All preparation and test activities on Gagan Islet and Illeginni Islet would be conducted with awareness of the possible presence of shorebirds and their eggs.

To minimize long-term risks to birds and marine life, all visible RV debris would be recovered. This could include the recovery of visible debris in the shallow ocean waters by RTS divers. Should any debris impact in areas of sensitive biological resources (i.e., coral reef), then USFWS and NMFS biologists would be offered the opportunity to provide guidance and/or assistance in recovery operations to minimize impacts on such resources.

Ocean and Reef

For impacts at KMISS, there should be minimal risk of impacts to the coral reef and marine life. Coral reef impact would be inadvertent and is not expected. As a precaution to minimize potential impacts on marine mammals and sea turtles, USAG-KA and/or RTS personnel would conduct helicopter or fixed-wing aircraft over-flights of the KMISS area during the week prior to the flight test and as close to launch as safely practical. Personnel would report marine mammal, and/or sea turtle observations (or a record of no sightings) in the impact vicinity to the USAG-KA Environmental Office, the RTS Range Directorate, and the Flight Test Operations Director for consideration in approving the launch as well as to USASMDC. During travel to and from Gagan Islet, Illeginni Islet, and the KMISS area, ship personnel would monitor for marine mammals and sea turtles to avoid potential ship strikes and report any observations to the USAG-KA Environmental Office and USASMDC. Vessel operators also would adjust their speed based on expected animal densities, and on lighting and turbidity conditions. Vessel operations would not involve intentional discharges of fuel, toxic wastes, or plastics or other solid wastes that could harm marine life. To minimize impacts during post-test operations, NMFS and USFWS would be offered the opportunity to provide guidance or assistance, or both, during recovery and cleanup. In all cases, recovery and cleanup would be conducted in a manner to minimize further harm to UES coordination and consultation species.

Sensors on rafts would be located in the surrounding ocean waters. To prevent collision with coral heads the rafts would be located in no less than 10 ft (3 m) of water. The rafts would be positioned as close to launch time as safely practical. The position of the rafts would be maintained by use of on-board battery powered electric motors. No anchors would be used to maintain raft positions. After completion of the flight test, the rafts would quickly be recovered.

For RV ocean impacts in the KMISS area, post-test operations would include a helicopter or fixed-wing aircraft overflight of the impact area by USAG-KA and/or RTS personnel as soon as safely practical after the test to survey for any dead or injured marine mammals and sea turtles. The USAG-KA Environmental Office and USASMDC would be notified of any findings and the information then forwarded to the NMFS, Pacific Islands Regional Office and RMIEPA.

Exposure to Contaminants

With the general exception of one MMIII/GBSD test RV per year, the RVs do not contain any ordnance and, therefore, do not present a risk of perchlorate contamination from impacts. The one RV per year that would contain small amounts of high explosives would detonate in an airburst or upon contact in deep ocean waters. Detonation of the RV would consume the explosives, thus eliminating any perchlorate contaminants. No residual combustible materials are expected to be present. As a result, the risk of marine species and migratory birds to be harmed by RV contaminants is low.

Sonic Boom Overpressures

As each descending test RV approaches Kwajalein Atoll at hypersonic velocity, sonic booms are initially generated over a very broad area of the open ocean northeast of the Atoll and continue in a southwesterly direction towards the designated target area, where the sonic boom footprint narrows to just a few miles on either side of the flight path. At the ocean surface, the in-air sound pressure levels for the sonic booms vary from 91 decibels (dB) at the eastern-most range and increase to 150 dB at the western-most range, close to the point of impact. Equivalent underwater overpressure levels range from 117 to 176 dB. In the KMISS area, the sonic boom footprint would occur almost entirely over open ocean. The duration for sonic boom overpressures produced by the RVs ranges from 40 milliseconds where the boom is strongest to 124 milliseconds where it is weakest.

Sonic boom overpressures may affect ESA-listed cetaceans, sea turtles, or fish in the open ocean. Underwater sound levels would not exceed thresholds for injury or death, Temporary Threshold Shift (TTS), or Permanent Threshold Shift (PTS) for any consultation species. Only four flight tests would be conducted annually for MMIII, with an additional four RV impacts over 4 years for the Fuze Modernization program. Up to five flight tests would be conducted annually for GBSD. Potential exposure to sonic boom overpressures occurs within a limited area and for short duration (40 to 124 milliseconds). Consultation cetaceans, sea turtles, and fish along the projected flight paths occur in low densities and have patchy distributions. Although loud sounds may cause consultation species to quickly react, briefly altering their normal behavior, these sounds would not cause long-term effects; and species are expected to return to normal behaviors within minutes.

On Gagan Islet, in-air sound pressure levels for an RV impact would peak around 150 dB. Such noise levels are expected to cause some startle and temporary flush responses in migratory birds.

On Illeginni Islet, in-air sound pressure levels for an RV impact would peak at 240 dB 10 ft (3 m) from impact. Such noise levels are expected to cause some startle and temporary flush responses in migratory birds. Birds are expected to return to normal behaviors and distributions after human disturbance on the islet has ended.

Direct Contact and Shock/Sound Wave from the Impact of Missile Components

An RV impacting in the ocean at the KMISS would result in underwater shock/sound waves comparable to the splashdown of the MMIII/GBSD rocket motors in the BOA, but with much

greater force because of the vehicle's hypersonic velocity at the time of impact. Whether or not the test RV contains a high explosives package (generally only once a year) makes little difference in the formation of shock/sound waves. The resulting underwater waveform in either case would last only about 10 to 30 milliseconds. As the shock/sound wave radiates away from the impact point, sound levels would decrease, as would the risk for injury or auditory effects.

Population estimates for marine mammal species are not available for the Kwajalein Atoll waters. However, when applying relatively conservative data from surveys conducted around the Hawaiian Islands and the Central Pacific Region, the probability for an RV to strike a cetacean or for underwater shock/sound wave to induce PTS in cetaceans in the ocean is very low for each RV impact event. The estimated number of individual cetaceans or sea turtles expected to be exposed to direct contact or be injured from loud sounds is considerably less than one for all species. Even if summed across the maximum of 15 tests per year over 10 years, the number of individuals expected to be exposed is less than one, even for the highest density species such as dolphins. Animal densities in the ocean areas of Kwajalein Atoll, are expected to be even lower than the density data used and therefore the probabilities would be lower. (USAFGSC 2015)

For up to three total tests, an RV may impact on land at Illeginni Islet. For RV impacts on land, test RV components would directly impact terrestrial habitats and have the potential to directly contact seabirds. Impact on land would result in ejecta and shock waves radiating out from the point of impact and potentially entering nearshore marine habitats. While sea turtles hauled out or nesting on land and sea turtle nests would have the potential to be adversely affected if struck by a piece of debris ejected during crater formation, no sea turtle nesting activity has been recorded on Illeginni Islet in over 20 years and impacts are not expected. Corals, mollusks, and humphead wrasses have the potential to be adversely affected if struck by a piece of debris ejected during crater formation. Larger pieces of debris could crack or break parts of coral colonies or injure individual mollusks or fish. Based on the expected debris dispersion and shock wave strength for RV impacts on Illeginni Islet, the NMFS concluded that up to 14,277 coral colonies, 228 individual mollusks, and 324 humphead wrasses listed as consultation species under the UES might be injured or killed from a total of 3 RV impacts.

5.4 Material and Waste Management

Other than the use of fuels and lubricants for operating transportation and other support equipment, there would be limited use of hazardous materials at USAKA in support of MMIII/GBSD pre-test preparations. Accidental spills from support equipment operations would be contained and cleaned up in accordance with the KEEP requirements. All hazardous and non-hazardous wastes would be properly disposed of in accordance with the UES. Any potentially hazardous wastes will be gathered, sampled, and properly containerized. Containers will be relocated to the Hazardous Waste Storage Facility on Kwajalein Island until appropriate disposal/treatment can be completed.

Following the RV's breakup on impact, hazardous materials contained in the RV are rapidly diluted in ocean waters and/or sink to the ocean floor.

An inadvertent RV impact in shallow water (less than 10 ft [3.0 m] deep) would form a smaller crater, generally 10 to 15 ft (3.0 to 4.6 m) wide and 2 to 4 ft (0.6 to 1.2 m) deep. At impact, the RV generally disintegrates, releasing small quantities of heavy metals including Be, cadmium, chromium, lead, DU, and asbestos. Soil sampling at Illeginni Islet has shown that concentrations of Be and U in soil in some parts of the relatively small deposition area of Illeginni Islet do exceed their natural background concentrations in coral atoll soils, a result of prior MMIII RV land impacts (Robison et al. 2006). However, the latest observed soil concentrations on the islet do not exceed the US Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for residential levels for assessing the need for soil cleanup under the UES (Robison, et al. 2013). To date, the last MMIII RV land impact at Illeginni Islet occurred in 2003. In October 2016, USAFGSC requested that land impacts at Illeginni Islet be removed from consideration because MMIII flight testing would no longer target Illeginni Islet. Land impacts at Illeginni Islet therefore are not required for at least the next 5 years, the duration of this project's DEP. For the GBSD program, The USAF plans one RV impact at Illeginni Islet, although up to three RV impacts have been analyzed. The first GBSD test could occur in 2024.

For test RV ocean impacts, recovery operations generally are not attempted at depths greater than 100 ft (30 m). For shallow water impact at Gagan Islet or Illeginni Islet, precautions are taken to secure the area from inadvertent traffic until recovery operations are completed. Cleanup and recovery procedures are conducted in accordance with established procedures identified in LLNL's MMIII Recovery Plan for USAKA/RTS Illeginni Island (Yakuma 2012). This recovery plan will be updated to include GBSD.

6.0 Dispersion Model for Modeling Air Sources

(Intent: Applicable if an air source is being built or emissions are related to or will result from the activity.)

The activities associated with MMIII/GBSD activities will not involve operation of permanent major stationary sources and their related air emissions. Air modeling will not be required for the activities described in this NPA.

7.0 Analysis of Waste Discharge for Point-Source Waste Discharges to Water

(Intent: Explains source and content of any waste that will be part of a point source discharge. Every effort should be made to not create a point source discharge; explains how it will be avoided.)

The UES states that a Point-Source is a "discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, vessel, or other floating craft, from which pollutants are or may be discharged" (USASMDC 2021, page 488). The activities associated with MMIII/GBSD activities as described in this NPA will not generate point-source discharges; therefore, analysis of waste discharges will not be required.

8.0 Information for Hazardous Waste Treatment, Storage, or Disposal Facilities

(Intent: Treatment, storage and disposal of hazardous waste are prohibited at USAKA/RTS. The text should reaffirm that such will not take place with the activity. If hazardous waste will be created due to the activity, it should be identified and how it will be removed from USAKA.)

Hazardous waste will not be treated, permanently stored, or disposed of at USAKA. All spills will be cleaned-up in accordance with the KEEP and mission specific emergency response plans.

Any hazardous waste recovered and removed will be properly containerized and shipped to Kwajalein for final shipment to the United States for proper disposal, in accordance with UES Section 3-6.6.5. Any RV debris will be packaged and shipped to CONUS for analysis and disposal.

9.0 Biological Assessment if Endangered Resources May Be Affected

(Intent: Addresses strictly endangered resources, as defined by UES §3-4. Endangered resources at USAKA are all marine. Explains precautions to protect endangered resources.)

Biological Assessments (BA) were prepared (2005 and 2015) to determine the extent to which the MMIII flight tests and supporting activities may affect special status species. In its 2005 BO of the effects of the MMIII flight test program on nesting habitat for green turtles at Illeginni Islet, the USFWS supported the determination that MMIII test and post-test cleanup activities (along with reasonable and prudent measures and conservation measures, including the protection of sea turtle nesting habitat on Eniwetak Islet) are not likely to jeopardize the continued existence of the species. Since there is no change in the MMIII action since 2015, the DAF will continue to abide by the 2005 BO through 2030 and consultation will not be reinitiated with the USFWS.

The 2015 BA was provided to NMFS to aid in the agency's development of their BO of the continued MMIII tests at USAKA. The 2015 BO will be appended to the DEP. Effects on mollusks in the near-shore marine environment also are possible but were considered minimal due to low risk of reef impacts. Acoustical impacts on marine mammals are also possible; however, the ocean areas that could be affected are extremely limited. Effects on coral and reef fish in the near-shore marine environment also are possible but are considered minimal due to low risk of reef impacts; if affected, no jeopardy to the species at USAKA would result.

A BA was prepared in 2020 for GBSD tests (USAF and USASMDC 2020) and provided to NMFS and USFWS to aid in the agency's evaluation of the effects of continued MMIII testing and the addition of GBSD tests at USAKA on UES consultation species. The 2021 BO (NMFS 2021) will be appended to the DEP. Based on analyses in the BA, proposed testing at Kwajalein Atoll may affect but is not likely to adversely affect cetaceans, sea turtles, and deep-water fish species. Proposed RV land impacts are not likely to adversely affect sea turtles on land or sea turtle nests. The USFWS provided a letter of concurrence for these sea turtles determinations on

7 January 2021. Proposed RV land impacts may affect and are likely to adversely affect individuals of six coral species, three mollusk species, and humphead wrasses.

10.0 Information on Receiving-Water Quality for Water Discharges

(Intent: Discusses the quality of water where a point source (including stormwater) is being introduced. Only existing Class B waters can receive point sources (water classification maps, UES Appendix 3-2A).)

Water discharges are not associated with this activity; therefore, information on receiving water quality is not required.

11.0 Information on Marine Life, Currents, and Other Characteristics of An Ocean Disposal Site

(Intent: Applicable for ocean disposal activities.)

There will be no intentional ocean disposal associated with the flight tests described in this NPA and companion DEP. Material and debris resulting from routine tests conducted at or near USAKA are not considered ocean disposal under the standards of the UES Appendix 3-5A.1 through 3-5A.9 and UES §3-5.6.2.

12.0 Information on Marine Life and Environment in Dredging or Filling Areas

(Intent: Applies if doing dredging or filling activities in waters of the RMI.)

Dredging and shoreline reinforcement are not anticipated for preparation or as a consequence of MMIII/GBSD test RV impacts; therefore, associated information on marine life and environment in dredging and filling areas is not required.

13.0 Species and Numbers of Migratory Birds and Other Wildlife Resources and Habitat That May Be Taken

(Intent: Provides complete discussion for migratory birds, wildlife resources, and habitats that may be "taken" because of the activity. "Take" and "taking" are defined in the UES.)

The RV impacts, equipment noise, and presence of personnel could temporarily affect migratory birds and wildlife resources. Consultation with the USFWS for the MMIII flight tests is not warranted as there is no substantive change from the 2005 BO, which will be appended to the DEP. Additionally, USFWS personnel were present to observe and document impacts from the Advanced Hypersonic Weapon (AHW) Demonstration Test, which included an RV land impact on Illeginni Islet in November 2011. In the USFWS Trip Report (USFWS 2011), USFWS personnel stated there were no observed impacts to sea turtle resources and no impacts to other wildlife resources from the test were reported. In 2020, the DAF consulted with the USFWS on the effects of addition of GBSD testing on nesting or hauled out sea turtles. The DAF concluded that GBSD testing was not likely to adversely affect sea turtles or nests on land due to proposed

protective measures and the lack of sea turtle activity on Illeginni Islet. The USFWS provided a letter of concurrence for that determination on 7 January 2021.

Equipment noise-related impacts could include displacement of wildlife, and short-term disruption of daily/seasonal behavior. No migratory birds or other terrestrial wildlife resources are expected to be harmed by the proposed MMIII/GBSD test flights and their related pre- and post-test activities. Efforts will be made to minimize disturbance to sensitive resources, such as posting signs designating sensitive areas on the islet and providing personnel with information on the need to protect and avoid harassment of sensitive species. Personnel will be instructed to avoid areas designated as avian nesting or roosting habitat. For land impacts on Illeginni, searches will be conducted for black-naped tern nests and chicks prior to any pre-test equipment mobilization. Any discovered nests will be flagged at a stake 3 feet (1 meter) from the nest to avoid inadvertent damage or disturbance.

As stated previously, proposed GBSD activities at Kwajalein Atoll are very similar to those of the MMIII action as evaluated and consulted on in 2015 (USAF 2015, NMFS 2015). Several marine UES consultation and coordination species have the potential to be affected by the proposed GBSD flight test. Consultation species that may occur in the Action Area are listed in **Table 5** and described in the GBSD BA. Complete analysis of the effect of the Action on consultation species has been conducted in a BA as described in **Section 9.0**. For most consultation species, it is not anticipated that they will be affected by the Proposed Action. Sea turtles on land and sea turtle nests may be affected by disturbance from human activity and introduction of hazardous chemicals. However, no sea turtle nests or nesting activity has been recorded on Illeginni Islet in over 20 years. Any potential effects are expected to be minimized by implementation of mitigation measures as outlined in **Section 5.0**. While a shoreline impact is not planned or expected, a shoreline impact or introduction of ejecta or payload components into the marine environment has the potential to affect six species of coral, three species of mollusk, and one fish species due to direct contact or human disturbance. Mitigation measures will be in place to minimize effects to consultation species in the event of a shoreline impact or introduction of foreign materials into reef habitat.

Based on analyses of all of the potential stressors in the Action Area, the DAF has determined that the Proposed Action would have “no effect” on 15 coral species (*Acanthastrea brevis*, *Acropora aculeus*, *A. aspera*, *A. dendrum*, *A. listeri*, *A. speciosa*, *A. tenella*, *A. vaughani*, *Alveopora verrilliana*, *Leptoseris incrustans*, *Montipora caliculata*, *Pavona cactus*, *P. decussata*, *Turbinaria mesenterina*, and *T. stellulata*) and two mollusk species (*Pinctada margaritifera* and *Tridacna gigas*) listed as consultation species under the UES. These species are not known to occur in the portion of the Action Area where they might be exposed to stressors resulting from the Proposed Action.

There is no RMI designated critical habitat for any listed species in the Action Area.

Table 5. Species in the Action Area Requiring Consultation under the UES that May Be Affected by the Proposed Action.

Scientific Name	Common Name	UES Consultation Species Listing Status[1]			
		ESA	MMPA	RMI Statute	UES 3-4.5.1(a)
Marine Mammals					
Balaenoptera musculus	Blue whale	E	Migratory	1	
B. physalus	Fin whale	E	Migratory		
Delphinus delphis	Short-beaked common dolphin			2	
Feresa attenuata	Pygmy killer whale		Resident		
Globicephala macrorhynchus	Short-finned pilot whale		Migratory		
Grampus griseus	Risso's dolphin		Resident		
Kogia breviceps	Pygmy sperm whale		Migratory		
Megaptera novaeangliae	Humpback whale (Western North Pacific DPS)	E[2]	Migratory		
Mesoplodon densirostris	Blainville's beaked whale		Migratory		
Orcinus orca	Killer whale		Resident		
Peponocephala electra	Melon-headed whale		Resident		
Physeter macrocephalus	Sperm whale	E	Resident	1	
Stenella attenuata	Pantropical spotted dolphin			2	
S. coeruleoalba	Striped dolphin			2	
S. longirostris	Spinner dolphin		Resident	2	
Tursiops truncatus	Bottlenose dolphin		Resident		
Reptiles					
Chelonia mydas	Green turtle (Central West Pacific DPS)	E		1,3	
Eretmochelys imbricata	Hawksbill turtle	E		3	
Fish					
Alopias superciliosus	Bigeye thresher shark				x
Carcharhinus longimanus	Oceanic whitetip shark	T			
Cheilinus undulatus	Humphead wrasse				x
Manta alfredi	Reef manta ray				x
M. birostris	Oceanic giant manta ray	T			
Sphyrna lewini	Scalloped hammerhead (Indo-West Pacific DPS)	T			
Thunnus orientalis	Pacific bluefin tuna				x

Scientific Name	Common Name	UES Consultation Species Listing Status[1]			
		ESA	MMPA	RMI Statute	UES 3-4.5.1(a)
Corals [3]					
Acropora microclados					x
A. polystoma					x
Cyphastrea agassizi	Agassiz's coral				x
Heliopora coerulea	Blue coral				x
Pavona venosa					x
Turbinaria reniformis					x
Mollusks					
Hippopus hippopus	Giant clam	C			
Tectus niloticus[4]	Top shell snail			3	
Tridacna squamosa	Giant clam	C			

Sources: USASMDC/ARSTRAT 2018, NOAA 2020, U.S. Navy 2019

Notes:

(1) UES Consultation Species Listing Status based on Appendix 3-4A of the UES (USASMDC/ARSTRAT 2018).

RMI Statutes: 1 = Endangered Species Act 1975, Title 8 MIRC Chapter 3; 2 = Marine Mammal Protection Act 1990, Title 33 MIRC Chapter 2; 3 = Fisheries Act 1997, Title 51 MIRC Chapter 2.

UES Section 3-4.5.1(a): X = Contained in RMI Environmental Protection Agency letter, 12 March 2015, or RMI Environmental Protection Agency letter, 28 September 2016

(2) The DPSs of humpback whales likely in the Action Area (Oceania DPS) are not listed under the ESA; however, there is some uncertainty about which DPS whales in the Action Area belong to (see Appendix B of the DEP).

(3) The coral species *Pocillopora meandrina* was included as a consultation species in the USAF 2020 BA and the NMFS 2021 BO. This species has subsequently been removed from the UES list of consultation species based on an RMI letter of concurrence for its removal from Appendix 3-4A.

(4) Within RMI legislation *Tectus niloticus* is inclusive of *Trochus maximus*, *Trochus niloticus*, and *Tectus maximus*. Most biological authorities currently synonymize all of these under the name *Tectus niloticus*.

Abbreviations: C = Species is a candidate for listing under the ESA, DPS = Distinct Population Segment, E = ESA Endangered, ESA = U.S. Endangered Species Act, MMPA = Marine Mammal Protection Act, T = ESA Threatened, UES = United States Army Kwajalein Atoll Environmental Standards (USASMDC/ARSTRAT 2018 Section 3-4.5.1).

The DAF has determined that the Proposed Action "may affect but is not likely to adversely affect" 16 cetacean species, 2 sea turtle species, and 6 fish species listed as consultation species under the UES in the Action Area. The species that may be but are not likely to be adversely affected by the Proposed Action include the cetaceans *Balaenoptera musculus*, *B. physalus*, *Delphinus delphis*, *Feresa attenuata*, *Globicephala macrorhynchus*, *Grampus griseus*, *Kogia breviceps*, the Western North Pacific Distinct Population Segment (DPS) of *Megaptera novaeangliae*, *Mesoplodon densirostris*, *Orcinus orca*, *Peponocephala electra*, *Physeter*

macrocephalus, *Stenella attenuata*, S. *coeruleoalba*, *S. longirostris*, and *Tursiops truncatus*; the Central West Pacific DPS of green turtle (*Chelonia mydas*); the hawksbill turtle (*Eretmochelys imbricata*); and the fish *Alopias superciliosus*, *Carcharhinus longimanus*, *Manta alfredi*, *M. birostris*, *Sphyrna lewini*, and *Thunnus orientalis*. Based on the analysis in the BA, the effects of the Proposed Action on these species would be insignificant or discountable. The NMFS concurred with the not likely to affect determination for these species in their 2021 BO for GBSD Test Program activities.

The DAF has determined that the Proposed Action "may affect and is likely to adversely affect" six coral species, three mollusk species, and one fish species listed as consultation species under the UES. The species likely to be adversely affected by the Proposed Action are the corals *Acropora microclados*, *A. polystoma*, *Cyphastrea agassizi*, *Heliopora coerulea*, *Pavona cactus*, and *Turbinaria reniformis*; the mollusks *Hippopus hippopus*, *Tectus niloticus*, and *Tridacna squamosa*; and the humphead wrasse. Based on the analysis conducted by NMFS in their 2021 BO, the Proposed Action may adversely affect up to 14,277 coral colonies, 228 individual mollusks, and 324 humphead wrasses.

14.0 Notification

(Intent: Provides emergency notification and any other type of notifications that are applicable to the activity.)

14.1 Emergency Notifications

For emergency notifications that pose a threat to human health and safety, notification must be made immediately by the most expeditious means available, but not to exceed 24 hours of a discovery of a human health and safety condition. Within 24 hours of discovery of an emergency environmental condition, USAG-KA shall notify the public affected or potentially affected by the condition and the Appropriate Agencies by the most expeditious means available. Emergency environmental conditions are those that pose an immediate threat to human health and safety, incidental take of protected species or habitats, and unplanned impacts to sensitive natural and cultural resources. Within 10 days following emergency notification, USAG-KA shall submit written notification of the event to the Appropriate Agencies that contains, at a minimum, the relevant information described in UES Section 2-7.2.2.

14.2 Public Notifications

Public notifications will be made by USAG-KA to advise the public of an activity or action that USAG-KA has taken or is planning. Public notification will be made through means that are widely available and consulted by the public at USAKA and the RMI. This normally includes publication in *The Kwajalein Hourglass* and *The Marshall Islands Journal*, posters or bulletins displayed in public places, and/or on public television.

15.0 Records Keeping

(Intent: States how long and where records will be stored.)

The NPAs; Environmental Comments, and Recommendations (ECRs); and DEPs permitting MMIII and Fuze Modernization and GBSD flight test activities at USAKA shall be preserved for

the duration of the activity plus 10 years or for 10 years after expiration of the DEP, whichever is less.

16.0 Resolution of Non-compliant Areas

(Intent: Fully explains areas of noncompliance and how the activity will or will not correct the noncompliance.)

Currently, there are no known noncompliant activities associated with the US Government MMIII and Fuze Modernization and GBSD flight tests at USAKA in the RMI, as described in this NPA.

APPENDIX B

Formal Consultation under the Environmental Standards for United States Army Kwajalein Atoll Activities in the Republic of the Marshall Islands Biological Opinion and Endangered Species Act- Section 7 Consultation for Ground Based Strategic Deterrent (GBSD) Test Program Activities 2021

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Endangered Species Act – Section 7 Consultation

Action Agency:	Department of the Air Force, U.S. Air Force (USAF) Nuclear Weapons Center, U.S. Army Space and Missile Defense Command (USASMDC) – Huntsville AL
Activity:	Ground Based Strategic Defense (GBSD) Test Program Activities
Consulting Agency:	National Marine Fisheries Service, Pacific Islands Region, Protected Resources Division
NMFS File No. (PCTS):	PIRO-2020-03355
PIRO Reference No.:	I-PI-20-1884-AG
Approved By:	Michael D. Tosatto Regional Administrator, Pacific Islands Region
Date Issued:	03/15/2021

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ACRONYMS

BA	Biological Assessment
BMP	Best Management Practice(s)
BO	Biological Opinion
BOA	Broad Ocean Area
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
cm	Centimeters
CO_2	Carbon Dioxide
dB	Decibel
DEP	Document of Environmental Protection
DoD	Department of Defense
DPS	Distinct Population Segment
DQA	Data Quality Act
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FE-1	Flight Experiment-1
FE-2	Flight Experiment-2
ft	Feet
FR	Federal Register
FWS	US Fish and Wildlife Service
FY	Fiscal Year
GBSD	Ground Based Strategic Deterrent Weapon System
HAFB	Hill Air Force Base
Hz	Hertz
ICBM	Intercontinental Ballistic Missile
in	Inch(es)
kg	Kilogram(s)
km	Kilometer(s)
km^2	Square Kilometer(s)
LAA	Likely to Adversely Affect
LLNL	Lawrence Livermore National Laboratory
m	Meter(s)
MAC	Mid-Atoll Corridor
mi^2	Square Mile(s)
MMIII	Minuteman III Weapon System
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NLAA	Not Likely to Adversely Affect
nm	Nautical Mile(s)
NMFS	National Marine Fisheries Service (aka NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
PIRO	Pacific Islands Regional Office
PTS	Permanent Threshold Shift
RCCTO	U.S. Army Rapid Capabilities and Critical Technologies Office

RMI	Republic of the Marshall Islands
RMS	Root Mean Square
ROV	Remotely Operated Vehicle
RTS	Ronald Reagan Ballistic Missile Test Site (aka Reagan Test Site)
SEL	Sound Exposure Level
SPL	Sound Pressure Level
SSP	Strategic Systems Programs
TTS	Temporary Hearing Effect Threshold
UES	USAKA Environmental Standards
U.S.	United States
USAF	U.S. Air Force
USAG-KA	United States Army Garrison – Kwajalein Atoll
USAKA	U.S. Army Kwajalein Atoll
USASMDC	Space and Missile Defense Command, US Army
VAFB	Vandenberg Air Force Base
yd^2	Square Yard(s)
µPa	Micro-Pascal

1 INTRODUCTION

The proposed action involves the U.S. Air Force's (USAF) development and testing of a new Intercontinental Ballistic Missile (ICBM) weapon system for the proposed Ground Based Strategic Deterrent (GBSD) Test Program. System tests would start in FY 2024 and continue until FY 2029. Each missile test would launch from Vandenberg Air Force Base (VAFB), California, and travel across a broad ocean area (BOA) of the Pacific Ocean. Payload impact would occur at target impacts at United States Army Garrison – Kwajalein Atoll (USAG-KA) sites in the Republic of the Marshall Islands (RMI). Implementation of the test program would also include facility construction or modifications at Hill Air Force Base (HAFB), VAFB, and Dugway Proving Ground.

The GBSD represents the modernization of the land-based nuclear arsenal and would eventually replace the aging Minuteman III (MMIII) weapon system, which has exceeded its designed life expectancy. While the system remains an active, viable deterrent for the United States, many components are becoming obsolete and unsupportable, resulting in continual upgrades to maintain system reliability and performance. It is in the best interest of national security to replace the MMIII weapon system. However, before the USAF can remove the MMIII weapon system from active status and deploy the new weapon system, system development and testing under the proposed GBSD Test Program must first occur. The GBSD tests will be similar to and a crucial step in the developmental process following the MMIII flight tests, which are conducted yearly.

The Endangered Species Act (ESA) would apply for the portions of the action that would take place in and over United States (U.S.) territory and international waters, but not for the portions of the action that would take place within the RMI. The Government of the RMI has agreed to allow the U.S. Government to use certain areas of Kwajalein Atoll (collectively referred to as U.S. Army Kwajalein Atoll or USAKA). "USAKA" is defined as "…the [USAKA]-controlled islands and the Mid-Atoll Corridor, as well as all USAKA-controlled activities within the [RMI], including the territorial waters of the RMI". The USAKA controls 11 islets around the atoll. The relationship between the U.S. Government and the Government of the RMI is governed by the Compact of Free Association (Compact), as Amended in 2003 (48 USC 1681). Section 161 of the Compact obligates the U.S. to apply the National Environmental Policy Act of 1969 (NEPA) to its actions in the RMI as if the RMI were a part of the U.S. However, the ESA does not apply within the RMI. Instead, the Compact specifically requires the U.S. Government to develop and apply environmental standards that are substantially similar to several U.S. environmental laws, including the ESA and the Marine Mammal Protection Act (MMPA). The standards and procedures described in the Environmental Standards and Procedures for USAKA Activities in the RMI (aka USAKA Environmental Standards or UES, 15th Edition) were developed to satisfy that requirement. Therefore, the US Government must apply the UES to its activities within the RMI. Because the ESA and UES both apply to this action, this biological opinion was written in a manner that considers and complies with each of those standards, as applicable.

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (ESA; 16 U.S.C. 1536(a) (2)) requires each federal agency to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species.

When a federal agency's action "may affect" a listed species or its designated critical habitat, that agency is required to consult formally with the National Marine Fisheries Service or the U.S. Fish and Wildlife Service, depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR 402.14(a)). Federal agencies are exempt from this general requirement if they have concluded that an action "may affect, but is not likely to adversely affect" endangered species, threatened species or their designated critical habitat, and NMFS or the FWS concur with that conclusion (50 CFR 402.14 (b)).

If an action is likely to adversely affect a listed species, the appropriate agency (either NMFS or FWS) must provide a Biological Opinion (Opinion) to determine if the proposed action is likely to jeopardize the continued existence of listed species (50 CFR 402.02). "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

The U.S. Air Force Nuclear Weapons Center is the lead agency and action proponent for the Proposed Action, along with the United States Army Space and Missile Defense Command (USASMDC) as a participating Agency. The UES requires all parties of the U.S. Government involved in this project to consult or coordinate with the NMFS and the FWS to conserve species and habitats of special concern at USAKA. We will address the USASMDC exclusively in this document as the participating agency. Section 3.4 of the UES establishes the standards and procedures to be followed "…to ensure that actions taken at USAKA will not jeopardize the continued existence of these species or result in destroying or adversely changing the habitats on which they depend." Section 3.4 is derived primarily from the regulations implementing the ESA, other U.S. regulations, and wildlife protection statutes of the RMI. As such, the list of UES consultation species includes all species present in the RMI that are listed under the ESA (including those that are candidates or are proposed for listing), all marine mammals protected under the MMPA, and all species and critical habitats as designated under RMI law. However, no critical habitat has yet been designated in the RMI.

Under the UES, "the final biological opinion shall contain the consulting agency's opinion on whether or not the action is likely to jeopardize the continued existence of a species or to eliminate a species at USAKA, or to eliminate, destroy, or adversely modify critical habitats in the RMI" (UES at 3-4.5.3(e)). Although the UES does not specifically define jeopardy, the Compact clearly intends that the UES provide substantially similar environmental protections as the ESA. We interpret this to include adoption of the ESA definition of jeopardy, as described above, and this review relies upon the ESA definition of jeopardy to reach its final conclusions.

This document represents NMFS' final Biological Opinion of the effects on marine species protected under the ESA and the UES that may result from the GBSD tests from VAFB, California, to the impact sites in the Kwajalein Missile Impact Scoring System (KMISS) deeper waters, in the vicinity of, and on Illeginni Islet in Kwajalein Atoll. This Opinion is based on the review of: the USAF and USASMDC November 5, 2020, Biological Assessment (BA) for the proposed action; recovery plans for U.S. Pacific populations of ESA-listed marine mammals, sea turtles, and elasmobranchs; published and unpublished scientific information on the biology and ecology of ESA-listed marine species, UES-

consultation marine species, and other marine species of concern in the action area; monitoring reports and research in the region; biological opinions on similar actions; and relevant scientific and gray literature (see Literature Cited).

1.1 Consultation History

In 2015, the USAF consulted with NMFS on the effects of MMIII Modification activities on UES-listed consultation species in the Action Area. On July 29, 2015 NMFS PIRO issued a Biological Opinion (BO) for MMIII activities that included up to five tests per year with Reentry Vehicle (RV) impacts on land at Illeginni Islet (PIRO-2015-9650). In this BO, NMFS concluded that the proposed MMIII action was not likely to adversely affect 43 consultation species and would have no effect on critical habitats designated in the RMI. NMFS concluded that the debris and ejecta from crater formation were LAA 15 UES-consultation coral species and top shell snails (*Tectus niloticus*), but not likely to result in the jeopardy of any of these UES consultation species (NMFS 2015a).

- After NMFS issued the 2015 BO for the MMIII Modification action, the USAF changed the location of proposed RV impacts and additional species were listed as consultation species under the UES. The USAF removed Illeginni Islet land impact from the MMIII action and proposed RV impacts in the KMISS and nearby deep ocean waters east of Gagan Islet only. Therefore, the USAF revised their effect determinations for the MMIII Modification action, concluding that the action was not likely to adversely affect UES consultation species in the Action Area. On April 17, 2019 NMFS amended the 2015 consultation and concurred with the USAF determination that the MMIII Modification project, with up to five tests per year between fiscal year (FY) 2019 and 2022 and four tests per year through 2030, may affect but would not likely adversely affect ESA or UES listed consultation species (I-PI-18-1732-AG).

On July 23, 2020 NMFS PIRO Biologists met with USASMDC and KFS, LLC personnel to conduct early coordination and discuss general information about the GBSD Test Program project as well as a consultation plan for the Proposed Action. During this meeting, parties discussed the similarity of the Proposed Action activities to those evaluated for the MMIII Fuze Modernization Program.

On November 16, 2020 we received from the USAF and USASMDC this consultation request in a letter dated November 5, 2020 stating that they had determined that the GBSD Test Program (the proposed action) may affect, but is not likely to adversely affect 25 marine ESA and/or UES consultation species (Table 1), and requested consultation for those species.

In the BA, the USAF/USASMDC further determined that the proposed action was likely to adversely affect (LAA) the ten marine UES consultation species listed in Table 2. Formal consultation was initiated on November 5, 2020, resulting in this Opinion.

Table 1. Marine consultation species not likely to be adversely affected by the proposed action

Scientific Name	Species	ESA	MMPA	CITES	RMI
	Sea Turtles				
Chelonia mydas	Central Western Pacific Green Sea Turtle DPS	Endangered		X	X
Eretmochelys imbricata	Hawksbill Sea Turtle	Endangered		X	X
	Marine Mammals				
B. musculus	Blue Whale	Endangered	X	X	X
B. physalus	Fin Whale	Endangered	X	X	
Delphinus delphis	Short-beaked common Dolphin				X
Feresa attenuata	Pygmy Killer Whale		X		
Globicephala macrorhynchus	Short-finned Pilot Whale		X		
Grampus griseus	Risso's Dolphin		X		
Kogia breviceps	Pygmy Sperm Whale			X	
Megaptera novaeangliae	Western North Pacific Humpback Whale DPSs	Endangered	X	X	
Mesoplodon densirostris	Blainville's Beaked Whale		X		
Orcinus orca	Killer Whale		X		
Peponocephala electra	Melon-Headed Whale		X		
Physeter macrocephalus	Sperm Whale	Endangered	X	X	X
	Marine Mammals				
Stenella attenuata	Spotted Dolphin				X
S. coeruleoalba	Striped Dolphin				X
S. longirostris	Spinner Dolphin		X		X
Tursiops truncatus	Bottlenose Dolphin, Pacific		X		
	Fish				
Alopias superciliosus	Bigeye Thresher Shark				X
Manta alfredi	Reef manta ray				X
M. birostris	Giant manta ray				
Sphyrna lewini	Indo-West Pacific Scalloped Hammerhead Shark DPS	Threatened			X
Thunnus orientalis	Pacific bluefin tuna				X
Carcharhinus longimanus	Oceanic white-tip shark	Threatened			

Table 2. Marine consultation species likely to be adversely affected by the proposed action

Scientific Name	Species	ESA	MMPA	CITES	RMI
	Fish				
Cheilinus undulatus	Humphead Wrasse			X	X
	Corals				
Acropora microclados	No Common Name			X	X
A. polystoma	No Common Name			X	X
Cyphastrea agassizi	Agassiz's coral			X	X
Heliopora coerulea	Blue coral			X	X
Pavona venosa	No Common Name			X	X
Turbinaria reniformis	No Common Name			X	X
Pocillopora meandrina	Cauliflower Coral	Candidate			X
	Mollusks				
Tectus niloticus	Top Shell Snail				X
Hippopus hippopus	Giant clam	Candidate			
Tridacna squamosa	Giant clam	Candidate			X

The USAF also has determined that the Proposed Action launch activities would have no effect on ESA-listed species or designated critical habitats at VAFB and that no consultation with NMFS is required for launch activities at VAFB. Guadalupe fur seals (*Arctocephalus townsendi*) are not likely to occur in the Action Area at VAFB, and no part of the Proposed Action would affect designated critical habitat for black abalone (*Haliotis cracherodii*) or leatherback sea turtles (*Dermochelys coriacea*). *In 2015, the USAF determined that MMIII launch activities would have no effect on ESA listed species under NMFS jurisdiction at VAFB (USAF 2020b, NMFS 2015a).*

On January 11, 2020 NMFS emailed USAF and requested the USAF to consider changing their species determination for the humphead wrasse from NLAA to LAA, and also to confirm the NE determination for the following species: green sea turtle (North Pacific DPS), olive ridley sea turtle, sei whale, and 15 coral: *Acanthastrea brevis, Acropora aculeus, A. aspera, A. dendrum, A. listeri, A. speciosa, A. tenella, A. vaughani, Alveopora verrilliana, Leptoseris incrustans, Montipora caliculata, Pavona cactus, P. decussata, Turbinaria mesenterina, and T. stellulata*), two mollusk species (*Pinctada margaritifera* and *Tridacna gigas*). The USAF responded via email on January 12, 2020 confirming their agreement to change the humphead wrasse species determination from NLAA to LAA, and also confirmed the NE determination for the above species.

2 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is described in detail in the USAF/USASMDC BA. The proposed flight tests would implement flight testing and booster development of the proposed GBSD weapon system that is intended to replace the aging MMIII weapon system. Testing will verify and validate system performance capabilities (baseline requirements), assess attainment of technical design parameters, and determine whether the system is operationally effective, survivable, and safe for its intended use. The proposed missile tests would launch from Vandenberg Air Force Base (VAFB), and would travel across a broad ocean area (BOA) of the Pacific Ocean with payload impact occurring on Illeginni Islet, in the vicinity of Illeginni Islet, and in the KMISS area in the RMI (Figure 1). In addition, the test program would also include facility construction/modifications at Hill Air Force Base (HAFB), VAFB, and Dugway Proving Ground. No ESA listed threatened, endangered, or candidate species or designated critical habitats are known to occur at or near any of the proposed GBSD Test Program sites on Dugway Proving Ground or on HAFB (USAF 2016; U.S. Army 2016; U.S. Army 2020). Infrastructure development would occur on land and would have no effect on any ESA or UES listed species; therefore, this part of the proposed action will not be discussed further in this Opinion.

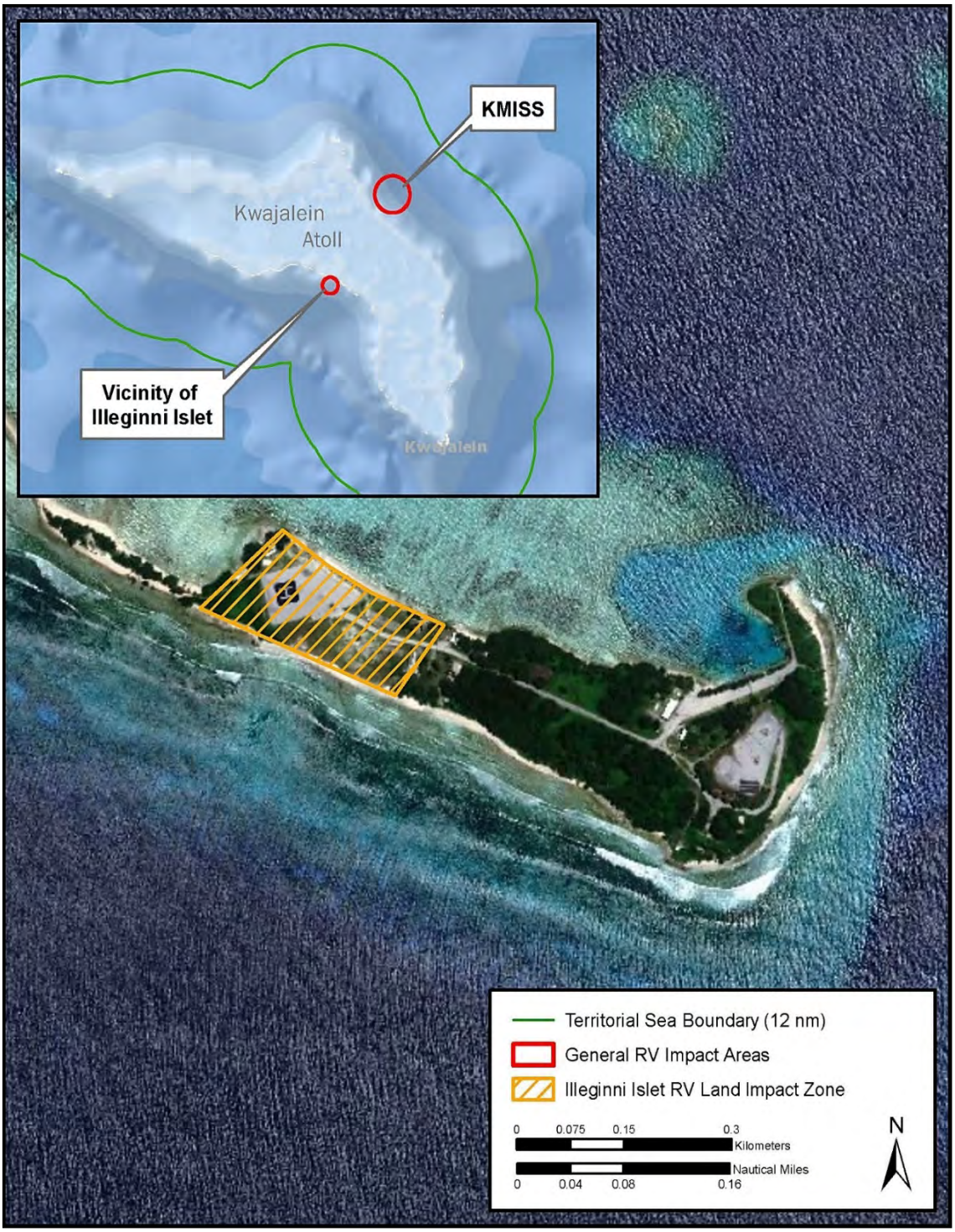

Figure 1. GBSD Reentry Vehicle (RV) Impact Areas at Kwajalein Atoll, RMI.

The proposed GBSD flight test activities include pre-flight preparation activities at Kwajalein Atoll, multiple flight tests in and above Kwajalein Atoll (including RV impact), payload impact, post-flight impact data collection, and post-flight operations at Kwajalein Atoll, debris recovery, and clean-up operations at USAKA. There are currently up to six GBSD flight tests planned per year (for a total of 28 GBSD flight tests) between FY 2024 and FY

2029, but the USAF anticipates up to nine tests per year (launching from VAFB) to account for shifts in scheduling and planning (Table 3). A portion of these tests would involve flight termination at USAG-KA; however, since the number of tests with terminal impact at Kwajalein remains unspecified, these analyses assume that all tests could use USAG-KA. The USAF currently anticipates only one land impact flight test at Illeginni Islet for the GBSD Test Program, but up to three total land RV impacts may be possible through FY 2029.

Deployment of the new GBSD weapon system cannot occur until it has been adequately tested and proven sufficiently developed for operational use; therefore, both GBSD and MMIII flight test activities and related operations would overlap at HAFB, VAFB, and USAG-KA. This testing would overlap for up to 10 years, or until decisions are made to remove the MMIII weapon system from active status.

Table 3. Proposed Number of GBSD and MMIII Flight Tests by Fiscal Year.

Test Program	**FY21**	**FY22**	**FY23**	**FY24**	**FY25**	**FY26**	**FY27**	**FY28**	**FY29**
GBSD	0	0	0	4	4	5	6	5	4
MMIII	4	5	3	4	4	4	3	3	3
Total	4	5	3	8	8	9	9	8	7

The following subsections include descriptions of the launch vehicle, pre-flight operations, flight, terminal phase operations, and post-flight operations.

Launch Vehicle Description

The specific design of the launch vehicle/proposed GBSD weapon system has not yet been confirmed; however, the plan is for the design of the launch vehicles to be sized to fit within existing MMIII launch facilities (LFs) at VAFB. The booster would use a solid propellant composition with similar properties to that of the MMIII booster. Comparable to the MMIII flight test missile, the GBSD flight test missile would carry a post boost vehicle on top of the booster that includes a propulsion system rocket engine with liquid hypergolic propellants, missile guidance set, and reentry system (Figure 2).

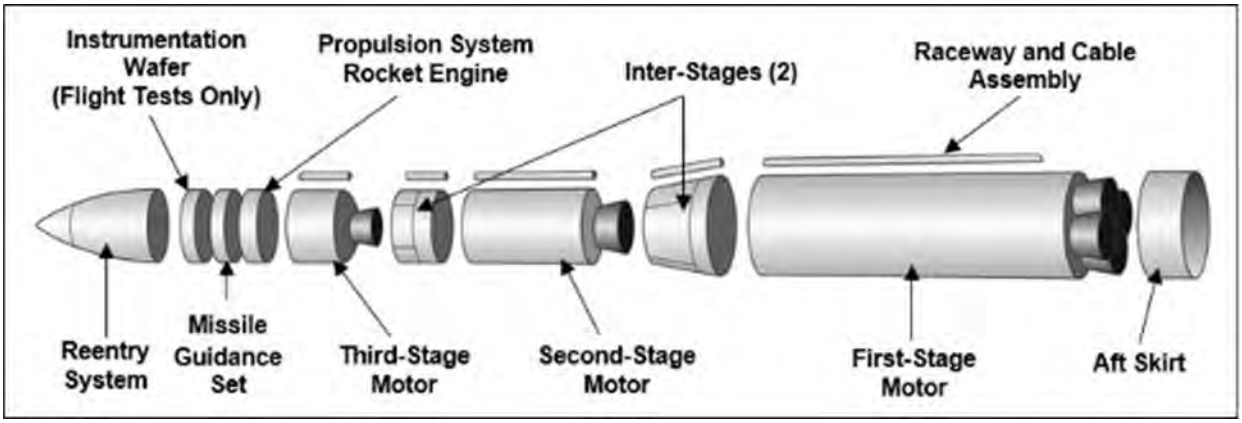

Figure 2. Minuteman III Missile Components.
Source: USAF 2004, 2013, 2020b

Similar to the MMIII system, the GBSD weapon system design is expected to use ordnance including a shroud ejection motor initiator, motor igniter assemblies, gas generators, and a flight termination system destruct package.

Although the GBSD payload may be of a new design, it would contain one to three test RVs which would be the same or similar to those used for MMIII flight testing. The MMIII reentry system was designed to contain one to three Mark 21 or Mark 12A RVs with a two-piece protective shroud (Figure 3). Test RVs are used for the annual MMIII flight tests, and the same is also expected for GBSD testing.

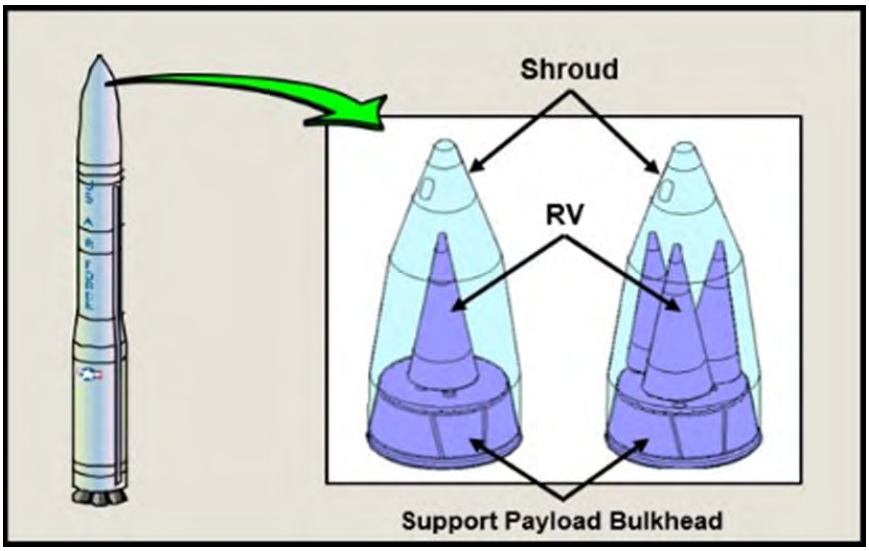

Figure 3. Minuteman III Payload/Reentry System.
Source: Modified from USAF 2013, 2020b

Typical test RVs, similar to the MMIII vehicles, do not contain any fissile materials but do contain some hazardous materials that would include silver zinc and thermal batteries, asbestos, depleted uranium, and other heavy metals (Table 4).

Table 4. MMIII Reentry Vehicle Characteristics.

Component	Description
Batteries	Mark 12A RVs contain one silver zinc battery, approximately 0.7 kilogram (1.6 pounds) Mark 21 RVs contain one silver zinc and one thermal battery, totaling approximately 1.1 kilograms (2.4 pounds)
Hazardous Materials	All test RVs typically include: 8 to 623 grams (1 to 22 ounces) of asbestos approximately 1 to 10 grams (<1 ounce) each of beryllium (Be), cadmium (Cd), and chromium (Cr) approximately 136 grams (45 ounces) of lead (Pb) less than 84 kilograms (185 pounds) of depleted uranium (DU)

Sources: USAF 2004, USAF 2020a, USAF 2020b

Pre-flight Preparations:

Pre-flight preparations would be the same as, or similar to, those conducted for the MMIII flight tests. Pre-flight activities would occur at the KMISS site, on land at Illeginni Islet, and in Kwajalein Atoll waters. In the vicinity of Illeginni Islet, pre-flight activities would include several vessel round-trips and helicopter trips to the RV impact location for personnel and equipment transport. For tests conducted at Illeginni Islet, portable camera stands would be set up on the western end of Illeginni Islet to record the flight test prior to the test. A barge or landing raft would be used to transport test equipment to Illeginni Islet. It is anticipated that, similar to other flight tests (such as the MMIII and FE-2 programs) with payload impact at Illeginni Islet, there would be increased human activity on Illeginni Islet over a three-month period (USAF 2020).

Launch: The GBSD weapon system RVs will be launched from land at VAFB, California and enter an over-ocean flight phase within seconds after the launch. *As described in the Consultation History, the USAF and USASMDC have concluded that all Proposed Action launch activities at VAFB are covered under existing programmatic consultations for ongoing launch activities at VAFB, and therefore will not be covered under or discussed further in this consultation.*

Over-Ocean Flight: After launching, a series of ground, sea, and/or air based sensors would monitor the GBSD vehicle during flight and collect data on vehicle flight and system performance (details below). Each flight test may have up to three RVs which would impact at USAG-KA. It is expected that most test RVs would be targeted at the KMISS ocean area just east of Gagan Islet, or within deep ocean waters in the vicinity of Illeginni Islet on the western side of Kwajalein Atoll (Figure 1). For flight tests terminating at Kwajalein Atoll, only test RVs would impact within RMI territorial waters or on land at Illeginni Islet. For security purposes, all other activities relating to over-ocean flight would occur over international waters and are described and evaluated in a separate classified annex to the GBSD Test Program Environmental Assessment, and will therefore not be discussed in this Opinion (USAF 2020a).

Testing at the KMISS ocean area would be conducted in the same manner as for the current/ongoing MMIII flight tests, while testing in the vicinity of Illeginni Islet would be conducted similarly to what was previously done under the MMIII program (USAF 2020b; USAF 2004, USAF 2015). The KMISS RV impact area would be in deep ocean waters east of Kwajalein Atoll. At Illeginni Islet, RVs would typically impact in ocean waters southwest of the islet. The RV impact zone on Illeginni Islet would only be used for up to three total tests through FY 2029, and only three total RV impacts would be expected. There is a small risk that a potential land impact test might result in an RV strike near the shallow waters or reef flats adjacent to the western end of Illeginni. For MMIII tests, the USAF estimated the probability of a shallow water or reef RV impact to be between 0.10 and 0.20 (USAF 2015).

A crater would form with soil, rubble, and RV fragments being ejected outward from the impact site as a result of an RV strike at Illeginni Islet. Prior MMIII RV tests have resulted in craters 6.1 to 9.1 m in diameter and 2.1 m to 3.0 m deep (USAF 2015). Any RV components or substances would be ejected outward from the RV impact point. Based on observations from MMIII and other payload testing at Illeginni Islet, most of the RV materials and substrate ejecta would remain close to edge of the crater. The density of ejecta would be

expected to decrease with distance from the impact point. For MMIII and other program flight tests (such as the FE-2 tests), ejecta resulting from crater formations was estimated to extend no more than 60 to 91 m from the impact location (USAF 2015, U.S. Navy 2019) and would be primarily within an area 120 degrees downrange along the flight path (USAF 2015) (Figure 4).

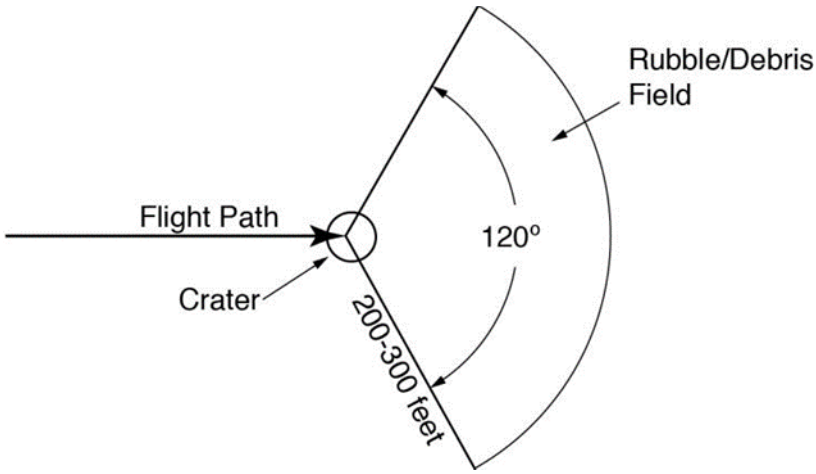

Figure 4. Approximate Debris Field for Reentry Vehicle Land Impacts.
Source: USAF 2015

A land impact test that strikes the shoreline could result in the dispersal of soil and rubble onto the shallow near shore reef flat. Although not planned, an RV shallow water impact (water depths of 3.0 m less) on the reef at Illeginni Islet could create a crater 3.0 to 4.6 m wide and 0.6 to 1.2 m deep (as estimated for MMIII testing). Prior tests have shown that no craters are formed in waters deeper than 3.0 m (USAF 2015). During most GBSD tests, RVs would remain intact until ocean water or land impact. However, up to two test RVs per year may contain an explosive charge for purposes of conducting a high fidelity test. During such tests, the RV may detonate upon contact with the land or ocean waters or may detonate at some altitude in air (airburst). Because of the RV's hypersonic velocity at time of detonation, the resulting debris (mostly aerosolized) impacts in a focused area at the impact site (USAF 2015). For MMIII, the USAF estimated that the energy associated with high fidelity test debris is less than the energy associated with a conventional RV impact (USAF 2015).

If the launch vehicle were to deviate from its course or should other problems occur during flight that might jeopardize public safety, the destruct devices (in the form of linear explosive assemblies) would separate the stages, split the motor casings, and stop forward thrust. This action would initiate a predetermined safe mode for the vehicle, causing it to terminate flight and fall into the ocean. No termination debris would be expected to fall on land. The need for flight termination is unplanned and would be an unexpected and unlikely event.

Sensor Coverage:

The flight paths would initiate from VAFB, travel across the BOA, and continue to USAKA in the RMI. A series of ground, sea, and/or air based sensors would monitor the GBSD vehicle during flight and collect data on vehicle flight and system performance. Up to 17 Lawrence Livermore National Laboratory (LLNL) sensor rafts stored at USAG-KA would be temporarily deployed in ocean waters near the RV impact location. The rafts measure

approximately 2.7 m wide and 4.6 m long, and contain various sensors including neutron detectors, hydrophones, video equipment, and cameras (Figure 5). The rafts generally use battery-powered tolling motors for station-keeping to ensure proper positioning for the flight tests (USAF 2020b). No anchors would be used to maintain the raft positions. Rafts would be deployed from a landing craft utility or similar vessel and would be placed in water depths at least 3 m.

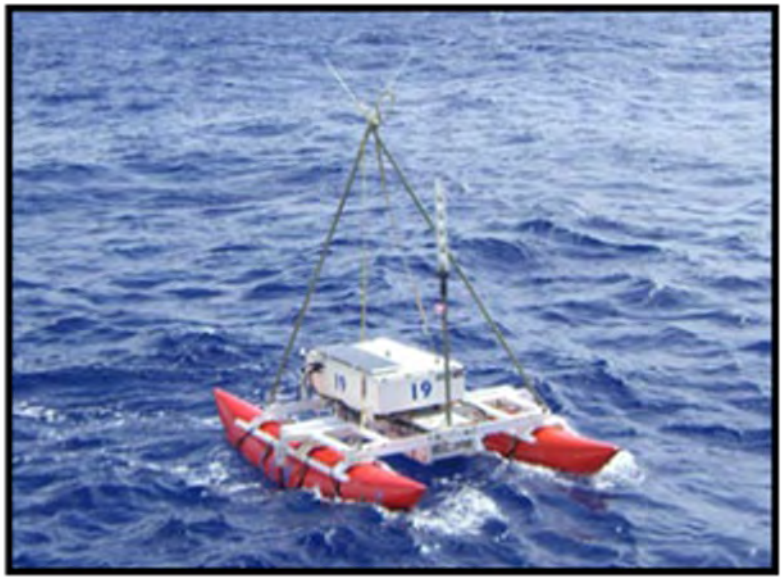

Figure 5. Representative Sensor Raft System.
Source: USAF 2010

Post-flight Operations:

Post-flight operations would involve post-test recovery and clean-up, which would include vessel traffic and personnel recovering GBSD post-flight debris at Illeginni islet either manually or with heavy equipment (similar to that used during site preparation). LLNL sensor rafts described above would be recovered with a landing craft. Landing craft utilities or other vessels would be used to transport cleanup and recovery equipment (such as a backhoe or grader) from Kwajalein Islet to Illeginni Islet. Visible RV debris on land, including hazardous materials, would be cleaned up by hand. Most RV debris would normally be found in the crater and a backhoe may be used to excavate the craters. The material excavated from these craters would be screened for RV debris and would then be backfilled with soil and rubble that was ejected around the wall of the crater. All recovered RV and other man-made debris would be shipped back to Kwajalein Islet or the United States.

Although lagoon and ocean reef flats will not be intentionally targeted during GBSD testing, recovery and cleanup of RV debris in these areas would be necessary if RV debris entered these areas due to a shoreline land impact or an unintentional reef impact. RV debris recovery would be attempted in areas within 152 to 305 m of the shoreline on the lagoon side of Illeginni Islet (USAF 2004). In shallow, nearshore areas recovery would be conducted similarly to land operations when tide conditions and water depth permit (USAF 2004, USAF 2015). If recovery operations were necessary in lagoon or ocean reef flats, USAF and USAG-KA personnel would coordinate with NMFS and USFWS to identify and use access corridors

to the crater site to avoid unnecessary and accidental impacts to protected species and sensitive habitats. If RV debris were in deeper waters, a USAG-KA dive team would be brought in to conduct underwater searches (USAF 2004). A ship would also be used for recovery operations. A remotely operated vehicle would first be used to locate the debris field and then divers in scuba gear would recover debris manually (USAF 2004). In the event of an unplanned lagoon or reef flat impact, it is predicted that rubble ejected from an impact crater larger than one inch would be found within a 1.5–3 m radius around the crater rim (USAF 2015).

No post-test recovery and clean-up activities are anticipated for GBSD flight tests conducted at the KMISS site. For a nominal/planned mission, RVs that impact in the deep ocean waters/ocean side of Illeginni Islet are not recovered. Searches for RV debris would only be attempted out to depths of 15 to 30 m in an operation similar to lagoon recovery operations (USAF 2004).

Further, the USAF would prepare a post-test recovery/cleanup plan detailing specific actions which would be taken, including the Mitigation Measures/Best Management Practices (BMPs) listed below, to avoid impacts to listed species. The Mitigation Measures listed below would be implemented as part of GBSD test program and are very similar to those implemented for MMIII (USAF 2015, USAF 2020b) and other recent test programs with payload impacts at Illeginni Islet (U.S. Navy 2019, U.S. Navy 2017). The following measures would be implemented as part of the Proposed Action and would be included in the DEP for GBSD Test Program activities at Kwajalein Atoll.

<u>Mitigation Measures/Best Management Practices (BMPs):</u>

Marine Mammal and Sea Turtle Monitoring

- During travel to and from impact zones, including Illeginni Islet, ship personnel would monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators would adjust speed or raft deployment based on expected animal locations, densities, and/or lighting and turbidity conditions.
- USAG-KA personnel would conduct a helicopter or fixed-wing aircraft overflight of the impact area three times over the week preceding a flight test and as close to launch as safely practical to survey for marine mammals and sea turtles. The final overflight would be within one day of the proposed launch. If personnel observe marine mammals or sea turtles in the vicinity, they would report such findings to the USAG-KA Environmental Office.
- Any observations of marine mammals or sea turtles during ship travel or overflights would be reported (including location, date, time, species or taxa, and number of individuals) to the USAG-KA Environmental Engineer who would maintain records of these observations and report sightings to NMFS and/or USFWS.
- Pre-flight monitoring by qualified personnel will be conducted on Illeginni Islet for sea turtles or sea turtle nests. For at least eight weeks preceding the launch, Illeginni Islet would be surveyed by pre-test personnel for sea turtles, sea turtle nesting activity, and sea turtle nests. If possible, personnel will inspect the area within days of the launch. If sea turtles or sea turtle nests are observed near the impact area, observations would be reported to appropriate test and USAG-KA personnel for consideration in approval of the launch, and to USFWS and NMFS.

- Personnel will report any observations (including location, date, time, species, and number of individuals) of sea turtles or sea turtle nests on Illeginni Islet to the USAG-KA Environmental Engineer who would maintain records of these observations and report sightings to USFWS.
- Although unexpected, any dead or injured marine mammals or sea turtles sighted by post-flight personnel would be reported to the USAG-KA Environmental Office and USASMDC, who would then inform NMFS and USFWS. USAG-KA aircraft pilots otherwise flying in the vicinity of the impact and test support areas would also similarly report any opportunistic sightings of dead or injured marine mammals or sea turtles.

Hazardous Materials Measures

- Vessel and equipment operations would not involve any intentional discharges of fuel, toxic wastes, or plastics and other solid wastes that could harm terrestrial or marine life.
- Any accidental spills from support equipment operations would be contained and cleaned up and all waste materials would be transported to Kwajalein Islet for proper disposal.
- Hazardous materials would be handled in adherence to the hazardous materials and waste management systems of USAG-KA. Hazardous waste incidents would comply with the emergency procedures set out in the Kwajalein Environmental Emergency Management Plan and the UES.
- Vessel and heavy equipment operators would inspect and clean equipment for fuel or fluid leaks prior to use or transport and would not intentionally discharge fuels or waste materials into terrestrial or marine environments.
- All equipment and packages shipped to Kwajalein Atoll will undergo inspection prior to shipment to prevent the introduction of alien species into Kwajalein Atoll.
- Following a land-impact test, the USAF and USAG-KA would collect soil and groundwater samples at various locations around the impact site and test the samples for beryllium (Be), DU, and other metals. Testing results that exceed UES criteria would require a soil investigation as detailed in the UES and may require subsequent soil removal or other remediation.

Reef Protection Measures

- To avoid impacts on coral heads in waters near Illeginni Islet, sensor rafts would not be located in waters less than 3 m deep.
- When feasible, within one day after the land impact test at Illeginni Islet, USAG-KA environmental staff would survey the islet and the near-shore waters for any injured wildlife, damaged coral, or damage to sensitive habitats (i.e., reef habitat). Any impacts to biological resources would be reported to the Appropriate Agencies, with USFWS and NMFS offered the opportunity to inspect the impact area to provide guidance on mitigations.
- If an inadvertent impact occurs on the reef, reef flat, or in shallow waters less than 3 m deep, an inspection by project personnel would occur within 24 hours. Representatives from NMFS and USFWS would also be invited to inspect the site as soon as practical after the test. The inspectors would assess any damage to coral and

other natural and biological resources and, in coordination with USAF, USAG-KA, and RTS representatives, decide on any response measures that may be required.

- If any man-made debris were to enter the marine environment and divers were required to search for payload debris on the adjacent reef flat, they would be briefed prior to operations about coral fragility and provided guidance on how to carefully retrieve the very small pieces of payload debris that they would be looking for.

General Measures at Illeginni Islet

- At Illeginni Islet, should any missile components or debris impact areas of sensitive biological resources (i.e., sea turtle nesting habitat or coral reef), a USFWS or NMFS biologist would be allowed to provide guidance and/or assistance in recovery operations to minimize impacts on such resources. To the greatest extent practicable, protected marine species including invertebrates will be avoided or effects to them will be minimized. This may include movement of these organisms out of the area likely to be affected.
- Debris recovery and site cleanup would be performed for the land impact. To minimize long-term risks to marine life, all visible project-related man-made debris would be recovered during post-flight operations. In all cases, recovery and cleanup would be conducted in a manner to minimize further impacts on biological resources.
- For recovery and rehabilitation of any injured migratory birds or sea turtles found at Illeginni Islet, USFWS and NMFS would be notified to advise on best care practices and qualified biologists would be allowed to assist in recovering and rehabilitating any injured sea turtles found.
- During post-test recovery and cleanup, should personnel observe endangered, threatened, or other species requiring consultation moving into the area, work would be delayed until such species were out of harm's way or leave the area.

2.1 Interrelated/Interdependent Actions

Military training and testing at Kwajalein Atoll has been ongoing since World War II. Testing of missile programs at Kwajalein began in 1959 for the Nike Zeus missile program. The Minuteman (MM) I program began in 1962, MMII began in 1965, and MMIII began in 1970. In addition to the MM program, anti-ballistic missile (e.g. Terminal High Altitude Area Defense (THAAD)), and other missile development and testing take place at the RTS, along with other military training and testing activities, and commercial missile launches. If it were not for these numerous activities, it is doubtful that the facilities at USAKA and RTS would be required. Therefore actions to develop and maintain USAKA and RTS facilities and infrastructure, and to support the various missions, are interrelated and/or interdependent with the training and testing activities that occur at the USAKA and RTS. However, much of the infrastructure and facilities are designed to support numerous programs and missions, with few being project-specific. Therefore, support activities that are solely attributable to the GBSD weapon system constitute a small portion of the total that occur at USAKA and RTS in support of the site's numerous missions. Further, per the Document of Environmental Protection (DEP) procedures outlined in the UES, any USAKA and RTS actions that may affect the USAKA environment require structured environmental review, with coordination and/or consultation as appropriate. Based on this, we expect that interrelated or interdependent actions that may be solely attributable to the GBSD flights would be virtually

inseparable from the routine activities at USAKA and RTS, and any impacts those actions may have would be considered through the DEP procedures outlined in the UES.

2.2 Action Area

The action area for this consultation begins at the launch site on VAFB, California to the terminal end of the GBSD test flights within the RMI territory, which includes the RV impact sites at: 1) in ocean waters of the KMISS area; 2) in ocean waters in the vicinity of Illeginni Islet; or 3) on land at Illeginni Islet. The GBSD launch vehicle would launch from VAFB, California and likely consist of a three stage booster system with an experimental payload. As described above, to comply with GBSD Test Program security classification requirements regarding missile flight paths and downrange testing, only GBSD downrange target locations at USAG-KA are described and analyzed in this Opinion. Other downrange actions and locations are described and analyzed in a separate, classified annex to the GBSD Test Program Environmental Assessment / Overseas Environmental Assessment (USAF 2020a). GBSD spent booster motors, post boost vehicle components, and test RVs would be expected to impact primarily in ocean waters away from land areas. Furthermore, although the launch activities will have no effect on listed species and are not discussed in this consultation, it is still included as part of the action area.

As mentioned above, testing in the RMI would be conducted in the same manner as for the ongoing MMIII flight tests in the KMISS area (USAF 2020b), and testing on and in the vicinity of Illeginni Islet would be conducted similarly to what was previously done under the MMIII program (USAF 2004, USAF 2015). The KMISS impact area currently used for MMIII is in deep ocean waters east of Kwajalein Atoll, at least 5.6 km (3 nm) offshore of Gagan Islet. The RV impact zone in the vicinity of Illeginni Islet would be in ocean waters southwest of the islet. For MMIII testing, the test RVs were expected to typically impact up to approximately 792 meters (2,600 ft) from the islet. The RV impact zone on Illeginni Islet is an area on the non-forested, northwest end of the islet that has been used for DoD testing for several decades.

The action area covered under this Opinion (RV impact areas) are not located in any ESA critical habitats.

3 SPECIES AND CRITICAL HABITATS NOT LIKELY TO BE ADVERSELY AFFECTED

As explained above in Section 1, the USAF/USASMDC determined that the proposed action was not likely to adversely affect (NLAA) the 35 consultation species listed in Tables 1 and 2. This section serves as our concurrence under section 7 of the ESA of 1973, as amended (16 U.S.C. §1531 et seq.), and under section 3-4.5.3(d) of the UES, 15th Edition, with the USAF/USASMDC's determination.

The UES does not specifically define the procedure to make a NLAA determination. However, the Compact clearly intends that the UES provide substantially similar environmental protections as the ESA. We interpret this to include adoption of the ESA NLAA determination process. In order to determine that a proposed action is not likely to adversely affect listed species, under the ESA, we must find that the effects of the proposed action are expected to be insignificant, discountable, or beneficial as defined in the joint

FWS-NMFS Endangered Species Consultation Handbook. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs; discountable effects are those that are extremely unlikely to occur; and beneficial effects are positive effects without any adverse effects (FWS and NMFS 1998). Many of the stressors for the Proposed Action are expected to be similar to the MMIII action and other test programs; therefore, portions of the MMIII Modification BA (USAF 2015), the NMFS BO on that action (NMFS 2015a), and Flight Experiment 2 (FE-2) BA (U.S. Navy 2019) are referenced and used in this analysis. Each phase has potential stressors; however, only stressors associated with terminal flight and impact in the RMI will be discussed and listed below, which are based on what the missile is doing and on activities done to support the test. As mentioned earlier in this Opinion, the launch activities portion of the action will not be discussed in this consultation, as the USAF has determined that the launch will have no effect on any listed species and critical habitat. Over-ocean flight activities will also not be discussed due to security measures; however, based on effects determinations made in previous consultations (such as with the MMIII program, Flight Experiment 1 (FE-1), and FE-2 tests) with similar test flights impacting the RMI, we expect similar effects to listed species.

No critical habitat has been designated in the RMI, and the action area covered under this consultation does not occur within any ESA-listed species critical habitats; therefore, no designated critical habitat occurs in the Action Area and there would be no effects to critical habitat.

Reentry Vehicle Impact in the RMI: The potential stressors during payload impact and preparation and restoration work in the KMISS, vicinity of Illeginni Islet, and Kwajalein Atoll are:

a) Exposure to elevated noise levels;
b) Direct contact from payload impacts;
c) Exposure to hazardous materials;
d) Disturbance from human activity and equipment operation; and
e) Collision with vessels.

NMFS has determined an additional stressor from this proposed action:

a) Long-term addition of man-made objects to the ocean.

Each of these stressors are addressed below to determine whether or not individuals of any of the ESA-listed and UES-protected marine species considered in this consultation are likely to be adversely affected by that stressor. The species that may be exposed to stressors during each phase, and their likely response to exposure are based on the biological and/or ecological characteristics of each species. Any incidence where a stressor has more than a discountable risk of causing an adverse effect on any individual of the ESA- and/or UES-protected species will result in that stressor and those species being considered in the following biological opinion.

a. Exposure to elevated noise levels: While in flight between VAFB and the RMI, the missile and the payload would travel at velocities that cause sonic booms. High-intensity in-water noise would be created when large missile components, such as the missiles payload, impact the ocean's surface. The impact from the payload hitting the ground will also create a sound to land and water that could transfer to water causing impulsive sound sources. High intensity

impulsive noises can adversely affect marine life. The USAF/USASMDC will also create sounds from vessels and human activity in and near water during placement and retrieval of sensors and other data collecting instruments, and retrieval of debris from the impact. Effects vary with the frequency, intensity, and duration of the sound source, and the body structure and hearing characteristics of the affected animal. Effects may include: non-auditory physical injury; temporary or permanent hearing damage expressed as temporary threshold shift (TTS) and permanent threshold shift (PTS) respectively; and behavioral impacts such as temporarily masked communications or acoustic environmental cues and modified behaviors.

Sound is a mechanical disturbance consisting of minute vibrations that travel through a medium, such as air, ground, or water, and is generally characterized by several variables. Frequency describes the sound's pitch and is measured in hertz (Hz) or cycles per second. Sound level describes the sound's loudness. Loudness can be measured and quantified in several ways, but the logarithmic decibel (dB) is the most commonly used unit of measure, and sound pressure level (SPL) is a common and convenient term used to describe intensity. Sound exposure level (SEL) is a term that is used to describe the amount of sound energy a receiver is exposed to over time. The dB scale is exponential. For example, 10 dB yields a sound level 10 times more intense than 1 dB, while a 20 dB level equates to 100 times more intense, and a 30 dB level is 1,000 times more intense. Sound levels are compared to a reference sound pressure, based on the medium, and the unit of measure is the micro-Pascal (μPa). In water, sound pressure is typically referenced to a baseline of 1 μPa (re 1 μPa), vice the 20 μPa baseline used for in-air measurements. As a rule of thumb, 26 dB must be added to an in-air measurement to convert to an appropriate in-water value for an identical acoustic source (Bradley and Stern 2008).

Transmission loss (attenuation of sound intensity over distance) varies according to several factors in water, such as water depth, bottom type, sea surface condition, salinity, and the amount of suspended solids in the water. Sound energy dissipates through mechanisms such as spreading, scattering, and absorption (Bradley and Stern 2008). Spreading refers to the apparent decrease in sound energy at any given point on the wave front because the sound energy is spread across an increasing area as the wave front radiates outward from the source. In unbounded homogenous water, sound spreads out spherically, losing as much as 7 dB with each doubling of range. Toward the other end of the spectrum, sound may expand cylindrically when vertically bounded such as by the surface and substrate, losing only about 3 dB with each doubling of range. Scattering refers to the sound energy that leaves the wave front when it "bounces" off of an irregular surface or particles in the water. Absorption refers to the energy that is lost through conversion to heat due to friction. Irregular substrates, rough surface waters, and particulates and bubbles in the water column increase scattering and absorption loss. Shallow nearshore water around Illeginni where the payload may impact, is vertically bounded by the seafloor and the surface, but is considered a poor environment for acoustic propagation because sound dissipates rapidly due to intense scattering and absorption. The unbounded deep open ocean waters where the motors would impact is considered a good acoustic environment where spherical spreading would predominate in the near field.

In the absence of location-specific transmission loss data, equations such as RL = SL – #Log(R) (RL = received level (dB); SL = source level (dB); # = spreading coefficient; and R = range in meters (m)) are used to estimate RL at a given range (isopleth). Spherical

spreading loss is estimated with spreading coefficient of 20, while cylindrical spreading loss is estimated with spreading coefficient of 10. Spreading loss in near shore waters is typically somewhere between the two, with absorption and scattering increasing the loss. $RL = SL - 20_{Log}(R)$ was used here to estimate ranges in deep open ocean water, and $RL = SL - 15_{Log}(R)$ was used to estimate ranges in the lagoon and reef flat areas around Illeginni.

The sound pressures associated with non-auditory injury are very high and are generally associated with a shock wave that is generally not found in sounds that are created by a splashdown. The Navy identified a threshold for non-auditory injury based on gastrointestinal bursting at 237 dB re: 1 µPa (Finneran and Jenkins 2012). The sounds estimated from the splashdowns and sonic booms are clearly below those thresholds and are not likely to cause non-auditory injury to marine mammals, sea turtles, elasmobranchs, and large fishes.

Table 5. Estimated thresholds for TTS and behavioral changes for hearing groups. Source: Finneran and Jenkins 2012; Popper et al. 2014; NMFS 2016.

Hearing Group	**TTS peak pressure threshold (SPL_{peak})**	**Weighted TTS onset threshold (SEL_{CUM})**	**Estimated threshold for behavioral changes**
Low-frequency cetaceans (humpback whale and other baleen whales)	213 dB	179 dB	Continuous = 120 dB_{RMS} Non-continuous = 160 dB (re: 1 µPa)
Mid-frequency cetaceans (dolphins, pilot whales and other toothed whales)	224 dB	178 dB	Continuous = 120 dB_{RMS} Non-continuous = 160 dB (re: 1 µPa)
High-frequency cetaceans (Kogia, true porpoises)	196 dB	153 dB	Continuous = 120 dB_{RMS} Non-continuous = 160 dB (re: 1 µPa)
Phocid pinnipeds (Hawaiian monk seals and other true seals)	212 dB	181 dB	Continuous = 120 dB_{RMS} Non-continuous = 160 dB (re: 1 µPa)
Sea turtles	224 dB	200 dB	160 dB
Sharks, rays, and fish	229 dB*	186 dB*	150 dB

* - SPL for lethal and sublethal damage to fish with swim bladders exposed to not specific to hearing.

The threshold for the onset of behavioral disturbance for all marine mammals from a single exposure to impulsive in-water sounds is ≥ 160 dB. Ongoing research suggests that these

thresholds are both conservative and simplistic (detailed in Southall et al. 2007 and NOAA 2013). The draft revised thresholds for marine mammals uses two metrics: 1) exposure to peak sound pressure levels (SPL_{peak}); and 2) exposure to accumulated sound exposure levels (SEL_{cum}). The thresholds for single exposures to impulsive in-water sounds are listed in Table 5 for the onset of injury and temporary hearing impacts (NMFS 2016). Corals and mollusks can react to exposure to intense sound and could be affected by concussive forces if exposed to very intense sound sources such as an underwater detonation.

The major sources of noise during this project are: 1) airborne sonic boom, and 2) objects impact onto the water and onto land.

Sonic booms

A sonic boom is a thunder-like noise caused by the shock wave generated by an object moving at supersonic speed. As objects travel through the air, the air molecules are pushed aside with great force and this forms a shock wave much like a boat creates a bow wave (Kahle et al. 2019).

These types of man-made sounds can physically adversely affect animals exposed to them in several ways: 1) non-auditory injury (e.g., barotrauma), hearing loss (expressed as permanent or temporary threshold shift), and behavioral responses. They may also experience reduced hearing by masking (i.e. the presence of one sound affecting the perception of another sound). Of these physical effects, the one measurable effect that is most likely to occur at the lowest noise intensity, would be temporary threshold shift (TTS) or temporary hearing loss. The level of noise generated during the action was not loud enough to cause non-auditory injuries, and animals were not close enough or exposed long enough to lose their hearing permanently.

The missile travels faster than the speed of sound, generating a sonic boom, which follows the object. Each vehicle would fly at speeds sufficient to generate sonic booms from close to launch and extending to impact in Kwajalein Atoll. Sonic booms create elevated pressure levels both in the air and underwater. Models were used to estimate sound pressure levels for sonic booms for the MMIII flight tests (Moody 2004, USAF 2015), and those estimates are used for the Proposed Action. As each descending test RV approaches KMISS at hypersonic velocity, sonic booms are generated over a very broad area of the open ocean northeast of the atoll and continue southwesterly toward the point of impact (Figure 6) (USAF 2015). The sonic boom footprint narrows to just a few miles on either side of the flight path (USAF 2015). At the ocean surface, the sound pressure levels for the sonic booms would vary from 91 decibels (dB) in-air (reference value at 20 μPa) (117 re 1 μPa in-water) at the eastern-most range and increase to 150 dB in-air (176 re 1 μPa in-water) at the western-most range, close to the point of impact (USAF 2015). For those RVs that impact in the KMISS area, the sonic boom footprint would occur almost entirely over the open ocean (USAF 2015). The duration for sonic boom overpressures produced by the RVs ranges from 40 milliseconds where the boom is strongest to 124 milliseconds where it is weakest (Moody 2004, USAF 2015).

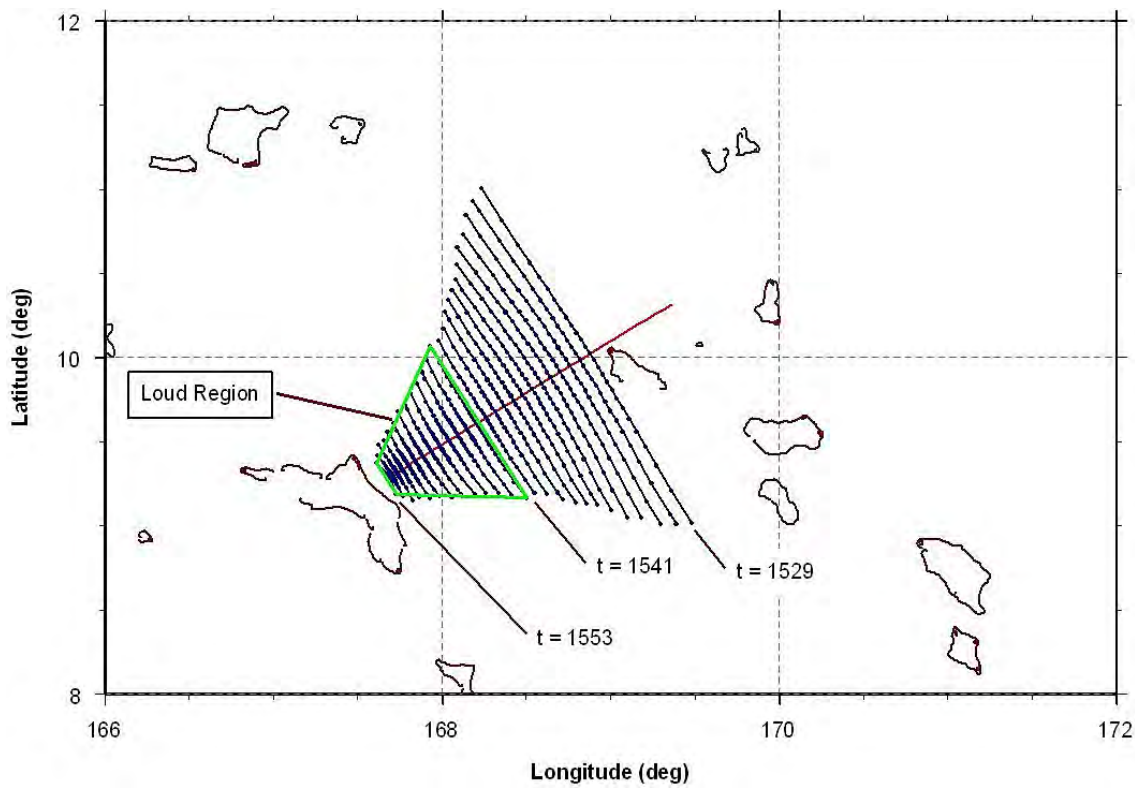

Figure 6. Representative Sonic Boom Footprint for an RV Impact at Kwajalein Atoll. Source: USAF 2015

At its loudest (176 dB in-water), the sonic boom at Kwajalein Atoll would not exceed permanent injury thresholds for consultation organisms and is below the TTS thresholds as well. Sonic booms are classified as impulsive and non-continuous sounds; therefore, for the purposes of this consultation we will be using the peak pressures to evaluate effects. Sounds in air are generally not loud enough to cause vibration and more specifically water molecules to move into each other and carry the sound further. Most of the airborne sound will be deflected, while the rest of the sound energy will be absorbed or refracted even further. The source sound level when it enters the surface is likely to be well below thresholds for injury of hearing loss. The sonic boom footprint for sounds above 160 dB re 1 µPa would likely cover a large area around the flight path; however, the sound would only last a fraction of a second (0.3 seconds). We believe that, at most, an exposed individual may experience temporary behavioral disturbance in the form of slight changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. We expect exposure to sonic booms would have insignificant effects on any of the species considered in this consultation.

RV Impact Noise

Impact of the RV at the terminal end of the flight would result in elevated sound levels in-air and underwater. Sound pressure estimates for the MMIII RV impact in ocean waters were up to 240 dB re 1 µPa at 3.1 m (USAF 2015). The sound pressures would decrease with water

depth and distance from the point of RV impact. Using a point source attenuation model with spherical spreading coefficient, sound pressures attenuate to 230 dB re 1 µPa at 10 m from RV splashdown, 224 dB re 1 µPa at 20 m, and 202 dB re 1 µPa at 251 m. Sound pressure estimates are not available for high fidelity RV tests; however, the energy released during high fidelity tests is expected to be an order of magnitude less than that of a non-high fidelity test RV and the airburst would occur at some altitude above the surface (USAF 2015). Because the energy release would be less than for a non-high fidelity test RV and because much of sound intensity loss at the air-water interface, in-water sound pressures of high fidelity tests are expected to be less than for non-high fidelity test RV impacts.

For RV impacts in KMISS or the Vicinity of Illeginni Islet waters, sound pressure levels may peak up to 250 dB (1 µPa) at impact (which would last no more than a couple of seconds). Using a spherical spreading model for deep ocean waters (described in USAF 2015, NMFS 2015a, U.S. Navy 2019, NMFS 2019), the range to pressure effect thresholds from RV impact was calculated for UES consultation species groups (Table 6). This is a conservative approach given that it does not account for differential sound attenuation due to ocean conditions such as water depth, temperature, salinity, or stratification. The sound pressures from RV impact would exceed the PTS or non-auditory injury thresholds for consultation species but only very close to the impact point. Sound pressures would also exceed the TTS thresholds out 20 to 501 m from impact for cetaceans and sea turtles and up to 1,585 m for fish. RV impacts in the Vicinity of Illeginni Islet would in deep waters approximately 790 m southwest of Illeginni Islet and approximately 470 m from the outer edge of the fringing reef (NMFS 2015a). Therefore, maximum sound levels in reef habitats would be less than 196 dB re 1 µPa.

No data on UES listed cetaceans, sea turtle, and fish species densities are available in deep ocean waters of Kwajalein Atoll. However, if maximum density data for these species in other areas of the central Pacific Ocean (detailed in U.S. Navy 2019 and Hanser et al. 2017) are used, the number of expected injury, PTS, and TTS exposures for all species is substantially less than one. For example, around the Hawaiian Islands, the island stocks of pantropical spotted dolphins have maximum density estimates of 0.061 per square kilometer (km^2) (Hanser et al 2017), which would likely be on the very upper end of density for any cetacean species at Kwajalein Atoll. Using this density, the estimated number of exposures to PTS would be only 0.00002 individuals for each impact and only 0.00006 potential TTS exposures per impact. Using green sea turtle density estimates for offshore waters of Guam of 1 per 3.4 km^2 (U.S. Navy 2015b), there may be 0.00008 individual turtle exposures per impact to sounds above the PTS threshold, and 0.00029 exposures to sounds above the TTS threshold. These examples provide an estimate of the maximum number of exposures for UES-consultation species in deep ocean waters of Kwajalein Atoll. Even if summed across the maximum of nine tests per year with up to three RVs per test, the number of individuals that might be exposed to pressures high enough to cause PTS or TTS is still estimated to be substantially less than one per year for these species and less than one over the proposed six years of the GBSD Test Program.

Table 6. Maximum Underwater Radial Distance to Elevated Sound Pressure Level Effect Thresholds for UES Consultation Species from GBSD RV Ocean Impact.

Species Group	Effect Category	Threshold Criterion (re 1 µPa)	Radial Distance from RV Impact Point	Area around Impact Point, km^2 (mi^2)
Low Frequency Cetaceans	PTS (non-lethal injury)	219 dB_{peak}	35 m (116 ft)	0.004 (0.002)
	TTS	213 dB_{peak}	71 m (232 ft)	0.016 (0.006)
Mid Frequency Cetaceans	PTS (non-lethal injury)	230 dB_{peak}	10 m (32 ft)	<0.001 (<0.001)
	TTS	224 dB_{peak}	20 m (65 ft)	0.001 (<0.001)
High Frequency Cetaceans	PTS (non-lethal injury)	202 dB_{peak}	251 m (824 ft)	0.198 (0.076)
	TTS	196 dB_{peak}	501 m (1,644 ft)	0.789 (0.305)
All Cetaceans	Behavioral Disturbance	160 dB_{peak}	32 km (20 mi)	3,142 (1,213)
Sea Turtles	Mortality/ Mortal Injury	237 dB_{peak}	4 m (15 ft)	<0.001 (<0.001)
	PTS (non-lethal injury)	230 dB_{peak}	10 m (32 ft)-	<0.001 (<0.001)
	TTS	224 dB_{peak}	20 m (65 ft)	0.001 (<0.001)
	Behavioral Disturbance	160 dB_{peak}	32 km (20 mi)	3,142 (1,213)
Fish	Mortality/ Mortal Injury	229 dB_{peak}	11 m (37 ft)-	<0.001 (<0.001)
	TTS	186 dB SEL_{cum} re 1 μPa^2-s	1,585 m (5,200 ft)	7.891 (3.046)
	Behavioral Disturbance	150 dB_{RMS}	100 km (62 mi)	31,416 (12,129)

It is more likely that at some UES consultation species would be exposed to sound pressures above the behavioral disturbance thresholds and that some individuals may respond to the RV impact noise. However, NMFS concluded for the similar MMIII action that any effects of this single impulsive noise are expected to "be limited to a temporary behavioral modification in the form of slight changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure" (NMFS 2015a). Therefore, the probability of those individuals being within injury or TTS thresholds from RV impact sound pressures are discountable, and their effects of non-injurious sound generated from the GBSD testing on all listed sea turtles, marine mammals, and fish species are expected to be insignificant.

Acute and temporary acoustic exposures such as those associated with RV impact would be expected to cause, at most, temporary consequences for some of the more specialized marine invertebrates (U.S. Navy 2019). Temporary disruption of feeding or predator avoidance behaviors (Mooney et al. 2010) in some invertebrates (such as mollusks) are possible; however, being much less acoustically sensitive, any exposed corals or mollusks that may be on the outer reef edge are expected to be unaffected by payload impact noise. Giant clam larvae are not likely to be present in BOA and most likely will not be present in the KMISS, or will be in low numbers. Based on the above information, the payload impact noise

associated with the GBSD testing would be insignificant on the ESA or UES-listed corals and mollusks listed in Table 2.

For payload impacts in the vicinity of Illeginni, the sea turtle and fish species listed in Table 1 that could occur along the outer edge of the fringing reef may be exposed to a brief pulse of sound from air or underground. Because the BOA and the KMISS are large open areas and the habitat for primarily pelagic and migratory sea turtle and fish species are as large, the probability of any individual of the pelagic species being in the action area during payload impacts is extremely low. The sound generated by vehicle impact will carry long distances and could be heard by the individuals of the species identified in table 1. Considering the large distribution of pelagic animals, the probability of those individuals being within injury or TTS thresholds are discountable, and their effects of non-injurious sound generated from the action are expected to be insignificant. At most, we expect that an exposed individual may experience a temporary behavioral disturbance, in the form of slight change in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, the exposure is expected to have insignificant effects. Based on the best available information, exposure to payload impact noises is expected to have insignificant effects for all species considered in this consultation.

Shock Waves

RV impact would result in the RV impacting the ocean at high velocity either in the deep ocean waters of the KMISS or in the vicinity of Illeginni Islet and would generate underwater shock/sound waves. These in-water pressures were discussed above and are expected to have a larger area of potential effect than the contact area of the RV itself. RV impact in these deep ocean waters would not result in ground borne shock waves strong enough to injure corals or other any other species considered in this consultation.

However, for MMIII tests, shock waves resulting from payload impact on land were estimated to be strong enough to damage corals out as far as 37.5 m from the point of impact, and if impact occurred on the shoreline, shock waves would propagate into the submerged seafloor (USAF 2015). Even though shoreline impact is not planned or expected for GBSD testing, it is assumed that shock waves strong enough to damage corals might propagate up to 37.5 m into the marine environment, and larger pieces of debris could also crack or break parts of coral colonies or injure individual mollusks or fish. The adverse effects of shock waves associated with payload impact on Illeginni islet on coral species listed in Table 2 are further discussed in Section 6.

Exposure to intense ground borne shock waves could also injure soft tissues in mollusks, but the range of onset of significant injuries is likely much less than that estimated for corals (NMFS 2019). Since top shell snails are anchored to the substrate by their muscular foot, the muscular foot would somewhat isolate the snail's shell and soft tissues from vibration and damage (NMFS 2019). Giant clams are anchored to the substrate; therefore, ground borne vibrations would travel through the clam's shell and soft tissues (NMFS 2019). Since the range to potential shock wave effects for mollusks is less than for corals, shock waves are not likely to be strong enough to injure these species. Therefore, shock waves are expected to have insignificant effects to top shell snails and giant clams.

Humphead wrasses have the potential to be injured by the concussive shock waves; however, several factors make this highly unlikely. The shock waves would propagate primarily through the substrate and it can be assumed that little of the pressure intensity would be transferred to the water. Therefore, the range of onset of significant injuries to fish from shock waves is likely substantially less than for corals (NMFS 2019). In addition, humphead wrasses observed near Illeginni Islet have been observed beyond the reef crest around 91 m from the shoreline (NMFS 2019). As with elevated noise levels discussed previously, any realized effects of shock waves on nearshore fish, including the humphead wrasse, would likely be limited to temporary behavioral responses. Fish would be expected to return to normal behaviors within moments of exposure to shock wave pressures; therefore, shock waves produced from payload impact at Illeginni islet are expected to have insignificant effects on listed fish in the Action Area.

Sea turtles have the potential to be injured by shock waves produced during crater formation. Empirical evidence from previous tests corroborates predictions of the propagation of shock waves associated with impact were approximately 37.5 m through the adjacent reef from the point of impact on the shoreline (USAFGSC and USASMDC/ARSTRAT 2015). Although green and hawksbill sea turtles may occur around Illeginni Islet, they do so infrequently and in low numbers, and typically in waters closer to the reef edge, which is over 150 m (~500 ft) from shore, where they spend the majority of their time under water. Therefore, we consider it unlikely that either turtle species would be close enough to shore to be within the range of shock wave effects. In the unlikely event of a turtle being within the ejecta zone during the impact, at most, an exposed animal may experience temporary behavioral disturbance in the form of slight changes in swimming direction or speed, feeding, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, shock waves are expected to have insignificant effects to sea turtles.

Given that the target area on Illeginni Islet only includes terrestrial areas, sea turtles hauled out or nesting on land and their nests also have the potential to be injured from shock waves during crater formation. However, no sea turtle nesting activity has been recorded on Illeginni Islet in over 20 years. Therefore, it is considered extremely unlikely that sea turtles would be in terrestrial habitats on Illeginni Islet and it is discountable that sea turtles would be affected by shock waves. As an additional avoidance measure, Illeginni Islet would be surveyed for sea turtle nesting and haul-out activity prior to the flight tests as described in BMPs listed in Section 2.

No UES or ESA-listed marine mammals are expected to be close enough to be the area affected from potential direct contact. Therefore, there would be no effect of shock waves on cetaceans from land impacts.

Non-larval Fish, Corals, and Mollusks near Illeginni Islet. Non-larval forms of humphead wrasse, seven coral species, and three mollusk species (Table 2) have the potential to occur on the reefs and waters in the vicinity of Illeginni Islet. These forms include the relevant coral and mollusk species and adults and juveniles of the relevant fish species. Although coral reefs are not planned or expected to be targeted, a land payload impact on the shoreline of Illeginni could result in shock waves, which may affect and will likely adversely affect at least some of the consultation fish, coral and mollusk species on the adjacent reef. The analysis of these potential effects are analyzed below in Section 6.

Vessel Noise

The USAF/ USASMDC will use vessels of varying size to install and retrieve equipment in water to gather data and remove debris. Large vessels can create sounds ranging from 170-190 dB (re: 1 µPa). Smaller vessels like skiffs with outboards range from 150-170 dB. Vessels are generally moving and the sound sources are considered non-impulsive and mobile. Human activity in water during retrieval of instruments, debris, and ejecta are not louder than those sources. Air bubbles from SCUBA are among the higher noise sources considered, and were reported by Radford et al. (2005) with mean levels of 161 dB and mean peak levels of 177 dB at 1 m. We consider this source a non-impulsive, mobile, intermittent noise source. Because of the mobile nature of vessels and the intermittent nature of SCUBA bubbles, animals of all hearing groups are not likely to be exposed to the source long enough or continuously enough to experience TTS from vessels and SCUBA air bubbles. Furthermore, behavioral disturbances are likely brief because the mobile and temporary nature of the sources, and the noises will likely have an immeasurable effect on an individual's behavior during and after exposure.

b. Direct contact from payload impacts: The Proposed Action will result in impact of the payload on land at Illeginni Islet, within the vicinity of Illeginni Islet, and in the KMISS. The RVs payloads and components will directly contact aquatic and/or terrestrial habitats and have the potential to directly contact consultation species. Payload component contact with the land may result in cratering and ejecta radiating out from the point of impact. For the reasons discussed below, it is discountable that any of the species considered in this consultation would be hit by a RVs payload, or to be close enough to an impact site to be significantly affected by concussive forces. It is also discountable that any of the species identified in Table 1 would be hit by payload or ejecta, or be significantly affected by concussive forces during the planned payload strikes on/within the vicinity of Illeginni Islet or in the KMISS. However, the payload strikes on Illeginni Islet may adversely affect the species identified in Table 2. Therefore, the potential effects of this stressor on those species are considered below in the effects of the action section (Section 6).

Direct Contact - Deep Ocean Water Impact

The GBSD RVs could potentially expose pelagic species in the vicinity of Illeginni Islet and KMISS by directly hitting them when the payload impacts into the ocean. Considering the size and speed of the components, a direct impact would likely kill or severely injure any animal it terminates on. Because the vicinity of Illeginni Islet and the KMISS are large open areas and the habitat for primarily pelagic and migratory shark, ray, and tuna species is as large, the probability of any individual of the pelagic species being in the action area during payload impact is extremely low. The likelihood of directly falling onto giant clam larvae is also extremely small, if present; however, the corals and mollusks listed in Table 2 are not expected to occur in deep ocean waters, and therefore would not be affected. If maximum density data for UES-consultation species in other areas of the central Pacific Ocean are used, the number individuals expected to be exposed to direct contact would be substantially less than one. Even if summed across the maximum of nine tests per year with up to three RVs per test and summed across the proposed six years of testing, the probability that any individual would be exposed to direct contact is still extremely low.

Therefore, the probability of falling missile payloads directly contacting listed marine mammals, sea turtles, fish, corals, and mollusks in deep ocean waters of the KMISS or in the vicinity of Illeginni Islet are discountable.

Direct Contact - Land Impact

For up to three total GBSD missile tests, an RV may impact on land at Illeginni Islet. Test RV components terminating at this test site would only directly impact terrestrial habitats but would have the potential to directly contact ESA and UES consultation species. No listed species would be at risk from crater formation; however, the potential exists for shoreline and nearshore reef-associated species to be at risk from debris being ejected from the crater and by shock waves radiating out from the point of impact as a result of the force from RV impact. Data from previous MMIII RV impact cratering and shock waves are used as estimates for the proposed GBSD testing. Craters from MMIII RV land impacts have been documented to be 6–9 m in diameter and 2–3 m deep (USAF 2015).

Crater formation would result in natural substrate (i.e., soil and coral rubble) being ejected around the rim of the crater upon impact. For MMIII testing, ejecta resulting from crater formations was estimated to extend no more than 60 to 91 m from the impact location (USAF 2015, U.S. Navy 2019). Based on observations from MMIII and other payload testing at Illeginni Islet, most of the RV materials and substrate ejecta would remain close to edge of the crater and the density of ejecta would be expected to decrease with distance from the impact point (USAF 2015).

A shoreline payload impact not expected or planned for the GBSD testing program, and most of the ejected debris would fall on land; however, a land RV impact near the shoreline could result in the dispersal of soil and rubble onto the shallow nearshore reef flat. For MMIII testing, the USAF estimated that the probability of a shallow water impact was between 0.1 and 0.2 (USAF 2015). Since the exact impact location and distribution of ejecta is unknown, these analyses assume a worst-case scenario of a shoreline RV impact where the ejected debris could enter the nearshore marine environment. Although the exact shape of the potential debris field is unknown, the seaward portion of such an area is conceptually illustrated below as a rough semi-circle on the lagoon and ocean sides of Illeginni Islet with a radius of 91 m (Figure 7). Based on the worst-case scenario, ejected debris has the potential to occur in a 13,008 square meter (m^2; 15,557 square yard [yd^2]) area.

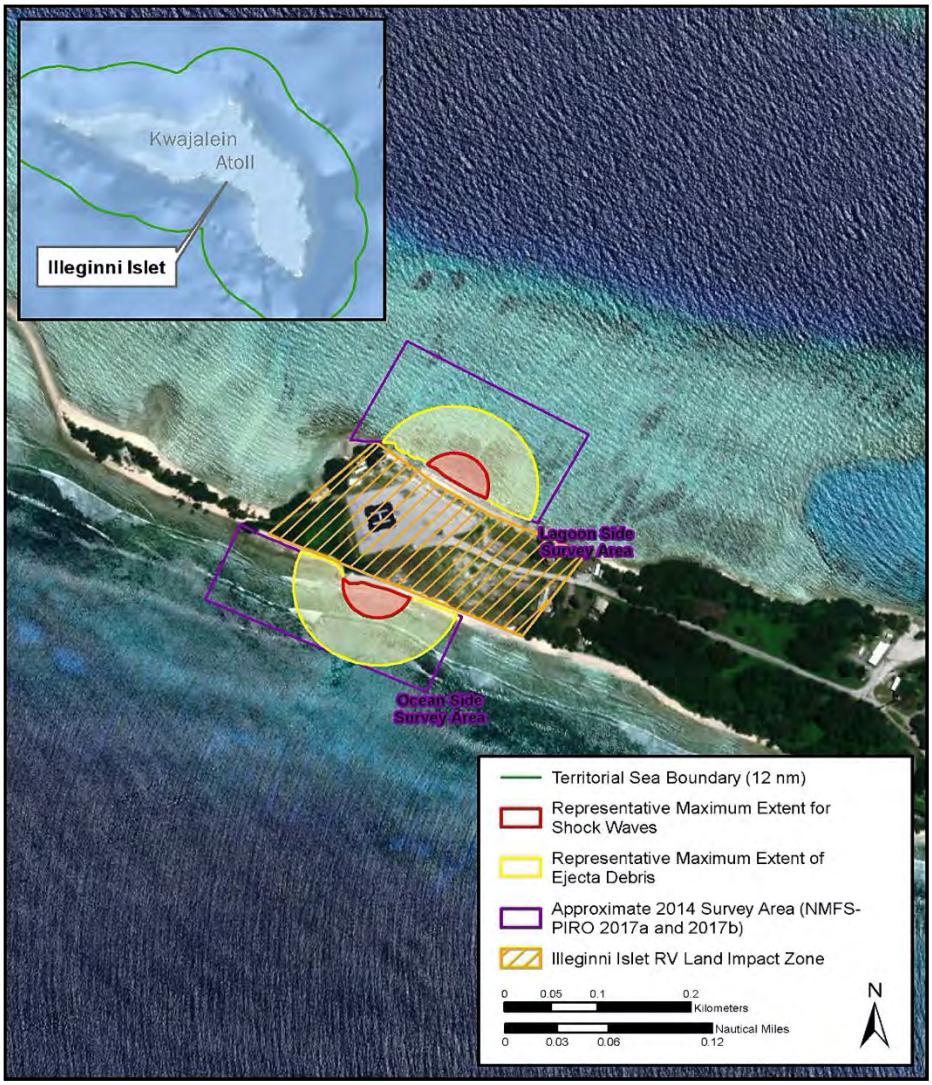

Figure 7. Representative Maximum Ejecta Debris Extent and Maximum Shock Wave Extent for a Shoreline RV Impact at Illeginni Islet (provided by USAF).

Furthermore, debris and ejecta from a land impact would be expected to fall within 91 m of the impact point. Of the species identified in Table 1, only green and hawksbill sea turtles may occur close enough to the potential impact site at Illeginni Islet to be affected by these stressors. Therefore we believe that, with the exception of green and hawksbill sea turtles, it is discountable that any of those species would be exposed to debris from the payload impact on Illeginni Islet.

Sea turtles have the potential to be injured if struck by debris ejected during crater formation. Empirical evidence from previous tests corroborates predictions of the propagation of shock waves associated with impact were approximately 37.5 m through the adjacent reef from the point of impact on the shoreline (USAFGSC and USASMDC/ARSTRAT 2015). Although green and hawksbill sea turtles may occur around Illeginni Islet, they do so infrequently and in low numbers, and typically in waters closer to the reef edge, which is over 150 m from shore, where they spend the majority of their time under water. Therefore, we consider it unlikely that either turtle species would be close enough to shore to be within this range and

that any exposure to ejecta would be in the form of relatively slow moving material sinking to the bottom near the animal. In the unlikely event of a turtle being within the ejecta zone during the impact, at most, an exposed animal may experience temporary behavioral disturbance in the form of slight changes in swimming direction or speed, feeding, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, direct contact from ejecta is expected to have insignificant effects to sea turtles.

Given that the target area on Illeginni Islet only includes terrestrial areas, sea turtles hauled out or nesting on land and their nests also have the potential to be injured if struck by debris ejected during crater formation. However, no sea turtle nesting activity has been recorded on Illeginni Islet in over 20 years. Therefore, it is considered extremely unlikely that sea turtles would be in terrestrial habitats on Illeginni Islet and it is discountable that sea turtles would be affected by direct contact. As an additional avoidance measure, Illeginni Islet would be surveyed for sea turtle nesting and haul-out activity prior to the flight tests as described in BMPs listed in Section 2.

No UES or ESA-listed marine mammals are expected to be close enough to be the area affected from potential direct contact. Therefore, there would be no effect of direct contact on cetaceans from land impacts.

Non-larval Fish, Corals, and Mollusks near Illeginni Islet. Non-larval forms of humphead wrasse, seven coral species, and three mollusk species (Table 2) have the potential to occur on the reefs and waters in the vicinity of Illeginni Islet. These forms include the relevant coral and mollusk species and adults and juveniles of the relevant fish species. Although coral reefs are not planned or expected to be targeted, a land payload impact on the shoreline of Illeginni could result in ejecta/debris fall and post-test cleanup operations, which may affect and will likely adversely affect at least some of the consultation fish, coral and mollusk species on the adjacent reef. The analysis of these potential effects are analyzed below in Section 6.

<u>c. Exposure to hazardous materials</u>: Impact of the GBSD RVs would have the potential to introduce propellants, battery acids, and heavy metals into the terrestrial or marine environment at the impact sites. The test RVs do not contain any fissile materials. However, based on the composition of MMIII RVs (detailed in Section 2), the test RVs would likely contain varying quantities of hazardous materials, potentially including batteries, explosives, asbestos, DU, and other heavy metals.

Immediately after payload impact in the KMISS or vicinity of Illeginni Islet, fragmentation of the RV would disperse any onboard hazardous materials such as Be and DU around the impact point. Be and DU fragments are highly insoluble (i.e., they dissolve extremely slowly), and dilution/mixing in the ocean water occurs much faster than dissolution of Be and DU; therefore, their concentrations in seawater would likely be indistinguishable from natural background levels (USAF 2015). RV components would also sink relatively quickly to the ocean floor and would not be recovered in waters greater than 30 m deep. Although we would not expect materials such as Be and DU to dilute quickly, we would not expect these chemicals that leak at the oceans' surface and water column accumulating to levels expected to elicit a detectable response should a protected species be exposed to the material in the upper reaches of the water column. Furthermore, on the seafloor, the materials would leak or

leach into the water and into bottom sediments. However, due to the amount of ocean water affected, this is highly immeasurable and is expected to be rapidly diluted by ocean currents.

Following an RV impact on land, fragmentation of the RV would also disperse any of the residual onboard hazardous materials around the impact point, however the majority of the RV fragments and materials would be expected to remain close to the impact point in terrestrial habitats. During post-test clean-up activities, attempts would be made to recover all visible man-made test debris. The impact crater and ejecta immediately surrounding the crater would be excavated and screened to remove RV debris. Pre-test preparatory and post-test cleanup activities may involve heavy equipment and ocean-going vessels, which have the potential to introduce fuels, hydraulic fluids, and battery acids to terrestrial habitats as well as marine habitats. Any accidental spills from support equipment operations would be contained and cleaned up. All waste materials would be transported to Kwajalein Islet for proper disposal in the United States. Only trace amounts of hazardous materials would be expected to remain in terrestrial areas after the test. Few, if any, hazardous materials would be expected to enter the nearshore marine environment and would be quickly diluted and dispersed by the large volume of ocean water and wave action.

Several avoidance, minimization, and mitigation measures would be in place as part of the Proposed Action to reduce the potential for adverse effects to listed species, including post-test soil and groundwater sampling for hazardous materials. Considering the planned cleanup of man-made materials, the very small quantities of hazardous materials expected to be introduce to terrestrial and marine habitats, and the dilution and mixing capabilities of the ocean and lagoon waters, materials released during RV impact would not be present in sufficient quantities or concentrations to adversely affect any of the UES or ESA-listed species listed in Tables 1 and 2 in the Action Area. Therefore, we believe that any effects from hazardous materials will be insignificant to all UES and ESA-consultation species in the area.

<u>d. Disturbance from human activities and equipment operation</u>: Both pre-flight preparations and post-flight cleanup activities may result in elevated levels of human activity in terrestrial and marine environments for several weeks.

At Illeginni Islet

During the several weeks of increased activity, several vessel round-trips are likely to occur. Helicopters would also be used to transport equipment and personnel to Illeginni Islet. Personnel and equipment would be used for preparation of the impact site including placement of cameras and other sensors in both terrestrial areas. Sensor rafts with onboard optical or acoustic sensors would be deployed by landing craft utility in the lagoon or ocean waters within approximately 792 m of the islet in waters no less than 3 m deep. Post-flight cleanup would involve recovery of all man-made test debris possible and would include personnel and equipment use in terrestrial habitats. Man-made debris would also be removed from the impact crater and filled with the surrounding substrate that was ejected. These post-test activities may involve the use of heavy equipment such as a backhoe or grader.

Post-test human activity in the marine areas near Illeginni Islet would likely only involve vessel traffic to and from Illeginni Islet as well as the collection of sensor rafts. Use of heavy equipment in the nearshore marine environment is not expected since shallow water and reef habitats would not be targeted. However, if test debris enters the nearshore marine

environment, including the reef flat, test personnel may manually recover debris. Human activity in the nearshore marine environment would be limited to the area near the RV land impact where debris entered the water. In the event of an unexpected shoreline or reef-flat payload impact, several measures and procedures would be in place to guide post-test activities in order to avoid impacts to listed species. If divers are required to search for RV debris on the adjacent reef flat, they would be briefed prior to operations about coral fragility and provided guidance on how to carefully retrieve the very small pieces of RV debris that they would be looking for.

During planned testing activities, nearshore reef species including corals and mollusks would not be affected by human activity and equipment operation. Sessile organisms such as mollusks may temporarily close their shells or adhere more tightly to the substrate, also returning to normal behaviors within minutes of cessation of the activity. Corals are not expected to have any measurable reaction to short-term non-contact activities. While it has properly been assumed for listed vertebrate species that physical contact of equipment or humans with an individual constitutes an adverse effect due to high potential for harm or harassment, the same assumption does not hold for listed corals due to two key biological characteristics: 1) all corals are simple, sessile invertebrate animals that rely on their stinging nematocysts for defense, rather than predator avoidance via flight response, so whereas it is logical to assume that physical contact with a vertebrate individual results in stress that constitutes harm and/or harassment, the same does not apply to corals because they have no flight response; and 2) Most reef-building corals, including all the listed species, are colonial organisms, such that a single larva settles and develops into the primary polyp, which then multiplies into a colony of hundreds to thousands of genetically-identical polyps that are seamlessly connected through tissue and skeleton. Colony growth is achieved mainly through the addition of more polyps, and colony growth is indeterminate. The colony can continue to exist even if numerous polyps die, or if the colony is broken apart or otherwise damaged. The individual of these listed species is defined as the colony, not the polyp, in the final coral listing rule (79 FR 53852). Thus, affecting some polyps of a colony does not necessarily constitute harm to the individual.

Motile listed species are either not expected to be within this area (marine mammals and oceanic whitetip sharks), or they are expected to temporarily leave the area with no measurable effect on their fitness (green and hawksbill turtles, manta rays, oceanic white tip sharks, bigeye thresher sharks, and scalloped hammerhead sharks), and animals would be expected to return to normal behaviors within minutes of cessation of activity. Therefore, increased human activity and equipment operation is expected to have insignificant effects.

Since most human activities and equipment operation would take place on land, the only listed species with the potential to be affected by human activity and equipment operation on Illeginni Islet are hauled out or nesting sea turtles. Several mitigation measures would be in place to minimize the chance of affecting sea turtles, including sea turtle nest and activity searches of suitable habitat at Illeginni Islet leading up to the test. As discussed previously, no sea turtle nests or nesting activity have been observed on Illeginni in over 20 years. Sea turtle nest pits (unidentified species) were last found on the northern tip of Illeginni Islet in 1996. Therefore, it is considered discountable that any sea turtles or sea turtle nests would be affected by human activity and equipment operation in terrestrial habitats.

Vicinity of Illeginni Islet

In the Vicinity of Illeginni Islet, human activity would involve pre-test deployment and post-test recovery of sensory rafts as well a possible post-test RV recovery and cleanup. RVs typically strike waters in the Vicinity of Illeginni at a distance of approximately 792 m from shore. If necessary, searches for debris would be attempted to depths of 15–30 m (USAF 2015). A ship would be used for recovery and a remotely operated vehicle would be used to locate the debris field on the bottom before scuba divers would attempt to recover the debris manually (USAF 2015). Divers would be briefed prior to operations about coral fragility and provided guidance on how to avoid or minimize unavoidable contact with fragile marine resources as they carefully retrieve the very small pieces of RV debris that they would be looking for (USAF 2015).

KMISS

There are no pre-test or post-test cleanup or recovery activities required for GBSD flight tests in the KMISS portion of the Action Area. KMISS optical and electronic sensors and system support equipment are already in place on Gagan Islet and in the offshore ocean waters. For nominal missions, RVs that impact in deep ocean waters are not recovered.

<u>e. Collision with vessels</u>: The Proposed Action has the potential to increase ocean vessel traffic in the action area during both pre-flight preparations and post-flight activities for several weeks. Pre-test activities would include several vessel round-trips to and from Illeginni Islet or the vicinity of Illeginni Islet for personnel and equipment transport. Sensor rafts would also be deployed from a vessel near either of these impact sites. Post-test recovery efforts would also result in increased vessel traffic to Illeginni Islet or the Vicinity of Illeginni Islet. Vessels would be used to transport heavy equipment (such as backhoe or grader) and personnel for manual cleanup of debris, backfilling or any craters, instrument, and sensor raft recovery.

Sea turtles and cetaceans must surface to breathe air. They also rest or bask at the surface. Therefore, when at or near the surface, turtles and cetaceans are at risk of being struck by vessels or their propellers as the vessels transit. Corals could also be impacted if a vessel runs aground or drops anchors on the reef. Conversely, scalloped hammerhead sharks, bigeye thresher sharks, oceanic white tip sharks, manta rays, Pacific Bluefin tuna, and humphead wrasse respire with gills and as such do not need to surface to breathe and are only infrequently near the surface. They are also agile and capable of avoiding oncoming vessels.

The conservation measures that are part of this action include requirements for vessel operators to watch for and avoid marine protected species, including adjusting their speed based on animal density and visibility conditions. Additionally, no action-related anchoring is planned and vessel operators are well trained to avoid running aground, and no increased vessel traffic would occur for RV impacts in the KMISS area. Therefore, based on the best available information we consider the risk of collisions between project-related vessels and any of the consultation species identified in Tables 1 and 2 to be discountable.

<u>f. Long-term addition of man-made objects to the ocean</u>

This operation will scatter missile components in the KMISS, vicinity of Illeginni Islet, and likely throughout the Pacific Ocean. Man-made objects in the form of vessels, piles,

pipelines, vehicles, and purposeful and unintended marine debris has entered all oceans for millennia and most of it is unquantified, especially things that do not float. Whales and sea turtles are most commonly observed entangled in fishing gear that floats on the surface, and recent surveys of sea turtles noted that they ingest plastics that float (high-density polyethylene, low-density polyethylene, and polypropylene) more commonly than plastic that does not float (Jung et al. 2018; White et al. 2018). This may suggest that man-made objects that float may pose more risk than objects that lay at the bottom of the ocean.

Almost all of the products in the missiles sink as soon as they impact the water and will likely remain on the bottom after the project is implemented. Although we do not know the specifics of the GBSD vehicle components and measurements, we expect complete combustion of propellant and liquid fuel.

All components of each missile are expected to sink immediately after entry into the water. If the payload does not detach and the missile is lost to the BOA, it would be expected to sink as well. We also understand that there is a paucity of data or observations of animals' interactions with debris at the bottom of the ocean, and that carcasses that do not float on the surface are almost never observed or captured for study. Nonetheless, based on empirical observation, the majority of entanglements are observed in gear that floats. Similarly, material that floats are observed more often in ingested non-organic material. The pelagic species are generally observed in the water column and are not considered bottom-dwelling, and they are less likely to be exposed to objects that are at the bottom than if they were mid-column or at the surface. We therefore expect the addition to debris from this proposed action to the bottom of the ocean to be insignificant.

4 STATUS OF THE SPECIES

This section presents biological or ecological information for the UES consultation species that the proposed action is likely to adversely affect. As stated above in Section 1, the USAF/USASMDC determined that the proposed action was likely to adversely affect the 11 marine UES consultation species listed in Table 2.

As described above in the introduction, the jeopardy analyses in this Opinion considers the risk of reducing appreciably the likelihood of survival and recovery of UES-protected marine species within USAKA. As such, subsections 4.1 through 4.11 provide species-specific descriptions of distribution and abundance, life history characteristics (especially those affecting vulnerability to the proposed action), threats to the species, and other relevant information as they pertain to these animals within USAKA. Factors affecting these species within the action area are described in more detail in the Environmental Baseline (Section 5).

4.1 *Pocillopora meandrina* (Cauliflower coral)

Pocillopora meandrina is listed as a species of "least concern" by the IUCN (IUCN 2015). The Center for Biological Diversity petitioned the NMFS to list the cauliflower coral in Hawaii as endangered or threatened under the ESA in March 2018 (CBD 2018). In September 2018, NMFS found that *P. meandrina* may warrant listing under the ESA (83 FR 47592 [September 20, 2018]). This species had been a candidate for listing under the ESA and was therefore protected under the UES; however, in 2020 NMFS found that the listing was not warranted and was removed as a candidate species. At this time, *P. meandrina* is still a UES consultation species.

Pocillopora meandrina is in the family Pocilloporidae. This hard coral species forms small upright bushes up to 30 cm in diameter that are cream, green, or pink in color (CBD 2018). Colonies form flattened branches that uniformly radiate out from the original growth point (CBD 2018). This species has a relatively fast growth rate with high recruitment; however, colonies may also be short lived due to recolonization by other coral species and high sensitivity to disturbance (CBD 2018).

4.1.1 Distribution and Abundance

Pocillopora meandrina is found throughout tropical and subtropical Indian and Pacific oceans in shallow reefs (CBD 2018). This range includes Hawaii, Johnston Atoll, American Samoa, the Marshall Islands, Micronesia, the Northern Mariana Islands, and Palau among other island groups (CBD 2018). *Pocillopora meandrina* occurs in shallow reef environments with high wave energy at depths of 1 to 27 m (CBD 2018). The abundance of this coral is still being determined through the status review process.

4.1.2 Life History Characteristics Affecting Vulnerability to Proposed Action

Pocillopora meandrina has been observed at all 11 of the surveyed Kwajalein Atoll islets since 2010 as well as in the Mid-Atoll Corridor. Overall, *P. meandrina* has been observed at 96% (120 of 125) survey sites in Kwajalein Atoll. This species was observed at 100% (5 of 5) of sites at Illeginni Islet since 2010 including in Illeginni harbor.

4.1.3 Threats to the Species

Major threats to *Pocillopora meandrina* include destruction and/or modification of habitat, harvest for the aquarium trade, disease, predation, and high susceptibility to bleaching due to thermal stress (CBD 2018). During a bleaching event in the coastal waters of West Hawaii in 2015, *P. meandrina* exhibited high post-bleaching mortality with approximately 96% of colonies exhibiting partial post-bleaching tissue loss (greater than 5%) and 78% of colonies exhibiting total post-bleaching mortality (CBD 2018). Other bleaching events in the Hawaiian Islands resulted in 1 to 10% mortality for this species (CBD 2018). NMFS is currently evaluating the threats to the species through its status review process.

4.1.4 Conservation of the Species

Pocillopora meandrina has been retained as a consultation species under the UES.

4.2 *Acropora microclados* (Coral)

A. microclados is broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *A. microclados* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.2.1 Distribution and Abundance

The reported range of *A. microclados* is from the Red Sea and northern Madagascar, the Chagos Archipelago in the central Indian Ocean, through the Indo-Pacific region, and eastward to the central Pacific Ocean out to Pitcairn Island. It ranges as far north as the Ryukyu Islands of Japan,

and to the south down along the eastern and western coasts of Australia. *A. microclados* is reported as uncommon to common (Veron 2014). Within the area potentially impacted at Illeginni, *A. microclados* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, all of the other USAKA islands, and at 34 of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *A. microclados* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.2.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. microclados is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. Scleractinian corals act as plants during the day and as animals at night, or in some combination of the two. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. Corals also feed by consuming prey that is captured by the nematocysts (Brainard et al. 2011).

A. microclados colonies are typically corymbose plates that are attached to hard substrate, with short, uniform, evenly spaced tapered branchlets. It occurs on upper reef slopes and subtidal reef edges at depths of 5 to 20 m. Like other corals, *A. microclados* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. *A. microclados* is a hermaphroditic spawner; releasing gametes of both sexes. It also reproduces through fragmentation, where broken pieces continue to grow to form new colonies (Brainard et al. 2011).

4.2.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is a potential effect of anthropogenic climate change. Little specific information is available to describe the susceptibility of *A. microclados* to these threats. However, the genus *Acropora* is ranked as one of the more susceptible to bleaching, where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard et al. 2011). Acidification experiments have demonstrated negative effects on *Acropora* calcification, productivity, and impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles (Brainard et al. 2011). The susceptibility and impacts of disease on *A. microclados* are not well understood, but subacute dark spots disease has been reported in this species, and its genus is considered moderate to highly susceptible to disease. The crown of thorns seastar (*Acanthaster planci*) and corallivorous snails preferentially prey on *Acropora spp.*, and the dead areas of the coral are rapidly overgrown by algae. Land-based toxins and nutrients are reported to have deleterious effects on *Acropora spp.* depending on the substance,

concentration, and duration of exposure. The genus *Acropora* has been heavily involved in international trade, and *A. microclados* is likely included in this trade (Brainard et al. 2011). As described above, *A. microclados* is likely highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects on a global level.

4.2.4 Conservation of the Species

A. microclados is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.3 *Acropora polystoma* (Coral)

A. polystoma is broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *A. polystoma* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.3.1 Distribution and Abundance

The reported range of *A. polystoma* is from the Red Sea to central Africa and Madagascar, and the Chagos Archipelago in the central Indian Ocean, through the Indo-Pacific region, eastward to the Tuamotus in the southeastern Pacific Ocean. It ranges as far north as the south of Taiwan, through the South China Sea and the Philippines, and to the south down along the northern coast of Australia and the Coral Sea. *A. polystoma* is reported as uncommon to common (Veron 2014). Within the area potentially impacted at Illeginni, *A. polystoma* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, all of the other USAKA islands, and at 34 of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *A. polystoma* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.3.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. polystoma is a stony coral. *A. polystoma* colonies are typically clumps or corymbose plates that are attached to hard substrate, with tapered branches of similar length. It occurs in highly active intertidal to shallow subtidal reef tops and edges with strong wave action and/or high currents, at depths down to about 10 m. *A. polystoma* is a hermaphroditic spawner; releasing gametes of both sexes. It also reproduces through fragmentation, where broken pieces continue to grow to form new colonies (Brainard et al. 2011).

4.3.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. Little specific information is available to describe the susceptibility of *A. polystoma* to these threats. However, the genus *Acropora* is ranked as one of the most severely susceptible to bleaching, where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching

can also result in mortality of the affected colony (Brainard et al. 2011). Acidification experiments have demonstrated negative effects on *Acropora* calcification, productivity, and impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles (Anthony et al. 2008). The genus *Acropora* is considered moderate to highly susceptible to disease, and *A. polystoma* has been reported to experience severe white-band/white plague disease. The crown of thorns seastar (*Acanthaster planci*) and corallivorous snails preferentially prey on *Acropora spp.*, and the dead areas of the coral are rapidly overgrown by algae. Land-based toxins and nutrients are reported to have deleterious effects on *Acropora spp.* depending on the substance, concentration, and duration of exposure. The genus *Acropora* has been heavily involved in international trade, and *A. polystoma* is likely included in this trade (Brainard et al. 2011). As described above, *A. polystoma* is likely highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects across its range.

4.3.4 Conservation of the Species

A. polystoma is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.4 *Cyphastrea agassizi* (Coral)

C. agassizi is found primarily in the Indo-Pacific. As a candidate species for listing under the ESA, *C. agassizi* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.4.1 Distribution and Abundance

The reported range of *C. agassizi* is from Indonesia to the Hawaiian Islands in the central Pacific Ocean, and from southern Japan and the Northern Mariana Islands, south to Northeastern Australia. *C. agassizi* is reported as uncommon (Veron 2014). Within the area potentially impacted at Illeginni, *C. agassizi* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, at six more of the 11 USAKA islands, and at 14 of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *C. agassizi* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.4.2 Life History Characteristics Affecting Vulnerability to Proposed Action

C. agassizi is stony coral. *C. agassizi* typically forms deeply grooved massive colonies attached to hard substrate. It occurs in shallow reef environments of back- and fore-slopes, lagoons and outer reef channels at depths of about 2 to 20 m. Like other corals, *C. agassizi* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. The reproductive characteristics of *C. agassizi* are undetermined, but its congeners include a mix of hermaphroditic spawners and brooders (Brainard et al. 2011).

4.4.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is a potential effect of anthropogenic climate change. *Cyphastrea* are considered generally resistant to bleaching, but elevated temperatures may still cause mortality within this genus (Brainard et al. 2011). The effects of increased ocean acidity are unknown for this genus, but in general, increased ocean acidity is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates for many corals. It also can induce bleaching more so than thermal stress, and tends to decrease growth and calcification rates. The specific susceptibility and impacts of disease on *C. agassizi* are not known, but some of its congeners have been infected with various "band" diseases. As such, it appears that *C. agassizi* is susceptible (Brainard et al. 2011). The susceptibility of *C. agassizi* to predation is unknown. The effects of land-based pollution on *C. agassizi* are largely unknown, but it may pose significant threats at local scales. This coral light to moderately exploited in trade at the genus level (Brainard et al. 2011). As described above, the genus *Cyphastrea* is considered generally resistant to bleaching, but mortality due to elevated temperatures, which may be attributable to anthropogenic climate change, may still occur. As such, this species may be currently adversely affected by those effects on a global level.

4.4.4 Conservation of the Species

C. agassizi is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.5 *Heliopora coerulea* (Coral)

H. coerulea is a very broadly distributed Indo-Pacific coral. It is considered the oldest living coral species. *H. coerulea* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.5.1 Distribution and Abundance

The reported range of *H. coerulea* is from southern east Africa to the Red Sea, across the Indian Ocean to American Samoa in central Pacific Ocean, and from Japan, south to Australia (Brainard et al. 2011). Colonies of *H. coerulea* are often patchy in their distribution, but can dominate large areas. Within the area potentially impacted at Illeginni, *H. coerulea* is estimated to be scattered across submerged hard pavement reef areas, including intertidal and/or inshore rocky areas, at a density of up to 0.53 colonies/m^2. It has been observed at Illeginni, at all of the other USAKA islands, and at 32 of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *H. coerulea* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.5.2 Life History Characteristics Affecting Vulnerability to Proposed Action

H. coerulea is a non-scleractinian stony coral. Stony corals are sessile, colonial, marine invertebrates. Unlike the calcium carbonate skeleton of scleractinian corals, the skeleton of *H. coerulea* consists of aragonite, and it is blue instead of white. As with scleractinian corals, the individual unit of a coral colony is called a polyp, which is typically cylindrical in shape, with a

central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense, but instead of living in "cups on the surface of the coral, *H. coerulea* polyps live in tubes within the skeleton. Each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue called the coenenchyme. As with other corals, *H. coerulea* acts as a plant during the day and as an animal at night, or in some combination of the two. The soft tissue harbors mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. Corals also feed by consuming prey that is captured by the nematocysts (Brainard et al. 2011).

H. coerulea is a massive coral that typically forms castellate blades. It occurs in water depths from the intertidal zone down to about 60 m. It is most abundant from the shallow reef crest down to forereef slopes at 10 m, but is still common down to 20 m. Like other corals, *H. coerulea* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. *H. coerulea* colonies have separate sexes. Fertilization and early development of eggs begins internally, but the planula larvae are brooded externally under the polyp tentacles. Larvae are considered benthic, as they normally distribute themselves by crawling away vice drifting in the plankton (Brainard et al. 2011).

4.5.3 Threats to the Species

Brainard et al. (2011) suggest that *H. coerulea* is a hardy species. They report that it is one of the most resistant corals to the effects of thermal stress and bleaching, and although there is no specific research to address the effects of acidification on this species, it seems to have survived the rapid acidification of the oceans during the Paleocene-Eocene Thermal Maximum acidification. They also report that disease does not appear to pose a substantial threat, and that adult colonies are avoided by most predators of coral. However, the externally brooded larvae are heavily preyed upon by several species of butterflyfish. Although *H. coerulea* tends to prefer clear water with low rates of sedimentation, Brainard et al. (2011) report that sediment appears to pose no significant threat to the species. Land-based sources of pollution may pose significant threats at local scales. Collection and trade appear to be the biggest threat to this species. *H. coerulea* has been reported as one of the top 10 species involved in international trade. Its morphology and natural color make it highly desirable (Brainard et al. 2011). As described above, *H. coerulea* does not appear to be particularly susceptible to effects attributed to anthropogenic climate change, but it is likely being adversely affected by international trade.

4.5.4 Conservation of the Species

H. coerulea is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.6 *Pavona venosa* (Coral)

P. venosa is a broadly distributed Indo-Pacific. It became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.6.1 Distribution and Abundance

The reported range of *P. venosa* extends down the eastern shore of the Saudi Arabian, into the Red Sea, down to central Africa and Madagascar, across the Indian Ocean to include the Chagos Archipelago and Sri Lanka, through the Indo-Pacific region, eastward to the Tuamotus in the southeastern Pacific Ocean. It ranges as far north as the Ryukyu Islands, through the South China Sea and the Philippines, and to the south down along the east and west coasts of Australia and the Coral Sea. *P. venosa* has been reported as common. Within the area potentially impacted at Illeginni, *P. venosa* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, all of the other USAKA islands, and at 16 of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *P. venosa* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.6.2 Life History Characteristics Affecting Vulnerability to Proposed Action

P. venosa is a stony coral. *P. venosa* typically forms massive to encrusting colonies attached to hard substrate. It occurs in shallow reef environments at depths of about 2 to 20 m. The reproductive characteristics of *P. venosa* are unknown, but six of its congeners are gonochoric (separate sexes) spawners; releasing gametes of both sexes that become fertilized in the water (Brainard et al. 2011).

4.6.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. *P. venosa* has moderate to high susceptibility to thermal stress induced “bleaching” where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard et al. 2011). In general, increased ocean acidity is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates for many corals. It can increase the susceptibility to thermal stress, and tends to decrease growth and calcification rates (Anthony et al. 2008). No studies have examined the direct impacts of ocean acidification on *P. venosa*, but some evidence suggests that the genus *Pavona* has some degree of tolerance to acidification (Brainard et al. 2011). The specific susceptibility and impacts of disease on *P. venosa* are not known, but susceptibility is considered to be low (Brainard et al. 2011). There are a medium number of reports of acuter white disease for the genus *Pavona*. The susceptibility of *P. venosa* to predation is considered to be low, but there is no specific information. Members of the genus *Pavona* have varied susceptibility to predation by the crown of thorns seastar (*Acanthaster planci*). There is no specific information about the effects of land-based pollution on *P. venosa*, but it may pose significant threats at local scales. International trade includes the genus *Pavona*, but at relatively low levels (Brainard et al. 2011). As described above, *P. venosa* is susceptible to effects of thermal stress, which may be attributable to anthropogenic climate change. As such, this species is likely being adversely affected by those effects across its range.

4.6.4 Conservation of the Species

P. venosa is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.7 *Turbinaria reniformis* (Coral)

T. reniformis is very broadly distributed across the Indo-Pacific region. *T. reniformis* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.7.1 Distribution and Abundance

The reported range of *T. reniformis* includes the Persian Gulf, the Red Sea, and most of the Indian Ocean basin, through the Indo-Pacific region, and eastward to the central Pacific Ocean out to Samoa and the Cook Islands. It ranges as far north as central Japan, down through the Philippines, around New Guinea, and down along the east and west coasts of Australia, and also down the Marianas, the Marshalls, and east to the Line Islands. It has been reported as common (Veron 2014). Within the area potentially impacted at Illeginni, *T. reniformis* is estimated to occur in small aggregations on submerged hard pavement reef areas, at a density of up to 0.16 colonies/m^2. It has been observed at Illeginni, at five more of the 11 USAKA islands, and at nine of 35 sites within the mid-atoll corridor (NMFS 2014a). In a recent survey conducted at the Minuteman III impact area *T. reniformis* was observed in the study area and the density estimates are slightly less than what was predicted (NMFS 2017a).

4.7.2 Life History Characteristics Affecting Vulnerability to Proposed Action

T. reniformis is a stony coral. *T. reniformis* colonies are attached to hard substrate and typically form large lettuce-like assemblages of plates. The plates tend to be very convoluted in shallow active water, whereas they are broad and flat in deeper calmer waters. It has been reported from the surface down to over 0 to 40 m, commonly on forereef slopes at 10 m and deeper, but it prefers turbid shallow protected waters where it forms massive and extensive stands. Like other corals, *T. reniformis* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. *T. reniformis* is a gonochoric (separate sexes) spawner; releasing gametes of one sex or the other that become fertilized in the water (Brainard et al. 2011).

4.7.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is a potential effect of anthropogenic climate change. Susceptibility of *Turbinaria spp*. to thermal stress induced bleaching (where the coral expels its zooxanthellae) varies regionally, and among species, but ranges between low to moderate. The physiological stress and reduced nutrition from bleaching may have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony. However, *T. reniformis* has shown the potential to reduce bleaching impacts through increased heterotrophic feeding rates (Brainard et al. 2011). The susceptibility of *T. reniformis* to acidification appears to be lower than that of other genera of scleractinian corals tested. However, in most corals studied, acidification impaired growth, as

well as impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles for some species (Brainard et al. 2011). Susceptibility and impacts of disease on *T. reniformis* are not known, but both white syndrome disease and black lesions have affected members of this genus. Adult colonies of *Turbinaria spp.* are rarely eaten by the crown of thorns seastar (*Acanthaster planci*), but the gastropod nudibranch (*Phestilla sibogae*) both feeds upon, and infects *Turbinaria spp.* with disease. *T. reniformis* appears to tolerate high turbidity and sedimentation, as well as low-salinity events, but land-based toxins and nutrients may have deleterious effects on a regional scale, depending on the substance, concentration, and duration of exposure. The genus *Turbinaria* has been heavily exploited in international trade, and *T. reniformis* is likely included in this trade (Brainard et al. 2011). As described above, *T. reniformis* may be susceptible to some effects attributed to anthropogenic climate change, and as such could be currently adversely affected by those effects on a global level.

4.7.4 Conservation of the Species

T. reniformis is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

4.8 *Tectus niloticus* (Top Shell Snail)

The top shell snail is also sometime referred to as *Trochus niloticus*. It is a broadly distributed marine gastropod, and is a consultation species under UES section 3-4.5.1 (a).

4.8.1 Distribution and Abundance

The top shell snail is distributed in sub-tropical to tropical waters of the Indo-Pacific region. They are indigenous to Yap, Palau, and Helen Reef in Micronesia, but have been introduced to nearly every island group across the Indo-Pacific region (Smith 1987). Larvae recruit to shallow intertidal zones, typically along exposed (seaward) shores. Individuals migrate into deeper water as they grow (Heslinga et al. 1984) with maximum reported depth being 24 m (Smith 1987). Data are insufficient to determine current population levels and trends across its range, including in the RMI. Within the area potentially impacted at Illeginni, the top shell snail is estimated to be scattered across submerged hard pavement reef areas, including intertidal and/or inshore rocky areas, at a density of up to 0.09 individuals/m^2. It has been observed at Illeginni, at all of the other USAKA islands, and at 12 of 35 sites within the mid-atoll corridor (NMFS 2014a).

4.8.2 Life History Characteristics Affecting Vulnerability to Proposed Action

The top shell is a nocturnal, herbivorous, marine gastropod mollusk. It is normally found on the reef surface in the intertidal and subtidal zones. The life span is between 15 and 20 years, with sexual maturity occurring at about 2 years. It is a hardy species that is commonly relocated between island groups with high success. Dobson (2001), reports that top shell snails can survive out of the water for up to 36 hours when kept cool and damp. After being relocated on a new reef area and left undisturbed for a brief period, top shell snails typically resume normal behaviors with no measurable effects assuming the relocation site supports adequate forage and shelter.

4.8.3 Threats to the Species

The top shell is highly susceptible to over-exploitation. It is an edible species whose shells are also commercially important in the mother of pearl button industry (Heslinga et al. 1984). They

are slow moving and are easily spotted by reef-walkers and snorkelers. Unregulated or poorly regulated harvesting has led to their depletion across their range. Although top shell snails are probably beginning to be affected by impacts associated with anthropogenic climate change (described in more detail in the Environmental Baseline section below), no significant climate change-related impacts to its populations have been observed to date.

4.8.4 Conservation of the Species

The top shell is afforded protection at USAKA as a consultation species under the UES (USAKA 2014).

4.9 *Hippopus hippopus* (giant clam)

H. hippopus is broadly distributed across the Indo-Pacific region. It is a candidate species for listing under the ESA, *H. hippopus* became a consultation species under UES section 3-4.5.1 (a).

4.9.1 Distribution and Abundance

H. hippopus are reported to be found in the eastern Indian Ocean at Myanmar and east to the Fiji and Tonga Islands, in the north as far as southern Japan and then south to the Great Barrier Reef, New Caledonia and Western Australia. Within the area potentially impacted at Illeginni, *H. hippopus* was found throughout the lagoon area but was rare on the ocean side in a recent survey conducted at the impact area. It has been observed at Illeginni, and at eight more of the 11 USAKA islands, and at nine of 35 sites within the mid-atoll corridor (NMFS 2017b).

4.9.2 Life History Characteristics Affecting Vulnerability to Proposed Action

H. hippopus is a giant clam which is markedly stenothermal (i.e., they are able to tolerate only a small range of temperature) and thus restricted to warm waters. Giant clams are typically found living on sand or attached to coral rock and rubble by byssal threads (Soo and Todd 2014), but they can be found in a wide variety of habitats, including live coral, dead coral rubble, boulders, sandy substrates, seagrass beds, macroalgae zones, etc. (Gilbert et al. 2006; Hernawan 2010).

The exact lifespan of tridacnines has not been determined; although it is estimated to vary widely between 8 to several hundred years (Soo and Todd 2014). Little information exists on the size at maturity for giant clams, but size and age at maturity vary by species and geographical location (Ellis 1997). In general, giant clams appear to have relatively late sexual maturity, a sessile, exposed adult phase and broadcast spawning reproductive strategy, all of which can make giant clams vulnerable to depletion and exploitation (Neo *et al.* 2015). All giant clam species are classified as protandrous functional hermaphrodites, meaning they mature first as males and develop later to function as both male and female (Chambers 2007); but otherwise, giant clams follow the typical bivalve mollusk life cycle. At around 5 to 7 years of age (Kinch and Teitelbaum 2010), giant clams reproduce via broadcast spawning, in which several million sperm and eggs are released into the water column where fertilization takes place. Giant clam spawning can be seasonal; for example, in the Central Pacific, giant clams can spawn year round but are likely to have better gonad maturation around the new or full moon (Kinch and Teitelbaum 2010). In the Southern Pacific, giant clam spawning patterns are seasonal and clams are likely to spawn in spring and throughout the austral summer months (Kinch and Teitelbaum 2010). Once fertilized, the eggs hatch into free-swimming trochophore larvae for around 8 to 15 days

(according to the species and location) before settling on the substrate (Soo and Todd 2014; Kinch and Teitelbaum 2010). During the pediveliger larvae stage (the stage when the larvae is able to crawl using its foot), the larvae crawl on the substrate in search of suitable sites for settlement and metamorphose into early juveniles (or spats) within 2 weeks of spawning (Soo and Todd 2014).

According to Munro (1993), giant clams are facultative planktotrophs, in that they are essentially planktotrophic (i.e., they feed on plankton) but they can acquire all of the nutrition required for maintenance from their symbiotic algae, *Symbiodinium*.

4.9.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, pollution, and exploitation. The harvest of giant clams is for both subsistence purposes (e.g., giant clam adductor, gonad, muscle, and mantle tissues are all used for food products and local consumption), as well as commercial purposes for global international trade (e.g., giant clam shells are used for a number of items, including jewelry, ornaments, soap dishes). The extent of each of these threats is largely unknown. Blidberg et al. (2000) studied the effect of increasing water temperature on *T. gigas, T. derasa,* and *H. hippopus* at a laboratory in the Philippines. *H. hippopus* experienced increased respiration and production of oxygen in elevated temperatures and was therefore more sensitive to higher temperature than the two other species tested. After 24 hours at ambient temperature plus 3°C, however, no bleaching was observed for any of the species. The susceptibility and impacts of disease on *H hippopus* are not known, but incidences of mortality from rickettsiales-like organisms in cultured clams in the western Pacific, one in the Philippines and one in Kosrae have been documented (Norton et al. 1993).

4.9.4 Conservation of the Species

H hippopus is listed in CITES Appendix II, is an ESA candidate species and is therefore a consultation species under the UES.

4.10 *Tridacna squamosa* (giant clam)

T. squamosa is broadly distributed across the Indo-Pacific region. It is a candidate species for listing under the ESA, therefore *T. squamosa* is a consultation species under UES section 3-4.5.1 (a).

4.10.1 Distribution and Abundance

T. squamosa has a widespread distribution across the Indo-Pacific. Its range extends from the Red Sea and East African coast across the Indo-Pacific to the Pitcairn Islands. It has also been introduced in Hawaii (CITES 2004). The species' range also extends north to southern Japan, and south to Australia and the Great Barrier Reef (bin Othman *et al*. 2010). This range description reflects the recent range extension of *T. squamosa* to French Polynesia as a result of observations by Gilbert et al. (2007). Within the area potentially impacted at Illeginni, *T. squamosa* was observed in the lagoon area but not on the ocean side in a recent survey conducted at the impact area. It has been observed at Illeginni, at five more of the 11 USAKA islands, and at 24 of 35 sites within the mid-atoll corridor (NMFS 2017b).

4.10.2 Life History Characteristics Affecting Vulnerability to Proposed Action

T. squamosa is a giant clam which are markedly stenothermal (i.e., they are able to tolerate only a small range of temperature) and thus restricted to warm waters. *T. squamosa* is usually recorded on reefs or sand; it is found attached by its byssus to the surface of coral reefs, usually in moderately protected localities such as reef moats in littoral and shallow water to a depth of 20 m (Kinch and Teitelbaum 2010). This species tends to prefer fairly sheltered lagoon environments next to high islands; however, *T. squamosa* appears to be excluded by *T. maxima* in the closed atoll lagoons of Polynesia (Munro 1992). Neo et al. (2009) found that *T. squamosa* larvae, like many reef invertebrates, prefer substrate with crustose coralline algae. *Tridacna squamosa* is also commonly found amongst branching corals (staghorn, *Acropora* spp.; CITES 2004).

The exact lifespan of tridacnines has not been determined; although it is estimated to vary widely between 8 to several hundred years (Soo and Todd 2014). Little information exists on the size at maturity for giant clams, but size and age at maturity vary by species and geographical location (Ellis 1997). In general, giant clams appear to have relatively late sexual maturity, a sessile, exposed adult phase and broadcast spawning reproductive strategy, all of which can make giant clams vulnerable to depletion and exploitation (Neo *et al.* 2015). All giant clam species are classified as protandrous functional hermaphrodites, meaning they mature first as males and develop later to function as both male and female (Chambers 2007); but otherwise, giant clams follow the typical bivalve mollusk life cycle. *T. squamosa* reaches sexual maturity at sizes of 6 to 16 cm, which equates to a first year of maturity at approximately four years old (CITES 2004). Giant clam spawning can be seasonal; for example, in the Central Pacific, giant clams can spawn year round but are likely to have better gonad maturation around the new or full moon (Kinch and Teitelbaum 2010). In the Southern Pacific, giant clam spawning patterns are seasonal and clams are likely to spawn in spring and throughout the austral summer months (Kinch and Teitelbaum 2010). Once fertilized, the eggs hatch into free-swimming trochophore larvae for around 8 to 15 days (according to the species and location) before settling on the substrate (Soo and Todd 2014; Kinch and Teitelbaum 2010). During the pediveliger larvae stage (the stage when the larvae is able to crawl using its foot), the larvae crawl on the substrate in search of suitable sites for settlement and metamorphose into early juveniles (or spats) within two weeks of spawning (Soo and Todd 2014).

According to Munro (1993), giant clams are facultative planktotrophs, in that they are essentially planktotrophic (i.e., they feed on plankton) but they can acquire all of the nutrition required for maintenance from their symbiotic algae, *Symbiodinium*.

4.10.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, pollution, and exploitation. The harvest of giant clams is for both subsistence purposes (e.g., giant clam adductor, gonad, muscle, and mantle tissues are all used for food products and local consumption), as well as commercial purposes for global international trade (e.g., giant clam shells are used for a number of items, including jewelry, ornaments, soap dishes). The extent of each of these threats is largely unknown. Blidberg et al. (2000) studied the effect of increasing water temperature on *T. gigas*, *T. derasa*, and *H. hippopus* at a laboratory in the Philippines. *H. hippopus* experienced increased respiration and production of oxygen in elevated temperatures and was therefore more sensitive to higher temperature than the two other species tested. After 24 hours at ambient temperature

plus 3°C, however, no bleaching was observed for any of the species. In a lab experiment, short-term temperature increases of 3 °C resulted in *T. squamosa* maintaining a high photosynthetic rate but displaying increased respiratory demands (Elfwing et al. 2001). Watson et al. (2012) showed that a combination of increased ocean CO_2 and temperature are likely to reduce the survival of *T. squamosa*. Specifically, in a lab experiment, *T. squamosa* juvenile survival rates decreased by up to 80 percent with increasing pCO_2 and decreased with increasing seawater temperature for a range of temperatures and pCO_2 combinations that mimic those expected in the next 50 to 100 years. The susceptibility and impacts of disease on *T. squamosa* are not known, but incidences of mortality from rickettsiales-like organisms in cultured clams in the western Pacific, one in the Philippines and one in Kosrae have been documented (Norton et al. 1993).

4.10.4 Conservation of the Species

T. squamosa is listed in CITES Appendix II, is an ESA candidate species and is therefore a consultation species under the UES.

4.11 Humphead wrasse

In October 2012, NMFS was petitioned to list the humphead wrasse as threatened or endangered under the ESA and to designate critical habitat for the species. In February 2013, in its 90-day finding, NMFS determined that this action may be warranted and initiated a status review to determine whether the species would be officially listed (78 FR 13614 [February 28, 2013]). In September 2014, NMFS determined that ESA listing of the humphead wrasse was not warranted (79 FR 57875 [September 26, 2014]). However, this species remains protected under the UES and is therefore a consultation species.

4.11.1 Distribution and Abundance

The humphead wrasse is widely distributed on coral reefs and nearshore habitats throughout much of the tropical Indo-Pacific Ocean. The biogeographic range of the humphead wrasse spans from 30° N to 23° S latitude and includes the Red Sea south to Mozambique in the Indian Ocean, from southern Japan in the northwest Pacific south to New Caledonia in the south Pacific and into the central Pacific Ocean including French Polynesia. The humphead wrasse has been recorded from many islands of Oceania including Kwajalein Atoll, but appears to be absent from the Hawaiian Islands, Johnston Island, Easter Island, Pitcairn, Rapa, and Lord Howe Island with the exception of occasional waifs (Randall et al. 1978).

Although humphead wrasses are widely distributed, natural densities are typically low, even in locations where habitats are presumably intact. Unfished or lightly fished areas have densities ranging from 2–27 individuals per 10,000 square meters of reef. At sites near human population centers or at fished areas, densities are typically lower by tenfold or more and in some locations humphead wrasse are rarely observed (Sadovy et al. 2003). Total abundance throughout its range is difficult to estimate because survey methods may not cover all habitable areas. Existing information suggests that humphead wrasse populations are most abundant and stable in the Indian Ocean.

The humphead wrasse is known to occur in the vicinity of Illeginni Islet. As was found in other studies (Donaldson and Sadovy 2001), the humphead wrasse appears to occur in low densities throughout the Kwajalein Atoll area in NMFS and USFWS biennial surveys. Occurrence records

of humphead wrasse suggest a broad, but scattered distribution at USAKA with observations of the species at 26% (32 of 125) of sites at 10 of the 11 surveyed islets since 2010. Adult humphead wrasses have been recorded in seaward reef habitats at Illeginni Islet (shallowest depths approximately 5 m deep (USFWS and NMFS 2012; NMFS and USFWS 2018). Although encountered on numerous occasions at USAKA, direct density measures of humphead wrasse have not been obtained. The adults of this species may range very widely, with typically four or fewer individuals observed within a broad spatial reef area (Dr. R. Schroeder pers, comm.). Two neighboring seaward reef flat sites in 2008 were noted to have adult humphead wrasse present (USFWS 2011); thus, a total of 24 adult individuals might be exposed to potential GBSD impacts in this region. Absent a direct physical or sound related impact, the adults might be expected to show temporary curiosity, altered feeding patterns, and/or displacement.

Shallow inshore branching coral areas with bushy macro-algae, such as those which may exist along the shallow lagoon reef flat at Illeginni Islet, have been noted as potential essential nursery habitat for juvenile humphead wrasse (Tupper 2007). Recent settler and juvenile numbers are presumed to greatly exceed 20 in such habitat (Tupper 2007) and might be grossly approximated to range from 0 to 100 within the lagoon-side waters of Illeginni (NMFS 2014a). A direct physical strike from a payload fragment, toppling or scattering of coral habitat and/or reef substrate, increased exposure to predation through displacement, and/or sound impacts may result in mortalities of juvenile humphead wrasse, assuming they are present within the impact area. Otherwise, loss of habitat may lead to simple displacement, but with a longer-term functional loss of nursery potential contingent both spatially and temporarily on habitat recovery potential (NMFS 2014b).

Humphead wrasse have been observed to aggregate at discrete seaward edges of deep slope drop-offs to broadcast spawn in the water column; they do not deposit their eggs on the substrate (Colin 2010). This type of behavior is not known at Illeginni Islet, but it may exist; however, similar habitat would occur in nearby waters. The flow dynamics of developing fish eggs and larvae around Illeginni Islet are not understood. Initial flow may be away from the islet, with future return or larval/adult source dynamics from another area. No information exists to support any reasonable estimation of potential ARRW impacts to humphead wrasse eggs and developing larvae (NMFS 2014a).

4.11.2 Life History Characteristics Affecting Vulnerability to Proposed Action

The humphead wrasse is the largest member of the family Labridae. The humphead wrasse is distinguished from other coral reef fishes, including other wrasses, due primarily to its large size along with its fleshy lips in adults (Myers 1999), prominent bulbous hump that appears on the forehead in larger adults of both sexes, and intricate markings around the eyes (Marshall 1964; Bagnis et al. 1972; Sadovy et al. 2003).

Similar to other wrasses, humphead wrasses forage by turning over or crushing rocks and rubble to reach cryptic organisms (Pogonoski et al. 2002; Sadovy et al. 2003 citing P.S. Lobel, pers. comm.). The thick fleshy lips of the species appear to absorb sea urchin spines, and the pharyngeal teeth easily crush heavy-shelled sea snails in the genera *Trochus* spp. and *Turbo* spp. The humphead wrasse is also one of the few predators of toxic animals such as boxfishes (*Ostraciidae*), sea hares (*Aplysiidae*), and crown-of-thorns starfish (*Acanthaster planci*) (Randall 1978; Myers 1989; Thaman 1998; Sadovy et al. 2003).

Both juveniles and adults utilize reef habitats. Juveniles inhabit denser coral reefs closer to shore and adults live in deeper, more open water at the edges of reefs in channels, channel slopes, and lagoon reef slopes (Donaldson and Sadovy 2001). While there is limited knowledge of their movements, it is believed that adults are largely sedentary over a patch of reef and during certain times of the year they move short distances to congregate at spawning sites (NMFS 2009). Humphead wrasse density increases with hard coral cover, where smaller fish are found in areas with greater hard coral cover (Sadovy et al. 2003).

Field reports reveal variable humphead wrasse spawning behavior, depending on location (Sadovy et al. 2003; Colin 2010). Spawning can occur between several and all months of the year, coinciding with certain phases of the tidal cycle (usually after high tide) and possibly lunar cycle (Sadovy et al. 2003; Colin 2010). Spawning can reportedly occur in small (< 10 individuals) or large (≤ 100 individuals) groupings, which can take place daily in a variety of reef types (Sadovy et al. 2003; Sadovy de Mitcheson et al. 2008; Colin 2010). Based on available information, it is suggested that the typical size of female sexual maturation for the humphead wrasse occurs at 40–50 cm TL (Sadovy de Mitcheson et al. 2010). Choat et al. (2006) estimated length at first maturity as 45–50 cm FL for females (6–7 years) and 70 cm FL (9 years) for males.

4.11.3 Threats to the Species

The ERA team identified four major threats to humphead wrasse: 1) habitat destruction, modification, or curtailment; 2) overutilization for commercial, recreational, scientific or educational purposes; 3) disease or predation; 4) the inadequacy of existing regulatory mechanisms; and 5) natural and other man-made factors. Habitat destruction, overfishing, and inadequacy of existing regulatory mechanisms, and some man-made factors such as pollution are threats locally throughout portions of its range. However, the ERA team concluded that four of the five threats evaluated are not significant risks to extinction. Natural and man-made factors, namely climate change, were noted as a small to moderate effect on species risk of extinction.

4.11.4 Conservation of the Species

Humphead wrasse is listed in CITES Appendix II, and has been retained as a consultation species under the UES.

5 ENVIRONMENTAL BASELINE

The UES does not specifically describe the environmental baseline for a Biological Opinion. However, under the ESA, environmental baselines include the past and present impacts of all state, federal or private actions and other human activities in the Action Area, anticipated impacts of all proposed federal projects in the Action Area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The Consultation Handbook further clarifies that the environmental baseline is “an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the Action Area” (FWS and NMFS 1998). The purpose of describing the environmental baseline in this manner in a biological opinion is to provide context for effects of the proposed action on listed species. We apply the ESA standards consistent with the intent of the UES agreement in our effects analysis. As described in Sections

2 and 3 above, the action area where the proposed action may adversely affect consultation species consists of the marine waters adjacent to Illeginni Islet at Kwajalein Atoll, RMI and in the KMISS area.

The Marshall Islands consist of 29 atolls and five islands aligned in two roughly parallel northwest-southeast chains: the northeastern Ratak Chain and the southwestern Ralik Chain. The total land area is about 70 square miles (mi^2), and the total lagoon area is about 4,500 (mi^2). Kwajalein Atoll is located near the center of the island group, about eight degrees above the equator, and is one of the largest coral reef atolls in the world. The past and present impacts of human and natural factors leading to the status of UES-protected species within the action area include coastal development, armed conflict, direct take, fishing interactions, vessel strikes and groundings, marine debris, and climate change.

Kwajalein Atoll was the site of heavy fighting during World War II (1940s), when the U.S. took it from the Japanese. Many of the islets have been heavily modified by dredge and fill construction operations by both the Japanese and U.S. forces. More recently, the RMI has provided eleven islets around the rim of Kwajalein Atoll for the use by the U.S. Government as part of the RTS. Hundreds of U.S. personnel live on some of the islets, and Marshallese workers commute daily between the U.S. occupied islets and the ones on which they reside. Vessel traffic occurs regularly between the islets, and to and from the atoll. This includes fishing boats, personnel ferries, military service craft, visiting military ships, and cargo vessels that supply the peoples of Kwajalein Atoll. For more than 18 years, the USAKA has participated in testing hypersonic vehicles from ICBM and other flight tests launched from Vandenberg AFB and other locations. Vehicle impacts from such tests have occurred and continue to occur on and in the vicinity of Illeginni Islet and in adjacent ocean waters. In the Opinion on the Minuteman III operations through the year 2030 it was estimated that 49,645 colonies of the 15 species of UES corals and 117 top shell snails may be killed (NMFS 2015).

On May 16, 2005, we issued a letter of concurrence with the USAF's "not likely to adversely affect" determination for sea turtles and marine mammals under our jurisdiction. It is important to note that sea turtles are under the jurisdiction of the FWS while in terrestrial habitats, whereas they are under our jurisdiction when in marine habitats. Therefore, any impacts on hauled-out or nesting adult turtles, eggs in nests, or hatchlings before they reach the water, were considered in the 2005 FWS Opinion, not in our letter of concurrence.

On March 2, 2017, the U.S. Navy SSP consulted with NMFS on the effects of a near identical action, the FE-1. NMFS concluded in a biological opinion dated May 12, 2017 that the FE-1 would not jeopardize 59 marine ESA/UES consultation species." (PIR-2017-10125; I-PI-17-1504-AG). In that opinion, NMFS estimated that the action would result in up to up to 10,417 colonies of UES consultation corals (as quantified in table 7) could experience complete mortality, up to four top shell snails may be killed by the proposed action, and up to 90 clams, and 108 humphead wrasses could be injured or killed by the proposed action. The target site was the exact same as this proposed action and made an impact on land and not in water. No take was quantified for this action.

On February 12, 2019, USASMDC/ARSTRAT, consulted on the Air-launched Rapid Response Weapon (ARRW) Flight Tests NMFS' Biological Opinion was dated July 30, 2019 (PIRO-2019-00639; I-PI-19-1751-AG). This missile test is expected to impact the same islet targeted in this proposed action. As with the FE-1 and FE-2, impact is expected to occur on land, but could

occur in water. In that opinion, NMFS estimated that the action would result in up to 10,417 colonies of UES consultation corals could experience complete mortality, up to four top shell snails may be killed by the proposed action, and up to 90 clams, and 108 humphead wrasses could be injured or killed by the proposed action.

On July 4, 2019, we completed informal consultation on the effects of launching a THAAD missile and subsequent intercept of a medium-range ballistic missile over the Pacific Ocean concluding the operation was not likely to adversely affect 44 species protected under the standards and procedures described in the Environmental Standards and Procedures for U.S. Army Kwajalein Atoll (PIRO-2019-01962; I-PI-19-1769-AG). This test is expected to launch from a neighboring islet within USAKA.

On June 14, 2018, USASMDC/ARSTRAT, on behalf of the U.S. Navy SSP, requested consultation on the effects of launching a single Flight Experiment-2 (FE-2) missile from the PMRF on Hawaii, across the Pacific, and impact at Kwajalein Atoll. NMFS concluded in a Biological Opinion dated September 27, 2019 that the FE-2 would not jeopardize any of the marine ESA/UES consultation species covered under that consultation (PIR-2019-02607; I-PI-19-1782-AG). In that opinion, NMFS estimated that the action would result in up to 10,404 colonies of UES consultation corals (as quantified in Table 10) could experience complete mortality, up to 4 top shell snails, 108 humphead wrasse, and up to 75 clams could be killed by the proposed action. The target site was the exact same as this proposed action and made an impact on land and not in water.

These estimates are likely higher than what the total impacts will be due to the unlikely event of a shoreline impact and the data the estimates were based on. The estimates were based on surveys that have been conducted throughout the area but not in the impact zone. A survey was completed after these estimates were made and some of the corals that were predicted to be in the area were not observed and others were observed at densities lower than what had been estimated (NMFS 2017a). Additional surveys could show that they are indeed in the area but not at higher levels than estimated. Direct take through harvest continues in the RMI for several of the UES consultation species. For example, sea turtles, black lip pearl oysters, and top shell snails (all of which are UES consultation species) are considered a food source or of economic value by many RMI nationals. The harvest of these and other UES-protected marine species is believed to continue on most of the inhabited islands and islets of the RMI, with the possible exception of the USAKA-controlled islets, where access is limited and the UES prohibits those activities. However, the level of exploitation is unknown, and no concerted research or management effort has been made to conserve these species in the RMI. No information is currently available to quantify the level of impact direct take is having on consultation species in the Marshall Islands.

Despite the development, wartime impacts, and human utilization of marine resources mentioned above, the atoll's position at the center of the Pacific Ocean is far from highly industrialized areas, and its human population remains relatively low. Consequently, the water quality level of the lagoon and the surrounding ocean is very high, and the health of the reef communities, along with the overall marine environment of Kwajalein Atoll, borders on pristine.

Climate change may be affecting marine ecosystems at Kwajalein Atoll. Climate refers to average weather conditions within a certain range of variability. The term climate change refers to distinct long-term changes in measures of climate, such as temperature, rainfall, snow, or wind patterns lasting for decades or longer. Climate change may result from: natural factors, such as

changes in the Sun's energy or slow changes in the Earth's orbit around the sun; natural processes within the climate system (e.g., changes in ocean circulation); and human activities that change the atmosphere's makeup (e.g., burning fossil fuels) and the land surface (e.g., cutting down forests, planting trees, building developments in cities and suburbs, etc.), also known as anthropogenic climate change (U.S. Environmental Protection Agency). The global mean temperature has risen 0.76°C over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (Solomon et al. 2007). Sea level rose approximately 17 cm during the 20th century (Solomon et al. 2007) and further increases are expected. Climate change is a global phenomenon so resultant impacts have likely been occurring in the action area. However, scientific data describing impacts in the action area are lacking, and no climate change-related impacts on UES-protected species within the action area have been reported to date.

Climate change-induced elevated water temperatures, altered oceanic chemistry, and rising sea level may be contributing to changes to coral reef ecosystems, and is likely beginning to affect corals and mollusks found in the action area. Globally, climate change is adversely affecting many species of corals. Increasing thermal stress due to rising water temperatures has already had significant effects on most coral reefs around the world. It has been linked to widespread and accelerated bleaching and mass mortalities of corals around the world over the past 25 years (Brainard et al. 2011). As the atmospheric concentration of CO_2 has increased, there has been a corresponding reduction in the pH of ocean waters (acidification). As ocean acidity increases, the calcium carbonate saturation state of the water decreases. Increased ocean acidity has the potential to lower the calcium carbonate saturation state enough to slow calcification in most corals and may increase bioerosion of coral reefs. It is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates for corals, and can induce bleaching more so than thermal stress, and tends to decrease growth and calcification rates (Brainard et al. 2011). By the middle of this century, ocean acidity could lower calcium carbonate saturation to the point where the reefs may begin to dissolve (Brainard et al. 2011).

Attempting to determine whether recent biological trends are causally related to anthropogenic climate change is complicated because non-climatic influences dominate local, short-term biological changes. However, the meta-analyses of 334 species and the global analyses of 1,570 species show highly significant, nonrandom patterns of change in accord with observed climate warming in the twentieth century. In other words, it appears that these trends are being influenced by climate change-related phenomena, rather than being explained by natural variability or other factors (Parmesan and Yohe 2003). However, the implications of these changes are not clear in terms of population level impacts, and data specific to the action area are lacking. Over the long-term, climate change-related impacts could influence the biological trajectories of UES-protected species on a century scale (Parmesan and Yohe 2003). However, due to a lack of scientific data, the specific effects climate change could have on these species in the future are not predictable or quantifiable to any degree that would allow for more detailed analysis in this consultation (Hawkes et al. 2009).

6 EFFECTS OF THE ACTION

In this section of a biological opinion, we assess the probable effects of the proposed action on UES-protected species. In Effects of the Action sections of biological opinions, NMFS presents the results of its assessment of the probable effects of federal actions on threatened and

endangered species and designated critical habitat that are the subject of a consultation. According to 50 CFR 402.02, Effects of the Action "are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. Furthermore, 50 CFR 402.17 defines reasonably certain to occur as "A conclusion of reasonably certain to occur must be based on clear and substantial information, using the best scientific and commercial data available. Factors to consider when evaluating whether activities caused by the proposed action (but not part of the proposed action) or activities reviewed under cumulative effects are reasonably certain to occur include, but are not limited to: (1) past experiences with activities that have resulted from actions that are similar in scope, nature, and magnitude to the proposed action;(2) existing plans for the activity; and (3) any remaining economic, administrative, and legal requirements necessary for the activity to go forward (50 CFR 402.02). The effects of the action are considered within the context of the Status of the Species, together with the Environmental Baseline and Cumulative Effects sections of this Opinion to determine if the proposed action can be expected to have direct or indirect effects on UES-protected species that appreciably reduce their likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (50 CFR 402.02), otherwise known as the jeopardy determination. The actions are not expected to adversely affect any essential features of critical habitat has been designated in the action area.

Approach. We determine the effects of the action using a sequence of steps. The first step identifies potential stressors associated with the proposed action with regard to listed species. We may determine that some potential stressors result in insignificant, discountable, or beneficial effects to listed species, in which case these potential stressors are considered not likely to adversely affect protected species, and subsequently are considered no further in this Opinion. Those stressors that are expected to result in significant negative (i.e., adverse) effects to listed species are analyzed via the second, third, and fourth steps described below.

The second step identifies the magnitude of the stressors (e.g., how many individuals of a particular species would be exposed to the stressors; *exposure analysis*). In this step of our analysis, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to a proposed action's effects, and the populations or subpopulations those individuals represent.

The third step describes how the exposed individuals are likely to respond to the stressors (*response analysis*). In this step, we determine if the stressors are likely to result in any adverse effects on exposed individuals.

The final step in determining the effects of the action is to establish the risks those responses pose to listed resources (*risk analysis*). The risk analysis is different for listed species and designated critical habitat. However, as mentioned above, the action area includes no designated critical habitat, thus it is not considered in this Opinion. Our jeopardy determinations must be based on an action's effects on the continued existence of UES-protected species within USAKA. Because the continued existence of listed species depends on the fate of the populations that comprise them, the viability (probability of extinction or probability of persistence) of listed species depends on the viability of their populations.

6.1 Stressors

As described above in Section 3, we believe that the proposed action would cause six stressors that may affect the consultation species considered in this consultation: exposure to elevated noise levels; direct contact from payload impact/shockwaves; exposure to hazardous materials; disturbance from human activity and equipment operation; collision with vessels; and long-term additions of man-made objects in the ocean. Of those stressors, direct contact from payload impact/shockwaves, is the only stressor that is likely to adversely affect consultation species. The remaining stressors are expected to have insignificant effects (i.e. effects would not result in take) and/or exposure is discountable (extremely unlikely to occur), and those stressors are discussed no further in this Opinion. Similarly, Section 3 described why all of the species identified in Table 1 are unlikely to be adversely affected, and therefore considered no further in this Opinion. In summary, the seven coral species, top shell snail, and two giant clams, and the humphead wrasse identified in Table 2 may be hit by the falling payload or by ejecta, or be significantly affected by concussive forces during the planned payload impacts (up to three) on Illeginni Islet.

Note: Within the seven coral species that may be adversely affected by the proposed action, the effects are expected to be practically identical. Addressing the species individually would significantly increase the length of this Opinion with no discernible improvement in the evaluation. Therefore, all seven coral species are referred to together as "corals", unless an individual species needs to be identified due to some unique sensitivity or response. The same is true for the two clam species.

6.2 Exposure to Impact by GBSD Reentry Vehicles

This section analyzes the proposed action's potential for exposing UES-consultation corals, giant clams, and top shell snails to being hit by up to three GBSD payload or ejecta thereof planned to strike on Illeginni Islet. This analysis is based on the distribution and density report completed for the MM III proposed action, the follow-up survey post action, and on personal communication with the survey team (NMFS 2014b, NMFS 2017a, Kolinski pers. comm. 2015), and the FE-2 flight test (SSP 2019). We believe that the distribution and density report likely over-estimates the number of coral and mollusk species that may be within the action area at Illeginni, but that it represents the best available information to make those estimates.

The quantitative estimates of species distribution and abundance within the potentially affected areas at Illeginni are based on surveys of 136 sites around the 11 USAKA islets, including four sites around Illeginni (NMFS 2014b). Species observed to occur on reef flat, crest, and gently sloping substrates around USAKA islets at depths less than or equal to 35 feet water depth were considered as potentially being present within the MMIII, FE-1, THAAD, and FE-2 impact area and hence the GBSD payload impact area. Because the available survey information also includes the observed distribution and abundance of the affected consultation species in numerous habitat types around the 11 USAKA islets and at 35 survey sites throughout the mid-atoll corridor (MAC), we believe that the existing information also serves as a reasonable foundation to estimate the distribution and abundance of these organisms throughout USAKA. Analyses of effect of MMIII reentry vehicle (USAFGSC and USASMDC/ARSTRAT 2015), FE-1 (U.S. Navy 2017), and FE-2 (U.S. Navy 2019) payload impacts at Illeginni Islet were conducted based on coral, mollusk, and fish densities extrapolated from coral presence and abundance from similar reef habitats throughout USAKA. In 2017, NMFS completed a report

with revised density estimates for many consultation species based on 2014 assessments of the reefs adjacent to the impact area at Illeginni Islet (NMFS-PIRO 2017a and 2017b). The areas surveyed for this assessment encompassed all of the Affect Area reef habitat on the lagoon side and 99% of the reef area on the ocean side (NMFS 2017a and 2017b). Additionally, NMFS conducted a survey within USAKA at two launch sites in 2018 to provide data for the THAAD operation (NMFS 2018). Based on coverage area of this assessment, these data are considered the best available information for coral and mollusk species presence and density in the affect area.

The humphead wrasse (*Cheilinus undulatus*) was not observed during the 2014 surveys for the most recent assessment of consultation organisms at Illeginni Islet (NMFS 2017a); however, this species has been recorded in both ocean-side and lagoon-side habitats adjacent to the impact area in other surveys. Since the humphead wrasse is a highly mobile species, the extrapolation methods for estimating density which were previously used for impact analysis are still considered the best available data for a conservative approach. Therefore, humphead wrasse densities were estimated by NMFS PIRO based on quantitative data collected during the 2008 species inventory, recent impact assessments on natural substrates at USAKA and, for egg and fish recruit derivations, from the literature (NMFS 2014b). *Cheilinus undulatus* typically occurs in broadly distributed low numbers and has been seen near Illeginni islet. It was estimated for the similar FE-2 single payload impact that eight adults may occur within the entire potential ocean-side affected area, and 0-100 juveniles could occur within the entire potential lagoon-side affected area. The same assumptions would be made for this consultation for each possible test, where it was discussed in Section 2 that up to three payload impacts could occur at Illeginni Islet. Therefore, we would estimate that up to 24 adults and 300 juveniles could be adversely affected (for up to the three anticipated payload impacts at Illeginni, with the assumption that each test could impact a different area each time).

There is a chance that the GBSD payloads could strike the water's edge along the lagoon or ocean shore at Illeginni. Empirical observations of historical reentry vehicle impacts from MMIII tests in very shallow waters found that most debris was contained within the crater and ejecta were concentrated within 1.5 to 3 m of the crater rim (USAFGSC and USASMDC/ARSTRAT 2015). As with MMIII reentry vehicles, FE-1, FE-2, or THAAD tests, we estimate that the payload land impacts may produce ejecta and debris concentrated near the impact site and extending outward to 91 m. Empirical evidence from MMIII tests corroborates predictions of the propagation of shock waves associated with impact were approximately 37.5 m through the adjacent reef from the point of impact on the shoreline (USAFGSC and USASMDC/ARSTRAT 2015). Coral, and mollusk mortality or injury could occur from impacts by shock/vibration. These reef impacts were based on observations of damaged corals, which can be affected by ground borne vibration.

Habitat suitability for consultation species is lowest along the water's edge and with the exception of sandy patches, typically increases with distance from shore. Only a portion of the area of potential direct contact effect offshore of the Illeginni Islet impact area is suitable habitat for consultation species. Based on the 2014 NMFS surveys of the area offshore of the RV land impact zone and the best professional judgment of NMFS survey divers, approximately 80 percent of the lagoon-side survey area and 75 percent of the ocean-side survey area are considered potentially viable habitat for consultation coral, mollusk, and reef-associated fish species (Figure 8) (NMFS 2019). Using these estimates of suitable habitat and assuming the

ejecta would be on only one side of the islet for a given test (i.e., either on the lagoon or ocean sides of the islet); the area of lagoon- side and ocean-side suitable habitat which may be impacted by debris was calculated. Using these percentages of suitable habitat likely results in an overestimate of the area of potential effect because habitat suitability for consultation species is lowest along the water's edge (where debris is more likely to occur) and with the exception of sandy patches, typically increases with distance from shore (NMFS 2019).

Figure 8. NMFS 2014 Marine Resource Survey Areas at Illeginni Islet, Kwajalein Atoll (provided by U.S. Army).

It is reasonable to assume that the effects of debris fall and shock waves would not occur evenly across an entire area of potentially viable habitat. Thus, the actual habitat area that would be

affected is considered to be a proportion of the total estimated viable habitat. Since there are no data available to identify this unknown proportion or the actual amount of viable habitat that would be affected by debris fall or shock waves, these analyses should be regarded as an overestimate and those of maximum effect.

Also, the area within the shockwave range of effect would be completely contained within the area at risk for ejecta impacts. The anticipated worst-case scenario of a payload land impact at Illeginni islet is a shoreline strike, which would result effects that would extend outward from the point of strike. On both sides of Illeginni Islet, the area may potentially be affected debris fall. Since these areas overlap and since harmed individuals should be counted only once in the effects of the Action, the affected habitat area with the largest estimated take was selected as the worst-case scenario. Although the exact shape of the affect area is impossible to estimate, the seaward portion of such an area is conceptually illustrated as a rough semi-circle on the lagoon and ocean sides of Illeginni Islet with a radius of 91 m (Figure 9).

Figure 9. Representative Maximum Direct Contact Affect Areas for a Shoreline Payload Impact at Illeginni Islet, Kwajalein Atoll.

If the worst- case scenario of a shoreline RV impact is considered, coral colonies might be exposed to shock waves. As discussed above, habitat suitability for consultation species is lowest along the water's edge (where shock waves would be most intense) and typically increases with distance from shore (NMFS 2019). If shock waves strong enough to damage corals might extend out 37.5 m from impact, shock waves might occur in approximately 2,209 m^2 (2,642 yd^2) of nearshore marine areas. In the event of a shoreline RV impact, it is likely that some coral

colonies would be affected, but the most likely realized effects would be cracks in the colony or broken branches or plates. As discussed for direct contact above, fracturing or broken branches would injure the soft tissue near the break but affecting some polyps of a colony does not necessarily constitute harm to the individual as the colony can continue to exist even if the colony is damaged.

Since the maximum debris exposure and potential shock wave exposure areas overlap and since harmed individuals should be counted only once in determining the effects of the Proposed Action, the effects on nearshore coral species were calculated based on the potential debris exposure area.

The estimated total number of colonies or individuals exposed for all three tests with land RV impact was calculated based on the 99% upper confidence level of the bootstrap mean densities for the potentially affected colonies or individuals exposed during a single test multiplied by three (Table 7). The number of colonies or individuals were based on a 2014 assessment of the reef areas offshore of the Illeginni Islet Impact Zone (NMFS-PIRO 2017a and 2017b). Coral colony, individual mollusk mean densities and 99% upper confidence level (UCL) were provided by NMFS-PIRO (2017a and 2017b). If it is assumed that each potential test involving land impacts would have a shoreline impact (a worst-case scenario) and assuming each test would expose different marine areas to debris, an estimated 31,224 UES-consultation coral colonies and 228 individual mollusks might be exposed to direct contact from debris from a total of three anticipated payload impacts based on mean densities in the area.

Table 7. Estimated numbers of consultation coral colonies, and individual mollusks and fish in affected habitat from three anticipated payload impacts.

Scientific Name	**Species**	**Colonies or Individuals Affected**
	Corals	
Acropora microclados	No Common Name	51
A. polystoma	No Common Name	51
Cyphastrea agassizi	No Common Name	42
Heliopora coerulea	No Common Name	14,049
Pavona venosa	No Common Name	42
Turbinaria reniformis	No Common Name	42
Pocillopora meandrina	Cauliflower coral	16,947
	Mollusks	
Tectus niloticus	Top Shell Snail	9
Hippopus hippopus	Giant clam	186
Tridacna squamosa	Giant clam	33

Scientific Name	Species	Colonies or Individuals Affected
	Fish	
Cheilinus undulates	Humphead wrasse	324 (24 adults/300 juveniles)

6.3 Response to Falling Missile Components

This section analyzes the responses of UES-consultation corals, top shell snails, giant clams, and humphead wrasse that may be exposed to being hit by the GBSD payloads and/or ejecta.

The GBSD payloads would be traveling at hypersonic velocity when it impacts the islet. The kinetic energy released into the substrate would be similar to the detonation of high explosives. The payload will effectively "explode", with some of its mass reduced to very fine particles ("aerosolized") and the remainder reduced to an undescribed range of fragment sizes. The substrate at the impact site would be blasted into a range of fragment sizes ranging from powder to larger rocks toward the outer edges of the crater. Some debris and substrate rubble would remain in the crater. The remainder would be thrown from the crater (ejecta). Initially, some of the ejecta would be moving at high velocity (bullet speeds). Some ejecta would move laterally, some would travel upward then fall back down up to 91 m from the impact site. The substrate immediately around the crater would be covered by larger chunks of ejecta from the outer edges of the crater as well as finer material that was thrown more vertically before falling back down. The movement of ejecta away from the crater would act to spread it out (scatter) over an increasing area, with decreasing available material being scattered over an increasing area. The velocity of the ejecta would also diminish with distance.

The intensity of the payload impact, and the uniformity of exposure to ejecta and the shockwave would decrease with distance from the point of impact. Any corals and top shell snails directly beneath the payload, or within the crater radius are expected to be instantly killed, with very little left of the organisms that would be recognizable. Beyond the crater, corals and top shell snails would be exposed to ejecta and the ground borne shockwave. Corals and top shell snails immediately beyond the crater would likely experience mortality from impact by high-velocity ejecta, from burial under mobilized crater material, or from exposure to the ground borne shockwave.

The response of corals to ejecta and the ground borne shockwave would depend largely on the scale and intensity of the exposure as well as the morphology of the coral. Impact by high-velocity dense ejecta (rock or metal), could fracture the hard structure of corals and would likely injure or destroy soft tissues. Fracturing would depend largely on the size and intensity of the impact and on morphology of the impacted coral. Plate-forming and branching corals are more easily broken than large massive or encrusting forms. Fractures due to payload impact are expected to range from pulverization of colonies in and close to the crater, to cracks and/or loss of branches in colonies toward the outer edge of effect. Additionally, exposure to the ground based shockwave could also fracture or dislodge coral colonies out to about 37.5 m from the payload impact. Because the coral skeletons are hard rock-like structures that are rigidly fixed to the hard substrate through which the shock wave would travel, much of the available energy in the substrate can be transferred directly into the coral's skeletal structure. If the shockwave is

intense enough, the coral's structure may crack or fracture and/or it may become unattached from the substrate. At close ranges, impact by lower velocity and/or lower density ejecta could affect the soft tissues of corals, ranging from burial to scouring away all or most of the living polyps and interconnecting soft tissues from a colony. At greater ranges, localized damage of a small part of a colony is possible.

Pulverization of a colony's structure, deep burial, or loss of a large proportion of a colony's soft tissue would likely result in the mortality of the colony. Partial fracturing of a coral skeleton and/or dislodgement of a coral from the substrate due to ejecta impact or from exposure to the ground based shock wave would injure the soft tissues at and around the break. Re-growth of soft tissues has energetic costs that could slow other growth and reproduction. Exposed areas of coral skeleton are prone to bioerosion and overgrowth by algae and certain sponges. Large areas of damaged or dead tissue could result in the introduction of algae that may prevent the regeneration of healthy coral tissue, or that may overcome the whole colony. Damaged and stressed tissues may also be more susceptible to infection by coral diseases that may hinder or prevent healing to the point that the colony dies.

Fragmentation is a form of asexual reproduction in some branching corals, resulting in the development of new, but genetically identical colonies. Bothwell (1981) reports that several *Acropora* species successfully colonize through fragmentation and translocation of fragments by storm-driven waves. However, not all coral fragments, or dislodged colonies would be expected to survive. Survival would depend largely on where a fragment falls and how it is oriented after it settles to substrate. A fragment or colony is likely to die if the living tissue is on the underside of the fragment or if the fragment settles into fine sediments. Additionally, in areas that experience regular high surf, such as the ocean side reef at Illeginni, loose coral fragments and colonies could repeatedly become mobilized by the waves. This reduces the likelihood of their survival, and potentially injures additional coral colonies should the fragments be cast against them.

Based on the available information, we believe that the numbers of coral colonies, identified above in Table 7, represent a conservative yet reasonable estimate of the corals that may be adversely affected by the proposed action. Further, this Opinion conservatively assumes that mortality would result for all exposed coral colonies. This approach is being taken to ensure a precautionary assessment is made of the jeopardy risk for the affected species.

In the case of the top shell snail, the effects of exposure to ejecta and shockwave is expected to quickly diminish to insignificance with distance from the payload impact site. Impact by high-velocity dense ejecta (rock or metal) immediately around the crater could penetrate or fracture an exposed snail's shell, either killing the animal directly, or leaving it vulnerable to predation. Conversely, with movement away from the payload impact site, ejecta would become slower, and the ejecta would have to penetrate increasing water depth to impact the snails. Considering the conical shape and thickness of a top shell snail's shell, most ejecta that may strike one that is under water and at any distance from the payload impact site is likely to be deflected without imparting a significant proportion of its kinetic energy to the shell or the animal within.

Top shell snails immediately around the payload crater may also be buried by ejecta. The potential for burial, and the depth of the material under which a snail may be buried would likely decrease quickly with distance from the payload impact site. Mortality could result if the snail is

crushed, smothered, or permanently pinned beneath rubble. Non-lethal effects could include energetic costs and/or foraging impacts.

Exposure to intense ground borne shockwaves could injure the soft tissues of top shell snails. Mortality of the snail is possible if the injury is significant enough. The range to the onset of significant injuries for top shell snails exposed to a ground based payload impact shockwave is unknown, but it is likely much less than that estimated for corals (37.5 m). Top shell snails are not rigidly attached to the substrate as are corals. Instead, they adhere to the reef using a muscular foot. Whereas rigidly attached corals would be directly linked to the substrate such that the energy could readily travel into and along its skeletal structure, the muscular foot of the snail would act to isolate the snail's shell from the vibration, and to reduce the transfer of the energy to other soft tissues and organs. Non-lethal effects could include bruising of the foot and other tissues, which may have energetic costs and/or may have reproductive impacts.

As stated above, habitat suitability for the consultation species is lowest along the water's edge and typically increases with distance from shore. Therefore, top shell snail density would be lowest in the area immediately adjacent to the payload impact site, where ejecta effects and shockwave would be greatest. Conversely, in the areas where top shell snail density would be highest, ejecta would be slower, and it would have to penetrate several feet of water to impact the snails. Based on this, on the robust nature of snails (see Section 4), and the characteristics of its shell, most ejecta that may strike top shell snails is likely to be deflected without imparting any significant proportion of its kinetic energy to the shell or the animal within. In this situation, ejecta impact would result in little more than inducing the affected snail to briefly adhere more tightly to the substrate before resuming normal behaviors. The range to adverse effects from burial and shockwaves would likely be similarly restricted to the area along the water's edge. Therefore, we expect that the nine top shell snails that may be exposed to the combined effects of three payload land strikes (Table 7, above), would be adversely affected by the exposure. Further, this Opinion conservatively assumes that mortality would result for all exposed top shell snails. This approach is being taken to ensure a precautionary assessment is made of the jeopardy risk for the affected species.

In the case of the clams, the effects of exposure to ejecta and shockwave is expected to quickly diminish to insignificance with distance from the payload impact site. Impact by high-velocity dense ejecta (rock or metal) immediately around the crater could penetrate or fracture an exposed clam shell, or damage soft tissue that is exposed possibly killing the animal. Conversely, with movement away from the payload impact site, ejecta would become slower, and the ejecta would have to penetrate increasing water depth to impact the clams. Considering the thickness of a clam shell, most ejecta that may strike one that is under water and at any distance from the payload impact site is likely to be deflected without imparting a significant proportion of its kinetic energy to the shell or the animal within unless it is able to lodge itself in the shell opening.

Clams immediately around the payload crater may also be buried by ejecta. The potential for burial, and the depth of the material under which a clam may be buried would likely decrease quickly with distance from the payload impact site. Mortality could result if the clam is crushed, smothered, or permanently pinned beneath rubble. Non-lethal effects could include feeding impacts if the clam is unable to filter feed due to debris.

Exposure to intense ground borne shockwaves could injure the soft tissues of clams. Mortality is possible if the injury is significant enough. The range to the onset of significant injuries for

clams exposed to a ground based payload impact shockwave is unknown. Clams can be buried in substrate or attached to corals which means they would be directly linked to the substrate such that the energy could readily travel into the shell and affect the soft tissue and organs. Non-lethal effects could include bruising of the tissues, which may have energetic costs and/or may have reproductive impacts.

As stated above, habitat suitability for the consultation species is lowest along the water's edge and typically increases with distance from shore. Therefore, clam density would be lowest in the area immediately adjacent to the payload impact site, where ejecta effects and shockwave would be greatest. Conversely, in the areas where clam density would be highest, ejecta would be slower, and it would have to penetrate several feet of water to impact the clams. Based on this, on the robust nature of clams, and the characteristics of its shell, most ejecta that may strike clams is likely to be deflected without imparting any significant proportion of its kinetic energy to the shell or the animal within. In this situation, ejecta impact would result in little more than inducing the affected clam to close before resuming normal behaviors. The range to adverse effects from burial and shockwaves would likely be similarly restricted to the area along the water's edge. Therefore, we expect that 219 clams that may be exposed to the combined effects of a payload land strike (Table 7, above), would be adversely affected by the exposure. As described above, this number is based on the worst-case scenario and under the assumption that the three tests could impact a different area every time and result in mortality. This approach is being taken to ensure a precautionary assessment is made of the jeopardy risk for the affected species.

In the case of the humphead wrasse, it is estimated that there will be up to 300 juvenile, and 24 adult humphead wrasses in the area of impact (worst case scenario expecting mortality from each test). An individual animal could be exposed to ejecta hitting and traveling through the water and from the shock wave produced from the main projectile's impact. An animal subjected to a direct impact, concussive shock waves from the impact, ejecta, or a near miss of ejecta would result in wounding or death. Potential injuries may include cuts, gashes, bruises, broken bones, rupture or hemorrhage of internal organs, amputation, or other broken body parts; any of which could result in an animal's death. Since the arcs (the affected area on the lagoon and the affected area on the ocean) were drawn and estimated based on shoreline strikes on each side, the model assumes mishits on every test, which is highly unlikely to occur. Furthermore, it assumes that ejecta will uniformly spread, especially to the outer extents of those circles (~100 m away). Humphead wrasses were observed beyond the reef crest near the edges of those arcs. As mentioned in previous sections, the USASMDC/ARSTRAT observed the majority of ejecta stayed within a few meters of the impact area. The density of ejecta is expected to decrease with distance from the point of impact (USAFGSC and USASMDC/ARSTRAT 2015). Ejecta is also likely to lose velocity the further it travels from the source. The depth of the water in the 91 m radius is expected to be less than 3 m. Humphead wrasses are generally not surface-dwelling fish where they would be the most vulnerable to strikes. Graham et al. (2015) reports that humphead wrasse are most often encountered on outer reef slopes and reef passes/channels at depths of only a few meters to at least 60 m (Randall 1978); other reports document humphead wrasses to depths of up to 100 m (Russell 2004; Zgliczynski et al. 2013). Graham et al. (2015) further notes at that personal observations from NMFS biologists familiar with the species, documented observations on deep dives and that the species was caught at depths greater than 100 m and up to approximately 180 m by deep gillnet (G. Davis pers. comm. as cited in Graham et al. 2015). On impact, the parts of the payload and substrate will explode into numerous pieces from

“aerosolized” bits to mid-sized rocks. The largest sized ejecta is likely to travel through the air slower than smaller and lighter pieces, and fall closer to the source. When ejecta hits the water, it slows down quickly before falling to the reef or substrate. Furthermore, ocean conditions are dynamic in the nearshore (i.e. waves, currents, etc.) and projectiles would lose the majority of their energy within a few inches of the surface. Humphead wrasse, even juveniles, are large and mobile and will likely flee from falling debris as it hits the water.

6.4 Risk

This section analyzes the risk posed by the proposed action for populations of UES-protected marine species at USAKA due to exposure to direct impact and removal from the water as described above. Because this Opinion assumes mortality for all exposed individuals, regardless of the stressor, the risk assessment below focuses on the species impacts from the direct impact.

6.4.1 Risk for coral populations due to expected levels of action-related mortality

As described in the exposure analyses above, up to 31,224 colonies of seven UES-consultation coral species (Table 7) could experience mortality from the payload strikes on Illeginni Islet. This would be due to the combined exposure to direct payload impact, ejecta, and ground based shockwaves. This represents the maximum possible impact associated with this action.

Based on the best information available, we believe that these corals are all widely distributed around the atoll, and that the potentially impacted area represents a very small fraction (not currently quantifiable) of coral-occupied habitat at Illeginni, and likely below 1% of coral-occupied habitat at USAKA. As described above, we further believe that the distribution and abundance of these coral species in similar habitat areas outside of the potentially impacted zones would be similar to their estimated distribution and abundance within the impacted zones, and as such, these 31,224 colonies likely represent a tiny fraction of their species found at Illeginni and across USAKA. Therefore, based on the best available information, we consider the risk negligible that project-related effects from direct payload impact, ejecta, and ground based shockwave would eliminate any of these species at USAKA, or appreciably reduce the likelihood of their survival and recovery at USAKA and across their global range.

6.4.2 Risk for top shell snails due to expected levels of action-related mortality

As described in the exposure and response analyses above, we expect up to nine top shell snails could experience mortality as the result of the planned direct payload impacts, ejecta, and ground based shockwaves. We believe that top shell snails are widely distributed at all of the USAKA islets around the atoll, and that the potentially impacted area represents a very small fraction (not currently quantifiable) of top shell snail-occupied habitat at Illeginni, and likely below 1% of top shell snail-occupied habitat at USAKA. As described above, we further believe that the distribution and abundance of these mollusks in similar habitat areas outside of the potentially impacted zones would be similar to their estimated distribution and abundance within the impacted zones, and as such, these nine top shell snails likely represent a tiny fraction of their species found at Illeginni and across USAKA, and their loss would be virtually indistinguishable from natural mortality levels in the region. Therefore, based on the best available information, we consider the risk negligible that the effects of direct payload impacts, ejecta, and ground

based shockwaves would eliminate this species at USAKA, or appreciably reduce the likelihood of its survival and recovery at USAKA and across their global range.

6.4.3 Risk for clams due to expected levels of action-related mortality

As described in the exposure and response analyses above, we expect up to 186 *H. hippopus* and 33 *T. squamosa* clams could experience mortality as the result of the planned direct payload impacts, ejecta, and ground based shockwaves. We believe that both species of clams are widely distributed at all of the USAKA islets around the atoll, and that the potentially impacted area represents a very small fraction (not currently quantifiable) of clam-occupied habitat at Illeginni, and likely below 1% of clam-occupied habitat at USAKA. As described above, we further believe that the distribution and abundance of these mollusks in similar habitat areas outside of the potentially impacted zones would be similar to their estimated distribution and abundance within the impacted zones, and as such, these 219 clams likely represent a tiny fraction of their species found at Illeginni and across USAKA, and their loss would be virtually indistinguishable from natural mortality levels in the region. Therefore, based on the best available information, we consider the risk negligible that the effects of direct payload impacts, ejecta, and ground based shockwaves would eliminate this species at USAKA, or appreciably reduce the likelihood of its survival and recovery at USAKA and across their global range.

6.4.4 Risk for humphead wrasses due to expected levels of action-related mortality

As described in the exposure and response analyses above, we expect up to 324 humphead wrasses could experience mortality as the result of direct payload impacts from all four payload strikes, ejecta, and ground-based shockwave, but more likely minor injury if any, will occur. We believe that humphead wrasse are widely distributed at all of the USAKA islets around the atoll, and that the potentially impacted area represents a very small fraction (not currently quantifiable) of habitat at Illeginni, and likely below 1% of humphead wrasse-occupied habitat at USAKA. As described above, we further believe that the distribution and abundance of these fish in similar habitat areas outside of the potentially impacted zones would be similar to their estimated distribution and abundance within the impacted zones, and as such, these 324 humphead wrasse likely represent a tiny fraction of their species found at Illeginni and across USAKA, and their loss would be virtually indistinguishable from natural mortality levels in the region. Therefore, based on the best available information, we consider the risk negligible that the effects of direct payload impact, ejecta, and ground-based shockwave would eliminate this species at USAKA, or appreciably reduce the likelihood of its survival and recovery at USAKA and across their global range.

7 CUMULATIVE EFFECTS

The UES does not specifically describe “cumulative effects” for a biological opinion. However, Section 161 of the Compact provides that for U.S. Government activities requiring the preparation of an environmental impact statement (EIS) under NEPA, the U.S. Government shall comply with environmental standards that protect public health and safety and the environment that are comparable to the U.S. environmental statutes, including the Endangered Species Act. Although not all USAKA actions that require formal consultation also require the preparation of an EIS, such as this action, we analyze cumulative effects in all USAKA consultations as that

term is defined in the ESA implementing regulations. Cumulative effects, as defined in the ESA, are limited to the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion (50 CFR 402.02). These effects do not include the continuation of actions described under the Environmental Baseline, and future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

The impacts of RMI coastal development, fisheries interactions, vessel groundings, direct take, marine debris, and global climate change are not only expected to continue, they are likely to intensify over time. The intensification of those impacts is expected to cause cumulative effects on UES-protected marine species at USAKA. Continued growth of the human population at Kwajalein Atoll would likely result in increased coastal development, fishing pressure, vessel traffic, and pollution of the marine environment.

Anthropogenic release of CO_2 and other greenhouse gases is considered the largest contributor to global climate change, and it is expected that the release of those gases is not only likely to continue, but the rate of their release is expected to increase during the next century (Brainard et al. 2011). Therefore, global climate change is expected to continue to impact UES-protected marine species and their habitats, especially on those species that are dependent on shallow coastal reefs and shorelines, such corals and marine mollusks.

There is uncertainty associated with the analysis of potential impacts of climate change on species and ecosystems (Barnett 2001). Effects of climate change will not be globally uniform (Walther et al. 2002) and information regarding the magnitude of future climate change is speculative and fraught with uncertainties (Nicholls and Mimura 1998). In particular, there is no comprehensive assessment of the potential impacts of climate change within the action area or specific to UES-protected marine species. In addition to the uncertainty of the rate, magnitude, and distribution of future climate change and its associated impacts on temporal and spatial scales, the adaptability of species and ecosystems are also unknown. Impact assessment models that include adaptation often base assumptions (about when, how, and to what conditions adaptations might occur) on theoretical principles, inference from observed observations, and arbitrary selection, speculation, or hypothesis (see review in Smit et al. 2000). Impacts of climate change and hence its ‘seriousness’ can be modified by adaptations of various kinds (Tol et al. 1998). Ecological systems evolve in an ongoing fashion in response to stimuli of all kinds, including climatic stimuli (Smit et al. 2000).

The effects of global climate change, the most significant of which for corals are the combined direct and indirect effects of rising sea surface temperatures and ocean acidification, are currently affecting corals on a global scale, particularly in parts of the Caribbean. The return frequency of thermal stress-induced bleaching events has exceeded the ability of many reefs and coral species to recover there. Brainard et al. (2011) report that those effects likely represent the greatest risk of extinction to ESA-candidate corals over the next century. Field observation and models both predict increasing frequency and severity of bleaching events, causing greater coral mortality and allowing less time to recover between events. However, predicting how global climate change may impact particular species remains poorly understood, especially in understudied areas such as USAKA.

The effects of global climate change could act synergistically on corals affected by the proposed action. The ability of impacted corals to respond to the effects of the proposed action could be

reduced due to the effects of elevated temperatures and increased ocean acidity, and the longer it takes for impacted corals to recover from the effects of the proposed action, the more likely it becomes that the effects of climate change would synergistically impact those corals. However, the degree to which those synergistic impacts may affect corals over the time required for them to recover from project impacts is unknown.

The effects of global climate change could also act synergistically on mollusks affected by the proposed action. However, no specific information is currently available to assess the impacts. Changes in ocean temperature and chemistry, and rising sea level may be affecting these species because they depend on an exoskeleton that is comprised primarily of calcium carbonate. We expect that minimally, increased acidity could have effects that parallel those described for corals above.

Given the small area and low numbers of individuals expected to be adversely affected by the proposed action, the possible synergistic impacts of climate change combined with the effects of the proposed action are not expected to be significant for the corals, mollusks, and fish considered in this Opinion.

8 INTEGRATION AND SYNTHESIS OF EFFECTS

The purpose of this Opinion is to determine if the proposed action is likely to jeopardize the continued existence of UES-protected marine species at USAKA. “Jeopardize the continued existence of” means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a UES-protected marine species at USAKA by reducing the reproduction, numbers, or distribution of that species. This Opinion considers the Effects of the Action within the context of the Status of the Species, the Environmental Baseline, and Cumulative Effects as described in Section 7 under “Approach”.

We determine if reduction in fitness to individuals of marine consultation species that may result from the proposed action are sufficient to reduce the viability of the populations those individuals represent (measured using changes in the populations’ abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures to make inferences about the risk of reducing the likelihood of survival and recovery of UES-protected species). In order to make that determination, we use the population’s base condition (established in the Status of Listed Species and Environmental Baseline sections of this Opinion), considered together with Cumulative Effects, as the context for the overall effects of the action on the affected populations at USAKA. The following discussion summarizes the probable risks the proposed action poses to corals, top shell snails, giant clams, and the humphead wrasse identified in Section 6.

8.1 Corals

As described in the Effects of the Action section, a total of up to 31,224 colonies of UES-consultation corals (seven species) could be killed through some combination of exposure to direct payload impact, ejecta, and ground based shock wave. Over 99% of the colonies are from two highly abundant and widely distributed species within USAKA; *P. meandrina* and *H. coerulea*.

As discussed in the Status of Listed Species, abundance and trend data are lacking for these corals at USAKA. However, they are all widely distributed around the atoll, with four of the seven corals being known to occur at all USAKA islets. Others are known to occur on at least half of the USAKA islets. All seven species have also been observed at survey sites in the MAC, with three found at over 30 of the 35 sites. It is important to recognize that survey data for USAKA is far from complete. Only a small portion of the total reef area around the USAKA islets and MAC has been surveyed, and surveys to specifically identify and quantify these species are yet to be done. A recent survey was completed at Illeginni Islet in the MM III reef impact area, which is also the area that has been analyzed for impacts from the ARRW payload and the results suggest that the estimate for corals in the area may be lower than what has been estimated (NMFS 2017a). Additionally, NMFS conducted a survey in 2018 at two launch sites in preparation of the THAAD test (NMFS 2018).

As discussed more fully in the Environmental Baseline and Cumulative Effects sections, the effects of continued flight testing, fisheries interactions, direct take, and climate change are expected to continue and likely worsen in the future for these corals. Although many actions at USAKA beyond what are described in the Environmental Baseline and Cumulative Effects sections are uncertain, we do have expected estimates (worst-case scenarios) for the actions described above in those sections, and we acknowledge that there are other federal actions occurring in the Atoll (previous, ongoing and known future actions) impacting these species. For example, the FE-1 testing will remove up to 10,417 coral colonies, the ARRW testing will remove up to 10,417 colonies, and the FE-2 testing will remove up to 10,404 colonies (for a total of up to 31,238 colonies cumulatively). PRD has considered the action's impacts with the other threats incurring on the species, and even with the worst-case scenario (loss of individuals due to this action) added to other losses discussed in the Environmental Baseline and Cumulative Effects sections, we do not expect these actions to result in appreciable reduction of the species.

The proposed action is anticipated to result in the mortality of up to 31,224 coral colonies at Illeginni Islet. These coral colonies represent an extremely small fraction of the total number of colonies found at Illeginni, and even less around USAKA. In the context of this action, the potential loss of these coral colonies is not expected to significantly impact reproduction or to impede the recovery of their species across USAKA and the MAC. Therefore, when taken in context with the status of these species, the environmental baseline, cumulative impacts and effects, the proposed action is not likely to eliminate any of the seven UES consultation corals considered in this Opinion from Illeginni, or appreciably reduce the likelihood of their survival and recovery across USAKA including the MAC.

8.2 Top Shell Snail

As described in the Effects of the Action section, a total of up to nine top shell snails could be killed through some combination of exposure to direct payload impact, ejecta, and ground based shock wave.

As discussed in the Status of Listed Species, top shell snails have been reported at all of the 11 USAKA islets as well as at 59 of 103 survey sites throughout Kwajalein Atoll including all four survey sites on Illeginni. It is important to recognize that survey data for USAKA is far from complete. Only a small portion of the total reef area around the USAKA islets has been surveyed, and surveys to specifically identify and quantify this species are yet to be done. As

such, it is possible that the distribution and abundance of top shell snails at USAKA is higher than the current information can confirm.

As discussed more fully in the Environmental Baseline and Cumulative Effects sections, the effects of continued flight testing, coastal development, direct take, and climate change are expected to continue and likely worsen in the future for this species. Although many actions at USAKA beyond what are described in the Environmental Baseline and Cumulative Effects sections are uncertain, we do have expected estimates (worst-case scenarios) for the actions described above in those sections, and we acknowledge that there are other federal actions occurring in the Atoll (previous, ongoing and known future actions) impacting these species. For example, the FE-1, ARRW, and FE-2 testing will remove up to four top shell snails for each project (for a total of up to 12 top shell snails cumulatively). PRD has considered the action's impacts with the other threats incurring on the species, and even with the worst case scenario (loss of individuals due to this action) added to other losses discussed in the Environmental Baseline and Cumulative Effects sections, we do not expect these actions to result in appreciable reduction of the species.

The proposed action is anticipated to result in death of up to nine top shell snails at Illeginni. The affected snails would represent a small fraction of the total number of top shell snails found at Illeginni, and an even smaller proportion of the population across USAKA. In the context of this action, the potential loss of nine top shell snails across the area is not expected to significantly impact reproduction or to impede the recovery of this species across USAKA and the MAC. Therefore, when taken in context with the status of the species, the environmental baseline, cumulative impacts and effects, the proposed action is not likely to eliminate top shell snails at Illeginni, or appreciably reduce the likelihood of their survival and recovery across USAKA including the MAC.

8.3 Giant Clams

As described in the Effects of the Action section, a total of up to 219 giant clams could be harassed, injured, or killed through some combination of exposure to direct payload impact, ejecta, and ground-based shock wave.

As discussed in the Status of Listed Species, the two clam species have been reported at most of the 11 USAKA islets, (nine for *H. hippopus* and six for *T. squamosa*) as well as at nine and 24 respectively of 35 survey sites in the mid-atoll corridor. It is important to recognize that survey data for USAKA is far from complete. Only a small portion of the total reef area around the USAKA islets has been surveyed, and surveys to specifically identify and quantify this species are yet to be done.

As discussed more fully in the Environmental Baseline and Cumulative Effects sections, the effects of continued flight testing, coastal development, direct take, and climate change are expected to continue and likely worsen in the future for this species. Although many actions at USAKA beyond what are described in the Environmental Baseline and Cumulative Effects sections are uncertain, we do have expected estimates (worst-case scenarios) for the actions described above in those sections, and we acknowledge that there are other federal actions occurring in the Atoll (previous, ongoing and known future actions) impacting these species. For example, the FE-1 testing will remove up to 90 giant clams, the ARRW testing will remove up to 90 giant clams, and the FE-2 testing will remove up to 75 giant clams (for a total of up to 255

giant clams cumulatively). PRD has considered the action's impacts with the other threats incurring on the species, and even with the worst-case scenario (loss of individuals due to this action) added to other losses discussed in the Environmental Baseline and Cumulative Effects sections, we do not expect these actions to result in appreciable reduction of the species.

The proposed action is anticipated to result in death of up to 219 (186 *H. hippopus* and 33 *T. squamosa*) at Illeginni. The affected clams would represent a small fraction of the total number of clams found at Illeginni, and an even smaller proportion of the population across USAKA. In the context of this action, the potential loss of giant clams across the area is not expected to significantly impact reproduction or to impede the recovery of this species across USAKA and the mid-atoll corridor. Therefore, when taken in context with the status of the species, the environmental baseline, cumulative impacts and effects, the proposed action is not likely to eliminate giant clams at Illeginni, or appreciably reduce the likelihood of their survival and recovery across USAKA including the mid-atoll corridor.

8.4 Humphead Wrasse

As described in the Effects of the Action section, a total of up to 342 humphead wrasses could be harassed, injured, or killed through some combination of exposure to direct payload impact, ejecta, and ground-based shock wave.

As discussed in the Status of Listed Species section, humphead wrasses are commonly observed at Kwajalein Atoll, and have been observed at 10 of the 11 surveyed islets since 2010. Observations suggest a broad but scattered distribution. It is important to recognize that survey data for USAKA is incomplete. Only a small portion of the total reef area around the USAKA islets have been surveyed, especially in deeper waters where humphead wrasse could live.

As discussed in the Environmental Baseline and Cumulative Effects section, the effects of continued flight testing, coastal development, direct take, and climate change are expected to continue and for climate change in particular expect to worsen in the future. Although many actions at USAKA beyond what are described in the Environmental Baseline and Cumulative Effects sections are uncertain, we do have expected estimates (worst-case scenarios) for the actions described above in those sections, and we acknowledge that there are other federal actions occurring in the Atoll (previous, ongoing and known future actions) impacting these species. For example, the FE-1, ARRW, and FE-2 testing will remove up to 108 humphead wrasse for each project (for a total of up to 324 humphead wrasse cumulatively). PRD has considered the action's impacts with the other threats incurring on the species, and even with the worst-case scenario (loss of individuals due to this action) added to other losses discussed in the Environmental Baseline and Cumulative Effects sections, we do not expect these actions to result in appreciable reduction of the species.

The proposed action is anticipated to result in the injury or death of up to 324 humphead wrasse (300 juveniles and 24 adults) at Illeginni. The affected individuals would represent a small portion of the total number of humphead wrasse found at Illeginni, and an even smaller proportion of the population across USAKA. In the context of this action, the potential loss of humphead wrasses by the action is not expected to significantly impact reproduction or to impede the recovery of this species across USAKA and the MAC. Therefore, when taken in context with the status of the species, the environmental baseline, cumulative impacts and effects, the proposed action is not likely to eliminate humphead wrasses at Illeginni, or

appreciably reduce the likelihood of their survival and recovery across USAKA including the MAC.

9 CONCLUSION

After reviewing the current status of UES-protected marine species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our Opinion that the USAF/USASMDC's implementation of the GBSD weapon system testing at USAKA, RMI is not likely to jeopardize the continued existence of any of the UES-protected corals considered in this Opinion, the top shell snail, humphead wrasse, or two species of giant clams. No critical habitat has been designated or proposed for designation for any UES-protected marine species in the BOA or elsewhere in the RMI. Therefore, the proposed action would have no effect on designated or proposed critical habitat in the RMI.

10 INCIDENTAL TAKE STATEMENT

The UES does not specifically describe "take" for a biological opinion. However, under the ESA "take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the reasonable and prudent measures and terms and conditions of the Incidental Take Statement (ITS). Although the ESA does not specifically apply to actions taken at USAKA, under section 161 of the Compact and the UES, the ESA provides the basis for determining the level of incidental take, so the ESA definitions will be used for this Opinion.

10.1 Anticipated Amount or Extent of Incidental Take

Based on the analysis in the accompanying Opinion, we conclude that the GBSD flight tests at USAKA would result in the take of seven species of UES consultation corals, top shell snails, humpback wrasse, and two clam species. As described above in the exposure and response analyses, we expect that up to 31,224 colonies of UES consultation corals (as quantified in Table 8, below) could experience complete mortality, up to nine top shell snail, up to 219 clams, and up to 324 humphead wrasse could be killed by the proposed action.

Table 8. Expected Take of Marine UES consultation species due to GBSD flight tests

Scientific Name	Species	Colonies or Individuals Affected
	Corals	
Acropora microclados	No Common Name	51
A. polystoma	No Common Name	51
Cyphastrea agassizi	No Common Name	42
Heliopora coerulea	No Common Name	14,049

Scientific Name	Species	Colonies or Individuals Affected
Pavona venosa	No Common Name	42
Turbinaria reniformis	No Common Name	42
Pocillopora meandrina	Cauliflower coral	16,947
	Mollusks	
Tectus niloticus	Top Shell Snail	9
Hippopus hippopus	Giant clam	186
Tridacna squamosa	Giant clam	33
	Fish	
Cheilinus undulates	Humphead wrasse	324 (24 adults/300 juveniles)

10.2 Effect of Impact of the Take

In this Opinion, we determined that this level of anticipated take is not likely to result in the jeopardy of any of the UES consultation species expected to be taken by the proposed action.

10.3 Reasonable and Prudent Measures

We believe the following reasonable and prudent measures, as implemented by the terms and conditions, are necessary and appropriate to minimize impacts of the proposed action and monitor levels of incidental take. The measures described below are non-discretionary and must be undertaken in order for the ITS to apply.

1. The USAF/USASMDC shall reduce impacts on UES-protected corals, top shell snails, clams, humphead wrasse and their habitats through the employment of best management practices and conservation measures.
2. The USAF/USASMDC shall record and report all action-related take of UES-consultation species.

10.4 Terms and Conditions

The USAF/USASMDC must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. To meet reasonable and prudent measure 1 above, the USAF/USASMDC shall ensure that their personnel comply fully with the conservation measures identified below.
    a. The USAF/USASMDC shall ensure that all relevant personnel associated with this project are fully briefed on the best management practices and the requirement to adhere to them for the duration of this project.

b. In the event the payload land impact affects the reef at Illeginni, the USAF/USASMDC shall require its personnel to secure or remove from the water any substrate or coral rubble from the ejecta impact zone that may become mobilized by wave action as soon as possible.
    i. Ejecta greater than six inches in any dimension shall be removed from the water or positioned such that it would not become mobilized by expected wave action, including replacement in the payload crater.
    ii. If possible, coral fragments greater than six inches in any dimension shall be positioned on the reef such that they would not become mobilized by expected wave action, and in a manner that would enhance its survival; away from fine sediments with the majority of the living tissue (polyps) facing up.
    iii. UES consultation coral fragments that cannot be secured in-place should be relocated to suitable habitat where it is not likely to become mobilized.
c. In the event the payload land impact affects the reef at Illeginni, the USAF/USASMDC shall require its personnel to reduce impacts on top shell snails.
    i. Rescue and reposition any living top shell snails that are buried or trapped by rubble.
    ii. Relocate to suitable habitat, any living top shell snails that are in the path of any heavy equipment that must be used in the marine environment.
d. In the event the payload land impact affects the reef at Illeginni, the USAF/USASMDC shall require its personnel to reduce impacts on clams.
    i. Rescue and reposition any living clams that are buried or trapped by rubble.
    ii. Relocate to suitable habitat, any living clams that are in the path of any heavy equipment that must be used in the marine environment.

2. To meet reasonable and prudent measure 2 above:
    a. The USAF/USASMDC shall assign appropriately qualified personnel to record all suspected incidences of take of any UES-consultation species.
    b. The USAF/USASMDC shall utilize digital photography to record any UES-consultation species found injured or killed in or near the ocean target areas and/or at Illeginni. As practicable: 1) Photograph all damaged corals and/or other UES-consultation species that may be observed injured or dead; 2) Include a scaling device (such as a ruler) in photographs to aid in the determination of size; and 3) Record the location of the photograph.
    c. In the event the payload impact affects the reef at Illeginni, the USAF/USASMDC shall require its personnel to survey the ejecta field for impacted corals, top shell snails, and clams. Also be mindful for any other UES-consultation species that may have been affected.
    d. Within 60 days of completing post-test clean-up and restoration, provide photographs and records to the USAKA environmental office. USAKA and our biologists will review the photographs and records to identify the organisms to the lowest taxonomic level accurately possible to assess impacts on consultation species.

e. Within 6 months of completion of the action, USAKA will provide a report to us. The report shall identify: 1) The flight test and date; 2) The target area; 3) The results of the pre- and post-flight surveys; 4) The identity and quantity of affected resources (include photographs and videos as applicable); and 5) The disposition of any relocation efforts.

11 CONSERVATION RECOMMENDATIONS

The following conservation recommendations are discretionary agency activities provided to minimize or avoid adverse effects of a proposed action on UES-protected marine species or critical habitat, to help implement recovery plans, or develop information.

1. We recommend that the USAF/USASMDC continue to work with NMFS staff to conduct additional marine surveys around Illeginni Islet to develop a comprehensive understanding of the distribution and abundance of species that are there.
2. We recommend that the USAF/USASMDC consider constructing a berm, artificial Hesco Bastion ("Concertainer"), or Bremer wall, around the perimeter of the island above the beach line (see start of grass line in Figure 2 for example) at the impact site in order to reduce the amount of potential ejecta material which can enter the ocean from an impacting projectile. We understand that depending on impact characteristics ejecta may arch at a higher angle than a berm's height. Additionally, consultation may be required with the USFWS for landbased activities. However, we believe it should be considered. This would reduce the risk to UES/ESA-listed species in the nearshore, allow for more precise definition of the target, and aid in the recovery of munition materials after impact.
3. We recommend the USAF/USASMDC equip USAG-KA personnel with metal detectors for recovery of projectile materials in the nearshore environment, if not already doing so. Furthermore, we recommend the USAF/USASMDC attempt to quantify the amount of recovered materials to determine the amount of tungsten that remains in the nearby environment.
4. We recommend that the USAF/USASMDC continue to work with NMFS staff to conduct marine surveys at additional sites around all of the USAKA islets and in the mid-atoll corridor to develop a more comprehensive understanding of the distribution and abundance of species and habitats at USAKA.
5. We recommend that the USAKA develop capacity and procedures for responding to marine mammal and turtle strandings.
    a. Acquire required permits and training to perform necropsies and/or to take and transport tissue samples.
    b. Develop professional relations with qualified federal agencies and universities to capitalize on samples and information gained at USAKA.
    c. Develop mechanisms to collect and disseminate the information.

11.1 Reinitiation Notice

This concludes formal consultation on the implementation of the GBSD program at the USAKA, RMI. Reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law, and if:

1. The amount or extent of anticipated incidental take is exceeded;

2. New information reveals that the action may affect UES-protected marine species or critical habitat in a manner or to an extent not considered in this Opinion;
3. The action is subsequently modified in a manner that may affect UES-protected marine species or critical habitat to an extent, or in a manner not considered in this Opinion; or
4. A new species is listed or critical habitat designated that may be affected by the action.

12 DATA QUALITY ACT DOCUMENTATION

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these DQA components, documents compliance with the DQA, and certifies that this Supplement has undergone pre-dissemination review.

12.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this Opinion is the USAF/USASMDC. Other interested users could include the citizens of RMI, USFWS, and NOAA. Individual copies of this Opinion were provided to the USAF/USASMDC. The format and naming adheres to conventional standards for style.

12.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

12.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this Opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with UES and ESA training and reviewed in accordance with Pacific Islands Region ESA quality control and assurance processes.

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APPENDIX C

Document of Environmental Protection (DEP): Minuteman III Modification and Fuze Modernization Flight Tests, DEP-14-003.0
January 2017

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FINAL DOCUMENT OF ENVIRONMENTAL PROTECTION (DEP)

ACTIVITY:
MINUTEMAN III MODIFICATION AND FUZE MODERNIZATION FLIGHT TESTS

CONTROL NUMBER DEP-14-003.0

JANUARY 2017

Effective Date 14 SEPTEMBER 2017

US ARMY GARRISON-KWAJALEIN ATOLL
IN THE
REPUBLIC OF THE MARSHALL ISLANDS

PREPARED BY TELEDYNE BROWN ENGINEERING, INC.
HUNTSVILLE, ALABAMA

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FOR
MINUTEMAN III MODIFICATION AND FUZE MODERNIZATION FLIGHT TESTS AT U.S. ARMY GARRISON· KWAJALEIN ATOLL (USAG-KA)

DOCUMENT NUMBER DEP-14-003.0
JANUARY 2017

SHALL TAKE EFFECT UPON SIGNATURE

FOR THE U.S. ARMY KWAJALEIN ATOLL

JAMES A. DeORE
COL, IN
Commanding

DATE 14 Sep 2017

REPUBLIC OF THE MARSHALL ISLANDS
ENVIRONMENTAL PROTECTION AUTHORITY
P.O. Box 1322
Majuro, Marshall Islands 96960
Phone: (692) 625-3035/5203 * Fax: (692) 625-5202 * Email: rmiepa@ntamar.net

June 7, 2017

To: Tom Craven
Environmental Division
Deputy Chief of Staff, Engineer
US Army Space and Missile Defense Command/Army Force Strategic Command

From: Moriana Phillip
General Manager
RMI Environmental Protection Authority (RMIEPA)

Subject: Minuteman III Modification and Fuze Modernization Flight Tests at U. S Army Garrison- Kwajlein Atoll (USAG-KA)- DEP-14-003.0

Dear Tom,

Thank you for incorporating RMIEPA's comments in the Document of Environmental Protection for Minuteman III Modification and Fuze Modernization Flight Tests at U.S Army Garrison- Kwajlein Atoll (USAG-KA);

RMI EPA agrees with the Document of Environmental Protection.

Sincerely,

Moriana Phillip
General Manager, RMI EPA

Cc: RMIEPA Files
Caleb Christopher

AGREE WITH DOCUMENT OF ENVIRONMENTAL PROTECTION FOR MINUTEMAN III MODIFICATION AND FUZE MODERNIZATION FLIGHT TESTS AT U.S. ARMY GARRISON - KWAJALEIN ATOLL (USAG-KA)

DOCUMENT NUMBER DEP-14-003.0

JANUARY 2017

National Marine Fisheries Service
Agency

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MINUTEMAN III MODIFICATION AND FUZE MODERNIZATION FLIGHT TESTS AT U.S. ARMY GARRISON - KWAJALEIN ATOLL (USAG-KA)

DOCUMENT NUMBER DEP-14-003.0

JANUARY 2017

U.S. EPA
Agency

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3/20/2017
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AGREE WITH DOCUMENT OF ENVIRONMENTAL PROTECTION FOR MINUTEMAN III MODERNIZATION AND FUZE MODIFICATION FLIGHT TESTS AT U.S. ARMY GARRISON - KWAJALEIN ATOLL (USAG-KA)

DOCUMENT NUMBER DEP-I4-003.0

JANUARY 2017

US FISH AND WILDLIFE SERVICE
Agency

Name *Date*

AGREE WITH DOCUMENT OF ENVIRONMENTAL PROTECTION FOR MINUTEMAN III MODERNIZATION AND FUZE MODIFICATION FLIGHT TESTS AT U.S. ARMY GARRISON - KWAJALEIN ATOLL (USAG-KA)

DOCUMENT NUMBER DEP-14-003.0

JANUARY 2017

U.S. Army Corps of Engineers, Honolulu District

Agency

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March 3, 2017

Date

MINUTEMAN III (MMIII) INTERCONTINENTAL BALLISTIC MISSILE (ICBM) MODIFICATION AND FUZE MODERNIZATION

January 2017

Revisions to the NCA and Final DEP Reflected in the Final DEP

Following the 30-day public and Appropriate Agencies' review and comment period on the Minuteman III (MMIII) Intercontinental Ballistic Missile (ICBM) Modification and Fuze Modernization Draft DEP, the Department of the Air Force, Headquarters Global Strike Command (AFGSC) made the request to remove the the possibility of up to five land impacts at Illeginni Islet for the remaining life of the program. Therefore, both the NCA and Final DEP are revised to remove program activities and requirements and limitations associated with the MMIII land impacts at Illeginni Islet.

DOCUMENT OF ENVIRONMENTAL PROTECTION

DATE SUBMITTED: January 2017
DEP EFFECTIVE DATE: 14 September 2017
DEP EXPIRES: Five Years After Final Signature

The Compact of Free Association between the Republic of the Marshall Islands (RMI) and the United States (US) requires all US Government activities at US Army Garrison-Kwajalein Atoll (USAG-KA)(formerly US Army Kwajalein Atoll (USAKA)), where Ronald Reagan Ballistic Missile Test Site (RTS) is a tenant organization, to conform to specific compliance requirements, coordination procedures, and environmental standards identified in the USAKA Environmental Standards and Procedures (UES)(USAKA, 2014). As specified in Section 2-2 of the UES, these standards also apply to all USAG-KA and RTS activities occurring elsewhere within the RMI, including the territorial waters of the RMI.

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TECHNICAL DESCRIPTION OF ACTIVITY

The activities described in this DEP are for conducting Minuteman III (MMIII) Intercontinental Ballistic Missile (ICBM) Modification and Fuze Modernization program flight tests.

In 2005, a Notice of Proposed Activity (NPA) and companion Document of Environmental Protection (DEP) (USAKA, 2005) went into effect for the Minuteman III (MMIII) Modification Flight Tests at RTS. The UES requires renewal of DEPs for continuing activities, thus requiring a Notice of Continuing Activity (NCA), issued 29 September 2014, and this companion DEP for the MMIII Modification Flight Tests, to include the Fuze Modernization program. Upon issuance, the renewed DEP will cover a five-year period.

The Department of Defense (DOD) is extending the life of the existing force of MMIII ICBMs and including a Fuze Modernization program using the same missile platform and infrastructure support. As a life-extension action, the MMIII weapon system will continue through year 2030 with up to four annual MMIII flight tests, and additionally up to four Fuze Modernization flight tests over a four-year period. The four Fuze Modernization flight tests are currently planned for first or second quarter FY19, FY20, FY21 and FY22. All will be from Vandenberg Air Force Base (VAFB), California, to the RTS in the RMI. Flight tests are necessary to ensure the safety, accuracy, and reliability of the MMIII and Fuze Modernization systems.

The ICBM Fuze Modernization program activities will include replacement of the existing MMIII Mark (Mk) 21 fuze to meet warfighter requirements and maintain current capability. Additionally, the ICBM Fuze Modernization program will address the associated Minuteman III weapon modifications, system testing, support equipment, data, training, and fielding efforts required to support and develop a new Mk 12A fuze capability to integrate with the new Mk 21 fuze and Mk 12A/W78 Life Extension Program.

The flight testing activities for MMIII have not changed substantially over the years, with the exception of the removal of the requirement for land impacts in 2016, and neither the MMIII program nor the Fuze Modernization activities will induce significant changes. Environmental resource areas impacted by the continuing Minuteman III program and Fuze Modernization activity missions are discussed in the NCA (Appendix A). Requirements for notification and reporting in the NCA are consistent with those in the original NPA. Monitoring procedures are addressed in the DEP.

LOCATION OF ACTIVITY

The Kwajalein Missile Impact Scoring System (KMISS) range located off the east reef near Gagan Islet, RTS, RMI.

COMPLIANCE STATUS

The Minuteman III Modification and Fuze Modernization program flight testing activities at RTS are in compliance with the USAKA Environmental Standards (UES). The testing activities and potential effects on endangered and threatened species will be monitored by US Air Force (USAF) (Defense Program) and RTS and reported to the Appropriate Agencies in accordance with this DEP to ensure continued compliance.

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ABBREVIATIONS AND ACRONYMS

BA	Biological Assessment
Be	Beryllium
BO	Biological Opinion
BOA	Broad Ocean Area
CITES	Convention on International Trade in Endangered Species
DEP	Document of Environmental Protection
DOD	Department of Defense
DU	Depleted Uranium
EA	Environmental Assessment
EOD	Explosive Ordnance Disposal
KEEP	Kwajalein Environmental Emergency Plan
LLNL	Lawrence Livermore National Laboratory
MMIII	Minuteman III
NCA	Notice of Continuing Activity
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NMFS	National Marine Fisheries Service
RMI	Republic of the Marshall Islands
RMIEPA	Republic of the Marshall Islands Environmental Protection Authority
RMIHPO	Republic of the Marshall Islands Historic Preservation Office
RTS	Reagan Test Site (Ronald Reagan Ballistic Missile Defense Test Site)
U-238	Uranium-238
UES	USAKA Environmental Standards and Procedures
US	United States
USACE	United States Army Corps of Engineers, Honolulu District
USAF	United States Air Force
USAFGSC	US Air Force Global Strike Command
USAG-KA	United States Army Garrison-Kwajalein Atoll
USAKA	United States Army Kwajalein Atoll, to include USAG-KA and all tenant organizations
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UXO	Unexploded Ordnance
VAFB	Vandenberg Air Force Base
µCi/ml	Microcuries per milliliter

1.0 REQUIREMENTS AND LIMITATIONS

(Predetermined responsibility for tasks is provided where appropriate.)

1.1 General Requirements and Limitations:

a. Prior to a flight test, safety precaution measures shall be implemented. Within the Mid-Atoll Corridor nonessential personnel shall be evacuated and mission critical personnel shall be sheltered. Notices to Airmen (NOTAMs) and Notice to Mariners (NOTMARs) shall be published and circulated in accordance with established procedures. Radar and visual sweeps of the hazard area shall be accomplished immediately prior to a test flight to ensure clearance of non-critical personnel. [Defense Program, USAG-KA, & RTS]

b. Personnel shall conduct a helicopter or fixed-wing aircraft overflight of the vicinity three times over the week prior to the test and as close to launch as safely practical to survey for marine mammals and sea turtles. The final overflight shall be made within one day of the proposed launch. [Defense Program & RTS]

c. During the flight test, personnel in the vicinity of the impact area shall comply with the Army's Hearing Conservation Program. Depending on their location, personnel may be required to wear hearing protection. [Defense Program]

d. Vessel operations, particularly in the Broad Ocean Area (BOA) near KMISS, shall only occur when weather and sea conditions are acceptable for safe travel. [Defense Program & USAG-KA]

e. Vessel operations shall not involve any intentional ocean discharges of fuel, toxic wastes, or plastics and other solid wastes that could potentially harm marine life. [Defense Program, USAG-KA, & RTS]

f. Prior to the shipment of test support equipment and materials from the US to RTS, the equipment shall be washed and a certified Pest Control Technician or Military Veterinarian shall inspect the equipment to ensure that it does not contain any insects, animals, plants, or seeds. [Defense Program]

g. Prior to returning the test support equipment and materials to the US, the equipment shall be washed and a certified Pest Control Technician shall inspect the equipment again to ensure that it does not contain any insects, animals, plants, or seeds that might have been picked up during fielding. [Defense Program & RTS]

h. To avoid impacts on coral heads off Gagan Islet, sensor rafts shall not be located in waters less than 10 feet (3 meters) deep. [Defense Program & RTS]

i. During ocean travel to and from impact and test support areas, ship personnel shall monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators shall also adjust their speed based on expected animal densities, and on lighting and turbidity conditions. [Defense Program, USAG-KA, & RTS]

j. If practical within mission requirements, the flight test shall be conducted during midday when birds are typically at rest and less likely to be within the impact area. [Defense Program & RTS]

k. Following impact, all sensor rafts shall be recovered using Landing Craft Utility (LCU) vessels. [Defense Program]

l. Any Beryllium (Be) or Depleted Uranium (DU), as Uranium (U) from previous MMIII impacts at Illeginni Islet-exceeding the UES standards for assessing the need for cleanup shall trigger an immediate investigation of the soil on Illeginni Islet to determine if the soil is contaminated. Coordination shall be initiated with the Defense Program, Space and Missile Defense Command (SMDC), RMI Environmental Protection Authority (RMIEPA), and the other appropriate UES agencies to determine the scope and methods/procedures to be followed during the investigation and any subsequent soil removal or other remediation activities. [Defense Program & SMDC]

m. Following the soil investigation required upon exceeding UES standards for Be and DU, the Defense Program and SMDC shall transmit the records of Be and DU concentrations in soil to the RMIEPA General Manager, National Marine Fisheries Service (NMFS) Pacific Islands Regional Office, and the US Fish and Wildlife Service (USFWS) Pacific Islands Fish and Wildlife Office within two weeks from the date of receipt of such records from LLNL or analytical laboratory. [Defense Program & SMDC]

n. During the above-referenced soil investigation, the possibility of endangered, threatened, or protected species moving into the area shall be monitored for, and work shall be delayed until any such species is out of harm's way, or leaves the area. [Defense Program & RTS]

o. The monitoring program for marine mammals established for the open water areas at USAKA shall be continued. Opportunistic sightings of marine mammals from various air and watercraft operating in the Atoll shall be collected. As funds become available, remote sensing would be performed in the open water range south of Illeginni Islet or in the KMISS range east of Gagan Islet. [Defense Program & RTS]

p. As close to the time of launch as safely practical, qualified biologists or environmental staff members shall inspect the proposed impact area for sea turtles. Such sightings shall be reported to the USAG-KA Environmental Office, the RTS Range Directorate, and the Kwajalein Test Director. [Defense Program & RTS]

q. Personnel shall conduct a helicopter or fixed-wing aircraft overflight of the impact vicinity as soon as safely practical after the test to survey for any dead or injured marine animals and sea turtles with reporting requirements as per section 2.0.e of this DEP. [Defense Program & RTS]

r. The USAF no longer plans land impacts; however, if it land impacts are ever again contemplated, then the USAF shall test soil samples to ensure that the concentrations of Be and U, as a surrogate for DU, do not exceed established UES standards. [Defense Program]

s. In the event of an RV impact that affects the reef, personnel shall secure or remove from the water any substrate or coral rubble from the ejecta impact zone that may become mobilized by wave action. [Defense Program & RTS]

t. In the event of a RV impact that affects the reef, the Defense Program shall require its personnel to reduce impacts on top shell snails. (Note: these requirements are also listed under Incidental Take Terms and Conditions, section 1.5 in this DEP)

- **(1)** Survey the ejecta field for impacted corals and top shell snails. Also be mindful for any other UES-consultation species that may have been affected.
- **(2)** Rescue and reposition any living top shell snails that are buried or trapped by rubble.
- **(3)** Relocate to suitable habitat, any living top shell snails that are in the path of any heavy equipment that must be used in the marine environment.

1.2 BOA Impact Requirements and Limitations:

a. The Defense Program shall prepare a detailed cleanup plan that satisfies human health and safety requirements and incorporates measures to minimize ocean pollution. [Defense Program]

b. Although no floating debris from the delivery vehicle or payload impact in the BOA is expected, ship personnel shall recover any floating debris from the vehicle and properly dispose of it. This shall include the recovery of visible debris in shallow (less than 100 ft (30 meters)) ocean waters by range divers. [Defense Program, RTS & USAG-KA]

c. Personnel shall conduct a helicopter or fixed-wing aircraft overflight of the impact area vicinity as soon as safely practical after the test to survey for any dead or injured marine animals. Such sightings shall be reported to the USAG-KA Environmental Office, the

RTS Range Directorate, the Kwajalein Test Director, and SMDC; SMDC shall then forward the information to the Appropriate Agencies. [Defense Program, USAG-KA, RTS, & SMDC]

1.3 Maintenance of Sea Turtle Nesting Habitat on Eniwetak Islet:

a. In accordance with previous consultation with USFWS; the Defense Program shall abide by the 2005 USFWS Biological Opinion (BO) through 2030 and continue to maintain sea turtle nesting habitat on Eniwetak Islet.

(1) The Eniwetak Conservation Area (ECA) Management Plan was developed and followed by USAG-KA, and shall continue to be followed. The ECA includes Eniwetak Islet and its marine waters and surrounding reefs extending at a minimum 300 meters seaward, of the mean low water line.

b. The Defense Program shall maintain the conservation area at Eniwetak Islet, comprised of terrestrial habitat, including sea turtle nesting habitat, and reasonable coral-reef buffer surrounding the islet in coordination and agreement with the RMI and USFWS. A no-anchor zone for unauthorized personnel shall be established 300 meters from the shoreline. [Defense Program & SMDC]

c. In consultation with the RMI, the established protocols shall be followed to ensure that unauthorized personnel shall not have access to Eniwetak. [Defense Program & SMDC] The unauthorized personnel protocols address/specify:

(1) Signage: "Off-limits" and/or "No Trespassing" signage shall be posted and maintained in both English and Marshallese on shorelines of Eniwetak.

(2) Announcement: Public shall be notified Eniwetak is off-limits. The prohibition shall be announced in English and Marshallese at public meetings, in newspapers, and on radio and television. The prohibition shall be posted in both English and Marshallese at the Kwajalein and Roi Namur boat harbors.

(3) Surveillance and trespass enforcement authority and responsibility: USAG-KA shall meet this requirement by:

i. Monitoring Eniwetak Islet on a regular basis, especially the western end, using a variety of assets including regularly scheduled aircraft and vessels. If it is determined that the regular monitoring is not deterring unauthorized visits to the island or poaching, USAG-KA and RMIEPA shall identify and coordinate additional measures required to prevent such acts.

ii. Installing no later than 31 December 2017 at least four cameras to detect unauthorized human disturbance of the ECA.

iii. Compiling serendipitous observation reports by pilots to the tower as to the presence or absence of humans on Eniwetak during regular flyovers.

iv. Compiling serendipitous observation reports by boat captains to harbor control after trips to or near Eniwetak on the presence or absence of humans on the islet.

v. Providing to SMDC (RTS) for submittal to the Appropriate Agencies and the Defense Program during May through November a monthly report of the regular monitoring conducted and any serendipitous aircraft pilot and boat captain observations.

vi. Developing methods/means for USAG-KA to notify the RMI of potential trespassers at Eniwetak.

vii. Assisting the RMI police to gain access to and enforcement of the conservation area at Eniwetak.

(4) Land inspection frequency for trespassers: Environmental personnel shall visit the islet at a minimum of once a month. If it is determined that the regular monitoring is

not deterring unauthorized visits to the island or poaching, USAG-KA and RMIEPA shall identify and coordinate additional measures required to prevent such acts.

d. Personnel shall monitor beaches at Eniwetak Islet for sea turtle nesting success. Inspections for sea turtle nests, egg incubation and hatchling success shall be made on a monthly basis during peak nesting periods (May through November). Inspection findings shall be reported to USFWS on a monthly basis. [Defense Program & SMDC]

e. Personnel shall maintain sea turtle nesting habitat at Eniwetak Islet by removing marine debris or other hazards that may impede female haul-out, nesting, egg incubation, and hatchling migration to the ocean. At least once a month during May through November, nesting beaches shall be closely inspected for and cleansed of debris (e.g., fishing net, rope) in which turtles could become entangled. [Defense Program]

1.4 Incidental Take Terms and Conditions (Based on USFWS Biological Opinion 2005, DEP Appendix B, and NMFS Biological Opinion 2015, DEP Appendix C):

a. Incidental take may occur in the form of harm or harassment to the breeding success; loss of up to three green turtle nests or injury, loss of up to 300 eggs or hatchlings; loss of up to 117 top shell snails; or loss of up to 49,645 colonies within the 15 species of UES consultation corals as a result of project-related payload impacts USAKA and RTS.

b. Payload shall be aimed away from known sea turtle nesting areas within the Mid-Atoll Corridor Impact Area in order to minimize the number of turtle nests destroyed. [Defense Program]

c. The Defense Program shall inspect the impact zones to assess sea turtle mortality after the Flight Test. Baseline data shall be collected at Illeginni prior to the Flight Test for comparison purposes.

d. The Defense Program shall reduce impacts on UES-protected corals and top shell snails and their habitats through the employment of Best Management Practices (BMPs) and conservation measures.

(1) The Defense Program shall ensure that personnel comply fully with the BMPs and conservation measures identified in the 2015 Biological Assessment (BA) and provided in the sections below.

(2) The Defense Program shall work with USAG-KA to ensure that all relevant personnel associated with MMIII flight tests are fully briefed on the BMPs and the requirement to adhere to them for the duration of MMIII flight tests.

e. All action-related take of UES-consultation species shall be recorded and reported by the Defense Program through SMDC. [Defense Program & SMDC]

(1) The Defense Program shall assign appropriately qualified personnel to record all suspected incidences of take of any UES-consultation species.

(2) The Defense Program shall utilize digital photography to record any UES-consultation species that is found injured or killed in or near the ocean target areas. As practicable: 1) Photograph all damaged corals and/or other UES-consultation species that may be observed injured or dead; 2) Include a scaling device (such as a ruler) in photographs to aid in the determination of size; and 3) Record the location of the photograph.

(3) Within 60 days of completing post-test clean-up, the Defense Program shall provide photographs and records through SMDC to the USAG-KA Environmental Office. Qualified biologists or environmental staff members and NMFS biologists shall review the photographs and records to identify the organisms to the lowest taxonomic level accurately possible to assess impacts on consultation species.

(4) Within 6 months of completion of each fiscal year, the Defense Program, through SMDC, shall provide an annual report for submittal to USAG-KA and NMFS. The report shall identify:

i. The flight test and date;

ii. The target area;

iii. The results of the pre- and post-flight surveys;

iv. The identity and quantity of affected resources (include photographs and videos as applicable); and

v. The disposition of any relocation efforts.

f. As funds become available, the Defense Program shall conduct additional marine surveys around all of the USAKA islands and in the Mid-Atoll Corridor to develop a more comprehensive understanding of the distribution and abundance of species and habitats at USAKA.

g. As funds become available, the Defense Program shall conduct regular (monthly or quarterly if possible) surveys of the KMISS and the RMI broad ocean area to develop a better understanding of the distribution and abundance of marine mammals and other species in the area.

h. As funds become available, the Defense Program shall support development of USAG-KA's capacity and procedures for responding to marine mammal and turtle strandings. To provide this capacity, USAG-KA shall:

(1) Acquire required permits and training to perform necropsies and/or to take and transport tissue samples.

(2) Develop professional relations with qualified federal agencies and universities to capitalize on samples and information gained at USAKA.

(3) Develop mechanisms to collect and disseminate the information.

i. If, during the course of the action, the level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of the consultation and review of the reasonable and prudent measures provided and activities causing or contributing to the taking shall immediately cease. The Defense Program, through SMDC, shall immediately provide an explanation of the causes of the taking, and review with the USFWS or NMFS, as applicable, the need for possible modification of the reasonable and prudent measures.

1.5 Material and Waste Management:

a. Hazardous waste treatment or disposal is prohibited at USAKA [UES §3-6.6.5(a)].

b. All activities at USAKA importing activity-specific hazardous materials into USAKA shall submit within 15 days of receiving the material or before actual use, whichever comes first, a separate Hazardous Materials Procedure to the Commander, USAKA, for approval (UES §3-6.4.3).

c. Response to releases of oil, fuels and lubricants into the USAKA environment shall be in accordance with the Kwajalein Environmental Emergency Plan (KEEP) (UES §3-6.5.8).

d. Delivery vehicle and payload debris could consist of batteries and various heavy metal components that include small quantities of Be, chromium and nickel alloys. All waste materials collected by the Defense Program shall be returned to USAKA for proper storage and disposal in accordance with the UES.

2.0 MONITORING PROCEDURES

a. Personnel shall conduct a helicopter or fixed-wing aircraft overflight of the KMISS vicinity at least three times over the week prior to the flight test and as close to the proposed test launch time as safely practicable. The final overflight shall be made within

one day of the proposed launch. If personnel observe marine mammals or sea turtles in the vicinity, they shall report such findings to the USAG-KA Environmental Office, the RTS Range Directorate, and the Flight Test Operations Director. [Defense Program & RTS]

b. During travel to and from Gagan and KMISS, personnel shall monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators shall adjust their speed based on expected animal densities, and on lighting and turbidity condition. [Defense Program, RTS & USAG-KA]

c. Any marine mammals or sea turtles observed during deployment of the free-floating sensors in the BOA impact area shall be reported to the USAG-KA Environmental Office, the RTS Range Directorate, and the Flight Test Operations Director. USAG-KA aircraft pilots flying in the vicinity of the impact and test support areas shall also report any opportunistic sightings of marine mammals and sea turtles. [Defense Program & USAG-KA]

d. If cultural or historic remains are discovered during the activities, work shall cease and the USAG-KA Environmental Office shall be notified. The RMI Historic Preservation Office (RMIHPO) shall be notified, and appropriate mitigation measures, developed in consultation with the RMIHPO, shall be implemented to minimize the effects on the resource or to recover as much of the resource as possible (conforming to professional standards for research), as directed by UES §3-7.5.7. [Defense Program & USAG-KA]

e. Post-test overflights of the impact area shall be conducted to survey for dead or injured cetaceans and sea turtles. Although unlikely, any dead or injured marine mammals or sea turtles sighted shall be reported through SMDC to the USAG-KA Environmental Office, who shall then inform NMFS and USFWS. USAG-KA aircraft pilots otherwise flying in the vicinity of the impact and test support areas shall also report any opportunistic sightings of dead or injured marine mammals or sea turtles. [Defense Program, SMDC, & USAG-KA]

f. During post-test recovery and cleanup, should personnel observe endangered, threatened, or other species requiring consultation moving into the area, work shall be delayed until such species were out of harm's way or leave the area. [Defense Program & RTS]

3.0 MINOR DEP MODIFICATIONS

Minor modifications to this DEP may be accomplished under the provisions of UES §2-17.3.6(e).

4.0 NOTIFICATION PROCEDURES

4.1 Emergency Notifications Material and Waste Management

a. Within 24 hours of discovery of an emergency environmental condition, USAG-KA shall notify the public affected or potentially affected by the condition and the Appropriate Agencies by the most expeditious means available.

b. Within 10 days following emergency notification, USAG-KA shall submit written notification of the event to the Appropriate Agencies that contains at a minimum the relevant information described in UES §2-7.2.2.

c. Emergency notifications shall be made for any condition that the Commander, USAG-KA, determines to constitute an emergency condition.

4.2 Public Notifications

a. Public notifications shall be made by USAG-KA to advise the public of an activity or action that USAG-KA has taken or is planning as a result of emergency conditions.

b. Public notification made as a result of emergency conditions shall be made in *The Kwajalein Hourglass* and *The Marshall Islands Journal*, posters or bulletins displayed in public places, announcements on Kwajalein Range Services Newsline and/or on public television.

4.3 Agency Notification

a. In the event that any species and habitats of Special Concern as stated in UES Appendices 3-4A thru 3-4D, are disturbed, transplanted, injured or killed due to test activities, NMFS, USFWS, and RMIEPA shall be informed by USAG-KA within 24 hours. [Defense Program, SMDC & USAG-KA]

b. If cultural or historic remains or artifacts are discovered during the course of MMIII activities, work at the site shall cease and the USAG-KA Environmental Office shall be notified. The RMIHPO shall be notified, and appropriate mitigation measures, developed in consultation with the RMIHPO, shall be implemented to minimize the effects on the resource or to recover as much of the resource as possible (conforming to professional standards for research), as directed by UES §3-7.5.7. [Defense Program & USAG-KA]

5.0 RECORDS KEEPING

a. The NCA, Environmental Comments and Recommendations, and the DEP permitting MMIII activities at USAKA shall be preserved for the duration of the activity plus 10 years or for 10 years after expiration of the DEP, whichever is less. (UES §2-13.2.7)

b. All records associated with the activity shall be maintained for at least five years. (UES §2-13.2)

c. Personnel-training records shall be preserved for 10 years beyond the period the employee is engaged in activities potentially affecting the environment at USAKA (UES §2-13.2.1).

6.0 REPORTING PROCEDURES

a. In the event of a test failure, anomalies, or termination, the respective Defense Program's Project Office shall provide a notification statement to the Government of the RMI, via the USAG-KA Host Nation Office and US Embassy, within five days of a test event which involves a test failure, anomalies, or termination. This notification statement shall include the location, safety, and environmental consequences of the event.

b. The USAF shall reduce impacts on UES-protected corals and top shell snails and their habitats through the employment of BMP and conservation measures.

c. The USAF shall record and report all action-related take of UES-consultation species.

d. A written report shall be provided to NMFS, USFWS, and the RMIEPA within 10 days following any emergency notification as per UES§2-7.3.1 of an incident resulting in the disturbance, transplant, injury, or death of any species and habitats of Special Concern as stated in UES Appendices 3-4A thru 3-4D. The report shall provide the type and number of organisms disturbed, transplanted, injured, or killed; their condition; the locations and conditions of the original and new habitats; and the projected chances of recovery if injured.

e. A written report shall be provided to the Appropriate Agencies if any of the requirements of the DEP or the UES are violated during the activity covered by this DEP within 30 days of the violation.

7.0 RESOLUTION OF NONCOMPLIANT AREAS

Currently there are no known non-compliant MMIII testing activities at RTS. With the implementation of the requirements, limitations, and monitoring protocols described in

this DEP, MMIII testing activities at RTS shall be in full compliance with the current UES Edition.

8.0 ENVIRONMENTAL COMMENTS AND RECOMMENDATIONS RECEIVED ON THE DRAFT DEP AND USAG-KA'S RESPONSES

US ENVIRONMENTAL PROTECTION AGENCY (USEPA)
COMMENT: Draft DEP may affect resources within the jurisdiction of this agency. Agree with proposed environmental controls. No comments provided.

USAKA RESPONSE: Comment noted.

US ARMY ENGINEER CORPS OF ENGINEERS (USACE), HONOLULU DISTRICT
COMMENT: Draft DEP does not affect resources within the jurisdiction of this agency. No comments are provided.

USAKA RESPONSE: Comment noted.

NATIONAL MARINE FISHERIES SERVICE (NMFS)
COMMENT: Draft DEP may affect resources within the jurisdiction of this agency. Conditionally agree with proposed environmental controls, subject to the enclosed comments/recommendations.

Comment 1: Page 3, sect. 1.2 m., lines 31-32: This requirement appears to be wholly captured under 1.2 j. (page 3, lines 14-17). If 1.2 m. is seen as simply repetitive, perhaps it can be removed.

Comment 2: Page 8, sect. 2.0 f, lines 26-27: The sentence seems to suggest that that testing results that indicate levels above UES criteria shall be removed, as opposed to the contaminated soil. May need to clarify here.

Comment 3: Page 8, sect. 2.0 g, line 31: Suggest changing "USFWS or NMFS" to "USFWS and/or NMFS"

USAKA RESPONSE:
Comment 1: Noted section was revised as recommended.

Comment 2: This paragraph was removed from the Final DEP based on the USAGSC statement that Illeginni Islet is no longer targeted.

Comment 3: This paragraph was removed from the Final DEP based on the USAGSC statement that Illeginni Islet is no longer targeted.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: Draft DEP may affect resources within the jurisdiction of this agency. Conditionally agree with proposed environmental controls, subject to the enclosed comments/recommendations.

Comment 1: Mitigation and Conservation Measures – The USFWS supports maintaining Eniwetak Conservation Area (ECA) to compensate for potential turtle impacts at Illeginni. However, we will note that the last Consultation was in 2004 and warrants a review and initiation of consultation.

Comment 2: The Service also recommends that the ECA be maintained as a coral reef mitigation area. In order to pursue the use of ECA as a coral reef mitigation area, we recommend developing a management/ mitigation plan for this area. The Service is currently developing habitat maps for ECA for USAG-KA and continues to encourage coral reef monitoring in this area to quantify and monitor the resources within ECA. This would be a first step in developing a management plan for ECA to offset potential losses of coral reef resources from a potential strike on coral reef habitat.

USAKA RESPONSE:
Response to Comment 1: The last consultation with USFWS was predicated on land impacts at Illeginni Islet. Following issuance of the Draft DEP, the USAFGSC requested that land impacts at Illeginni Islet be removed from consideration because Minuteman III flight testing would no longer target Illeginni Islet. All MMIII RV impacts will occur at the KMISS. Based on this change, there are no land impacts at Illeginni Islet by the Minuteman III program and therefore no requirement to re-consult.

Response to Comment 2: USAF and SMDC will work with the UES Appropriate Agencies to review the existing ECA Management Plan and modify it if necessary. The USAF will fund the necessary and agreed to environmental mitigations as approved by all the UES agencies and included in the DEP.

REPUBLIC OF THE MARSHALL ISLANDS ENVIRONMENTAL PROTECTION AUTHORITY (RMIEPA) COMMENT:
USAKA RESPONSE: Draft DEP may affect resources within the jurisdiction of this agency. Conditionally agree with proposed environmental controls, subject to the enclosed comments/recommendations.

Comment 1: Please specify the quantity of DU in the test RVs.

Comment 2: Please include additional information regarding asbestos released from test RVs, RMIEPA is concerned about asbestos inhalation hazards for flight tests involving RV land impacts at Illigenni Islet. Please determine the presence of any asbestos contaminants in the air following test flights in the same manner that the presence of Be and DU is determined now.

Comment 3: RMIEPA supports USFWS' comments concerning maintaining the Enewetak Conservation Area (ECA) [Note: see USFWS Comment 1 above], better developing a coral reef mitigation area, and initiating new consultation. RMIEPA further requests that the Air Force's annual support for the ECA include support for a yearly meeting between representatives of the Traditional and Customary Landowners of Enewetak Islet, the RMI Ministry of Foreign Affairs, USAG-KA and RMIEPA in order to review, evaluate, and if necessary, update, the Enewetak Conservation Area MOU (2006) and USAG-KA regulations concerning the ECA. Given the length of time since the ECA was designated, the first such meeting should occur immediately.

USAKA RESPONSE:
Response to Comment 1: There are 85 kilograms of DU per RV for each high fidelity test. The high fidelity test generally is performed one time per year.

Response to Comment 2: There are a total of 8.136 grams (0.018 pounds) of asbestos in an MK21 RV with 8 grams of that total mass bound as asbestos adhesive and the remaining 0.136

grams used as battery sheathing. For the MK12A, there are 624.68 grams (1.377 pounds) of asbestos bound in adhesive and another 0.5 grams used as battery sheathing.
Following issuance of the Draft DEP, the USAFGSC requested that land impacts at Illeginni Islet be removed from consideration because Minuteman III flight testing would no longer target Illeginni Islet. Based on this change to the Minuteman III program, there would be no inhalation hazards for flight tests involving RV land impacts at Illigenni Islet.

Response to Comment 3: USAF and SMDC will work with the UES Appropriate Agencies to review the existing ECA Management Plan and modify it if necessary. The USAF will fund the necessary and agreed to environmental mitigations as approved by all the UES agencies and included in the DEP.
The last consultation with USFWS was predicated on land impacts at Illeginni Islet. Following issuance of the Draft DEP, the USAFGSC requested that land impacts at Illeginni Islet be removed from consideration because Minuteman III flight testing would no longer target Illeginni Islet. All MMIII RV impacts will occur at the KMISS. Based on this change, there are no land impacts at Illeginni Islet by the Minuteman III program and therefore no requirement to re-consult.

9.0 ENVIRONMENTAL COMMENTS AND RECOMMENDATIONS RECEIVED ON THE NOTICE OF CONTINUING ACTIVITY AND USAG-KA'S RESPONSES

US ENVIRONMENTAL PROTECTION AGENCY (USEPA)
COMMENT: NCA may affect resources within the jurisdiction of this agency. Agree with proposed environmental controls. No comments provided.

USAKA RESPONSE: Comment noted.

US ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT (USAEDH)
COMMENT: NCA does not affect resources within the jurisdiction of this agency. No comments are provided.

USAKA RESPONSE: Comment noted.

US FISH AND WILDLIFE SERVICE (USFWS)
COMMENT: NCA may affect resources within the jurisdiction of this agency. Agree with proposed environmental controls. No comments provided.
USAKA RESPONSE: Comment noted.

NATIONAL MARINE FISHERIES SERVICE, PACIFIC ISLANDS REGIONAL OFFICE, PROTECTED RESOURCES DIVISION (NMFS)
COMMENT: NCA may affect resources within the jurisdiction of this agency. Agree with proposed environmental controls. No comments provided.

USAKA RESPONSE: Comment noted.

REPUBLIC OF THE MARSHALL ISLANDS ENVIRONMENTAL PROTECTION AUTHORITY (RMIEPA)
COMMENT: No comments received.

USAKA RESPONSE: No comment response required.

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APPENDIX A

MINUTEMAN III
NOTICE OF CONTINUING ACTIVITY

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NOTICE OF CONTINUING ACTIVITY
(NCA)

ACTIVITY:
MINUTEMAN III MODIFICATION AND FUZE MODERNIZATION FLIGHT TESTS

CONTROL NUMBER NCA-14-003.0

September 2014
Revised December 2015, January 2017

U.S. ARMY GARRISON-KWAJALEIN ATOLL
IN THE
REPUBLIC OF THE MARSHALL ISLANDS

PREPARED BY TELEDYNE BROWN ENGINEERING, INC.
HUNTSVILLE, ALABAMA

Public Release #4121

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NOTICE OF CONTINUING ACTIVITY

ACTIVITY: MINUTEMAN III MODIFICATION AND FUZE MODERNIZATION FLIGHT TESTS CONTROL NUMBER NCA-14-003.0

The Compact of Free Association between the Republic of the Marshall Islands (RMI) and the United States (US) requires all US Government activities at US Army Garrison-Kwajalein Atoll (USAG-KA)(formerly US Army Kwajalein Atoll (USAKA), where Ronald Reagan Ballistic Missile Test Site (RTS) is a tenant organization, to conform to specific compliance requirements, coordination procedures, and environmental standards identified in the USAKA Environmental Standards and Procedures (UES) (USAKA, 2014). As specified in Section 2-2 of the UES, these standards also apply to all USAG-KA and RTS activities occurring elsewhere within the RMI, including the territorial waters of the RMI.

In 2005, a Notice of Proposed Activity (NPA) and companion Document of Environmental Protection (DEP) (USAKA, 2005) went into effect for the Minuteman III (MMIII) Modification Flight Tests at RTS. The UES requires renewal of DEPs for continuing activities, thus requiring this Notice of Continuing Activity (NCA) and subsequent companion DEP for the MMIII Modification Flight Tests at USAG-KA, to include the Fuze Modernization program. Upon issuance, the renewed DEP will cover a five-year period.

The Intercontinental Ballistic Missile (ICBM) Fuze Modernization program activities will include replacement of the existing MMIII Mark (Mk) 21 fuze to meet warfighter requirements and maintain current capability. Additionally, the ICBM Fuze Modernization program will address the associated Minuteman III weapon modifications, system testing, support equipment, data, training, and fielding efforts required to support and develop a new Mk 12A fuze capability to integrate with the new Mk 21 fuze and Mk 12A/W78 LEP.

The flight testing activities for MMIII have not changed substantially over the years, with the exception of the removal of the requirement for land impacts in 2016 and neither the MMIII program nor the Fuze Modernization activities will induce significant changes. Additionally, currently there are no requirements and thus no plans for land impacts at Illeginni Islet from MMIII flight testing as of October 2016. The NCA differs from the NPA in that the NCA provides greater detail on the mission components, preparations, and impact activities. Environmental resource areas impacted by the continuing Minuteman III program and Fuze Modernization activity missions also are discussed in greater detail. Requirements for notification and reporting in the NCA are consistent with those in the original NPA. Monitoring procedures will be addressed in the DEP.

DATE SUBMITTED: September 2014; revised December 2015 and November 2016

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DESCRIPTION OF ACTIVITY

The continuing activity described in this NCA is for conducting MMIII ICBM and Fuze Modernization program flight tests.

LOCATION OF ACTIVITY

The Kwajalein Missile Impact Scoring System (KMISS) range located off the east reef near Gagan Islet, RTS, RMI.

COMPLIANCE STATUS

The Minuteman III and Fuze Modernization program flight testing activities at USAG-KA are in compliance with the UES. The testing activities and potential effects on endangered and threatened species will be monitored by USAF and USAG-KA and reported to the Appropriate Agencies in accordance with the associated DEP to ensure continued compliance.

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ABBREVIATIONS AND ACRONYMS

AHW	Advanced Hypersonic Weapon
BA	Biological Assessment
Be	Beryllium
BO	Biological Opinion
BOA	Broad Ocean Area
CITES	Convention on International Trade in Endangered Species
CONUS	Continental United States
DEP	Document of Environmental Protection
DOD	Department of Defense
DU	Depleted Uranium
ECR	Environmental Comments and Recommendations
EOD	Explosive Ordnance Disposal
ESA	Endangered Species Act
ft	Feet
HAP	Hazardous Air Pollutant
ICBM	Intercontinental Ballistic Missile
KEEP	Kwajalein Environmental Emergency Plan
KMISS	Kwajalein Missile Impact Scoring System
kg	Kilogram
km	Kilometer
lb	Pounds
LCU	Landing Craft Utility
LIDSS	Lawrence Livermore National Laboratory Independent Diagnostics Scoring System
LLNL	Lawrence Livermore National Laboratory
m	Meter
mi	Mile
Mk	Mark
MMIII	Minuteman III
NCA	Notice of Continuing Activity
NPA	Notice of Proposed Activity
NMFS	National Marine Fisheries Service
nmi	Nautical Mile
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
PTS	Permanent Threshold Shift
RMI	Republic of the Marshall Islands
RMIEPA	Republic of the Marshall Islands Environmental Protection Authority
RS	Reentry System
RSL	Regional Screening Level
RTS	Ronald Reagan Ballistic Missile Defense Test Site
RV	Reentry Vehicle
SOSBI	Species of Significant Biological Importance

ABBREVIATIONS AND ACRONYMS (CONTINUED)

TT	Thrust Termination
TTS	Temporary Threshold Shift
U	Uranium
UES	USAKA Environmental Standards and Procedures
US	United States
USAF	United States Air Force
USAFGSC	US Air Force Global Strike Command
USAG-KA	United States Army Garrison-Kwajalein Atoll
USAKA	United States Army Kwajalein Atoll
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
UXO	Unexploded Ordnance
VAFB	Vandenberg Air Force Base
$\mu g/m^3$	Micrograms per cubic meter

1.0 TECHNICAL DESCRIPTION OF ACTIVITY

Note: The following information was obtained from the Supplemental Environmental Assessment for Minuteman III Program, In Process, 2015.

1.1 Overview

The Department of Defense (DOD) is extending the life of the existing force of Minuteman III (MMIII) ICBMs and including a Fuze Modernization program using the same missile platform and infrastructure support. As a life-extension action, the MMIII weapon system will continue through year 2030 with up to four annual MMIII flight tests, and additionally up to four Fuze Modernization flight tests over a four-year period. The four Fuze Modernization flight tests are currently planned for first or second quarter FY19, FY20, FY21 and FY22. All flight tests will be from Vandenberg Air Force Base (VAFB), California, to the Kwajalein Missile Impact Scoring System (KMISS), Ronald Reagan Ballistic Missile Defense Test Site (RTS) at USAG-KA in the RMI. Flight tests are necessary to ensure the safety, accuracy, and reliability of the MMIII and Fuze Modernization systems.

1.2 Minuteman III Description

The MMIII ICBM consists of five major sections: the three-stage solid propellant booster, the propulsion system rocket engine, the missile guidance set, the Model or MOD 7 instrumentation wafer (flight test configuration only), and the reentry system. The missile is approximately 59.9 feet (ft) [18.3 meters (m)] long with a maximum diameter of 5.5 ft (1.7 m), and weighs approximately 79,400 pounds (lb) [36,000 kilograms (kg)].

The payload section on top of the MMIII missile is referred to as the reentry system (RS). Inside the RS, the Support Payload Bulkhead provides a structural support base for one to three reentry vehicles (RVs) (Figure 1-1), and carries the electronics needed to activate and deploy the RVs in flight.

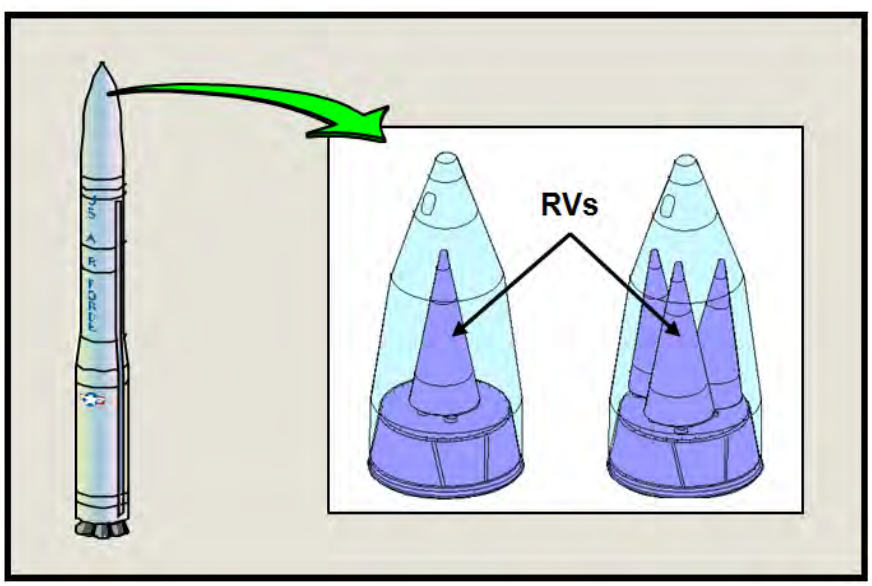

Figure 1-1. Minuteman III Reentry System

In its current configuration, the MMIII RS employs either the Mark (Mk) 12A or Mk 21 RV. For the MMIII flight tests conducted annually from VAFB to USAG-KA, the operational RVs are

replaced with one to three test RVs (one Mk 21 or up to three Mk 12A RVs), and for the Fuze Modernization flight tests, the Mk 21 fuzes will be replaced with modified arming and fuzing assemblies and ultimately the Mk 21 Fuze replacement system. The test RVs do not contain any fissile materials; however, they do contain varying quantities of hazardous materials, including batteries, high explosives, asbestos, beryllium (Be), depleted uranium (DU), and other heavy metals. All test RVs typically include 0.29 to 22 ounces (8.2 to 624 grams) of asbestos; approximately 0.035 to 0.353 ounces (1 to 10 grams) each of Be, cadmium, and chromium; approximately 4.8 ounces (136 grams) of lead; and an unspecified quantity of DU. In general, only one test RV per year contains high explosives.

To provide electrical power to the MMIII subsystems, several different types of batteries are carried on board the motors, the RS, and other sections of the missile. These include multiple silver-zinc batteries, a single lithium carbon monofluoride battery, and a single lithium silicon/iron disulfide (thermal) battery. Approximately 15 batteries are carried on each MMIII flight test missile (depending on the RS configuration used); each weighing from 1 to 21 lb (0.5 to 9.5 kg). The individual Mk 12A RVs contain one silver zinc battery (weighing approximately 1.6 lb [0.7 kg]), while the Mk 21 RV contains one silver zinc and one thermal battery (for a total battery weight of approximately 2.4 lb [1.1 kg]).

1.3 Flight Test Scenario

Figure 1-2 shows a representative missile flight path and the booster drop zones for a MMIII and Fuze Modernization test missile launched from VAFB towards RTS. Following motor burnout and separation, the spent first-stage motor will splash down in the Pacific Ocean approximately 95 to 140 nautical miles (nmi) (176 to 259 kilometer [km]) off the California coast. Following in sequence, the spent second-stage motor will splash down approximately 785 to 835 nmi (1,454 to 1,546 km) off the coast. As the missile travels along a flight path well north of the Hawaiian Islands, it will reach an apogee several hundred miles in altitude. Prior to this point, the third-stage motor will have separated from the post-boost vehicle. The spent third-stage motor will travel on a ballistic course and break into several pieces during reentry prior to splashing down in the open ocean. The third-stage debris pattern location is determined during the mission design and targeting process such that the third-stage debris will impact safely in the open ocean. The third-stage debris splash-down points vary from approximately 50 to 600 nmi (93 to 1,111 km) northeast of the Marshall Islands in the open ocean, as the post-boost vehicle maneuvers the RV(s) toward designated target point(s) in the vicinity of USAG-KA.

There are six Thrust Termination (TT) port assemblies in the forward end of the MMIII third-stage motor; they are blown out upon achieving a desired missile velocity. The TT port assemblies will fly downrange of the third-stage debris by a distance varying from approximately 110 to 280 nmi (204 to 519 km) (Figure 1-3), depending on the mission reentry angle and the third-stage chamber pressure at the time of TT. Each of the six TT port assemblies contains three components that may survive reentry: the port itself, the port cover, and the charge retainer. Each of the TT port components is less than 1 ft (0.3 m) in diameter, has a mass of less than a pound (0.5 kilograms), and has low ballistic coefficients (approximately 1.9 to 6.3 pounds per square foot [0.09 to 0.30 kilopascals]). Thus, the kinetic energy of each component at impact likewise is very small and will vary between approximately 9.7 and 22.2 foot-pounds (13.1 and 30.1 joules).

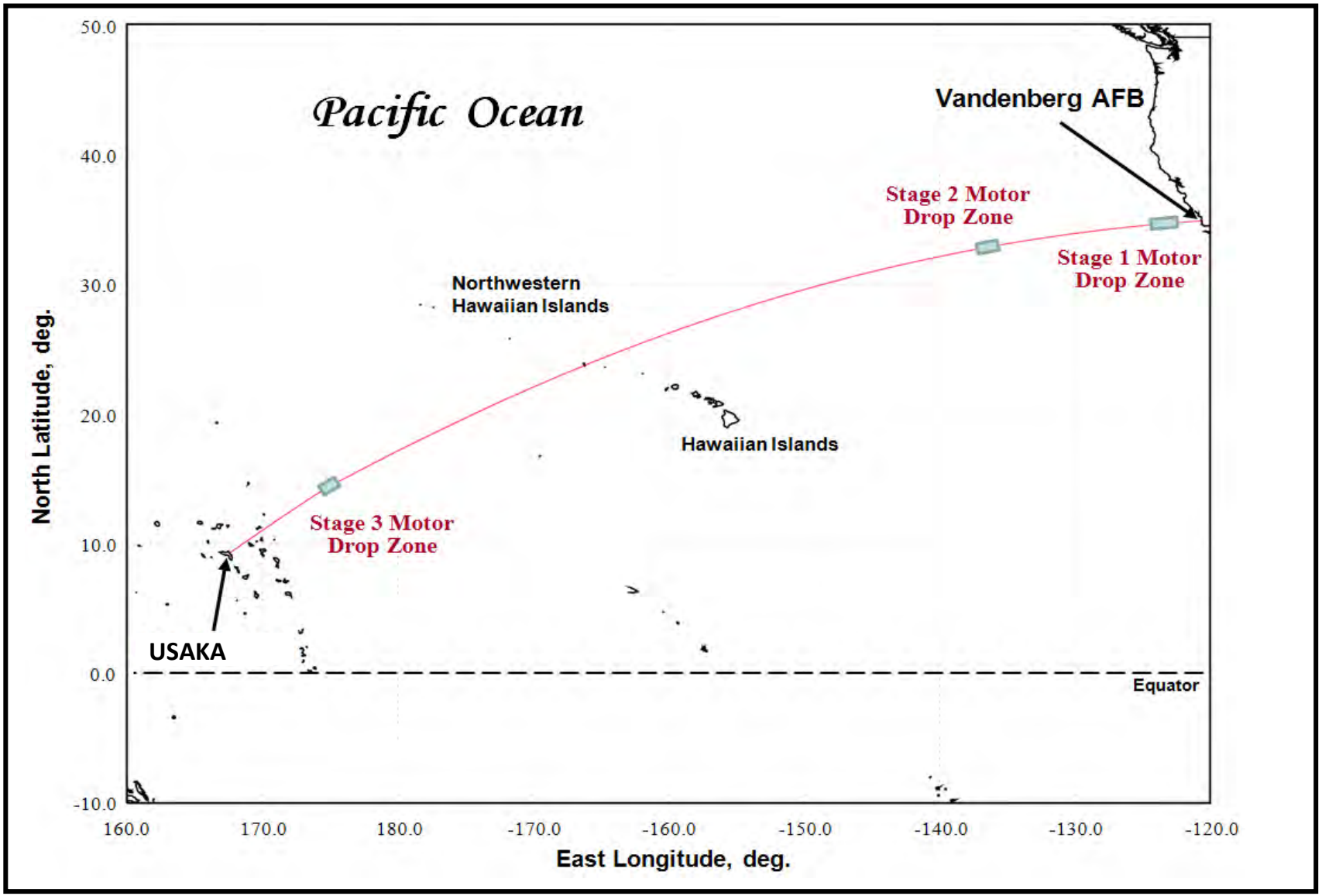

Figure 1-2. Representative Over-Ocean Flight Path and Motor Drop Zones for Minuteman III and Fuze Modernization Flight Tests

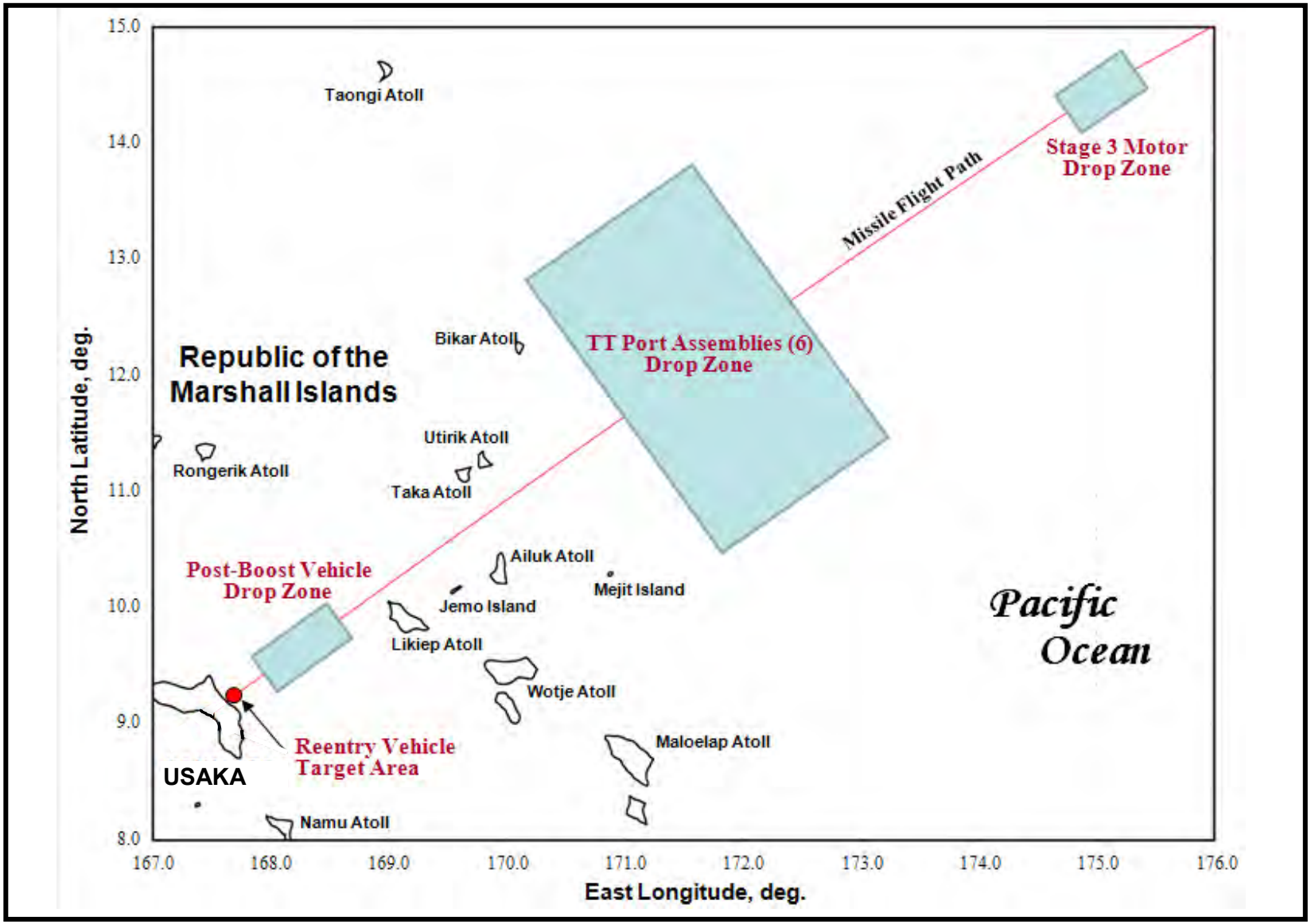

Figure 1-3. Representative Flight Path and Hazard Areas for Minuteman III and Fuze Modernization Flight Tests in the Marshall Islands

1.4 Terminal Phase Preparations and Operations

MMIII and Fuze Modernization flight tests target the vicinity of the Kwajalein Missile Impact Scoring System (KMISS) area east of Gagan Islet for RV impacts (Figure 1-4). The MMIII flight tests involve four to six RV impacts per year, with an additional four RV impacts over four years for the Fuze Modernization program, at USAG-KA. All RV impacts will occur in the ocean waters adjacent to the atoll for the remaining life of the MMIII system and within the five-year cycle of the renewed DEP. The last MMIII RV impact on Illeginni Islet occurred in 2003.

Pre-Test Activities

RTS and USAG-KA support the MMIII missions by providing tracking, sensing, and other technical and logistical support. An extensive array of missile tracking radars and optical sensors are located on several of the islets. Depending on mission requirements, other auxiliary sea-based, aircraft-based, and satellite-based sensors (optical and radar systems) may be involved in tracking the missile and collecting data. Test support is provided primarily by existing government personnel and contractors based at USAG-KA.

Existing optical and electronic sensors and system support equipment are already in place on Gagan Islet and in the KMISS offshore ocean waters. Fixed underwater sensors are located a minimum of 3 nmi (5.5 km) offshore at depths ranging from 7,000 to 12,000 ft (2,134 to 3,658 m). The system is used to score the precision of in-water impacts by RVs and other projectiles. The KMISS system was refurbished beginning in 2014, as analyzed under the *KMISS Refurbishment Environmental Assessmen*t (USASMDC/USAFGSC, 2014) and permitted under the *DEP, KMISS Refurbishment*, DEP-14-001.0 (USAKA, 2014). Additionally, up to 17 Lawrence Livermore National Laboratory (LLNL) Independent Diagnostic Scoring System (LIDSS) rafts with onboard optical and/or acoustical sensors are deployed from a Landing Craft Utility (LCU) vessel, temporarily placed in ocean waters no less than 10 ft (3 m) deep, and maintain position in the water using onboard battery-powered trolling motors. No anchors will be used to maintain raft positions.

Terminal Flight and Impact Activities

Towards the terminal end of each MMIII and Fuze Modernization flight, beyond the third-stage motor drop zone, the post-boost vehicle fragments impact in a predetermined area of the Broad Ocean Area (BOA) northeast of USAG-KA (Figure 1-3). The MMIII flights have no more than six RVs per year and the Fuze Modernization flights have only one RV on each of four test flights. The one to three RVs on each flight continue traveling at hypersonic velocities towards the KMISS area. Individual flight tests conducted at the KMISS site can involve up to three RV impacts. The RVs impact in deep ocean waters at least 3 nmi (5.5 km) offshore of Gagan Islet.

For most tests, the RVs remain intact until impact in water. Approximately once a year, however, a single test RV will contain a conventional explosive charge for purposes of conducting a high fidelity test. During such tests, the exploding RV may detonate upon contact with deep ocean waters. The RV may also detonate at some altitude (airburst) over deep ocean waters. During such airburst tests, the resulting debris impacts in a focused area of the ocean. Trade winds typically blowing from the

east/northeast quickly disperse any RV-related dust. The energy associated with an explosive detonation is 10 times less than the energy associated with a conventional RV impact. (USAFGSC, 2015)

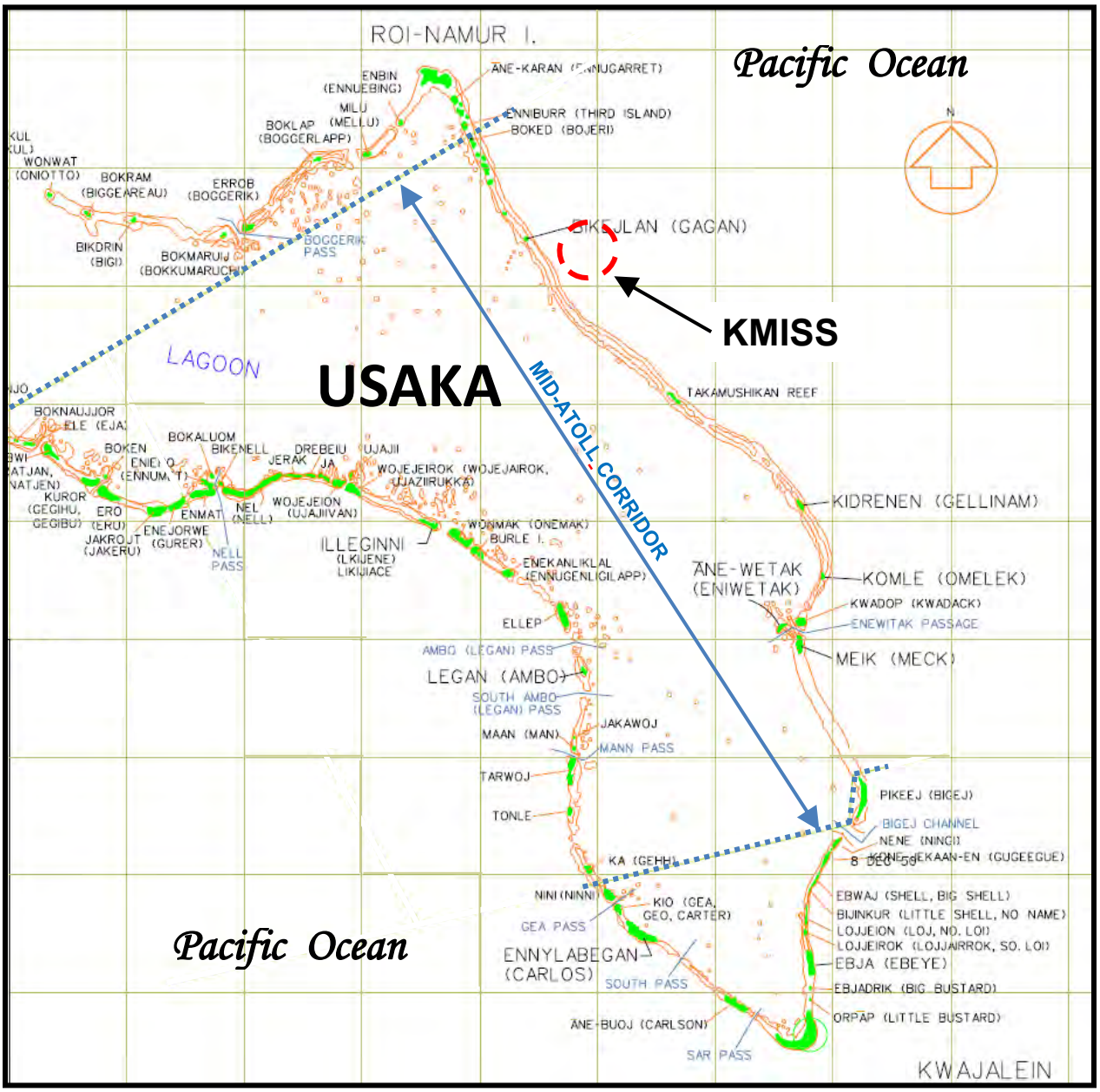

Figure 1-4. General Target Areas for Reentry Vehicle Impacts at USAG-KA

To ensure the safe conduct of the MMIII and Fuze Modernization flight tests, a Mid-Atoll Corridor (MAC) has been established across the Kwajalein Atoll (Figure 1-4). Should a project require a point of impact in the MAC, a number of strict precautions are taken to protect personnel. Such precautions may consist of evacuating nonessential personnel and sheltering all other personnel remaining within the Mid-Atoll Corridor. Notices to Airmen (NOTAMs) and Notices to Mariners (NOTMARs) are published and circulated in accordance with established procedures to provide warning to personnel, including the indigenous population of the Marshall Islands, concerning any potential

hazard areas that should be avoided. Public notices also are published in the local newspaper and are broadcast on television. Visual sweeps of hazard areas are accomplished starting four (4) days prior to each flight test to assist in the clearance of non-critical personnel. Only mission-essential personnel are permitted in hazard areas.

Post-Test Activities

After a MMIII or Fuze Modernization flight test impacting at the KMISS site, the ocean waters are inspected for debris when the mission is anomalous. No post-test cleanup or recovery activities are anticipated for MMIII or Fuze Modernization flight tests conducted at the KMISS site. For nominal (i.e., according to plan) missions, RVs that impact in the deep ocean waters are not recovered. USAG-KA, RTS, USAF and LLNL personnel would recover the free-floating sensor rafts using an LCU vessel.

1.5 Mitigation and Conservation Measures

The USAF has developed and implemented mitigation and conservation measures to minimize the impacts of the MMIII flight tests on the environment. Many of these mitigation and conservation measures have evolved over time through consultation with NMFS and USFWS for the MMIII flight tests and other similar USAF activities in the Action Area, such as the Conventional Strike Missile program.

The 2005 consultation for the MMIII flight test program resulted in 2005 BO prepared by USFWS. This BO contained nondiscretionary and discretionary conservation measures and nondiscretionary reasonable and prudent measures, with implementing terms and conditions aimed at minimizing effects on the green sea turtle. The measures in the BO were captured in the 2005 MMIII DEP and are described below with current information about implementation status and methods. The mitigation and conservation measures for the MMIII and Fuze Modernization flight tests will be updated and defined in detail as part of the MMIII DEP renewal process.

Most of the conservation measures in the 2005 BO concerned the establishment of a sea turtle nesting preserve at Eniwetak Islet within USAG-KA. The USAF, in coordination with the RMI, and USFWS, agreed to support establishment of the preserve, to initiate consultation with the RMI to establish protocols to ensure that unauthorized personnel will not have access to Eniwetak, to inspect the beaches at Eniwetak Islet monthly for sea turtle nesting success during peak nesting periods (May to November), and to maintain nesting beaches at Eniwetak Islet by removing marine debris or other hazards that may impede female haul-out, nesting, egg incubation, and hatchling migration to the ocean (USFWS 2005). Since preparation of the 2005 BO, the sea turtle nesting preserve at Eniwetak has been established and the other measures have been met. The USAF plans to continue to fund and support the preserve through 2030. The Eniwetak Conservation Area Management Plan (Kwajalein Range Services 2007) contains a detailed description of the conservation activities that the USAF supports in maintaining the preserve.

The remaining conservation measure directed USAG-KA to inspect beach areas for active nests at Illeginni Islet before each RV impact (USFWS 2005). In October 2016, the USAF made a request that "the possibility of up to five land impacts at Illeginni Islet for the remaining life of the MM III system….requirement be removed as we no longer target the Illeginni Islet."

The 2005 BO included an incidental take statement for green turtles. Incidental take may occur in the form of harm to or harassment of the breeding success or loss of up to three green turtle nests or injury or loss of up to 300 eggs or hatchlings per year as a result of project-related RV impacts and cleanup activities (USFWS 2005). Since completion of the BO in 2005, no incidental takes have been identified, and the last MMIII RV impact on Illeginni occurred in 2003. Reinitiation of USFWS consultation would occur if:

- The amount or extent of incidental take of nesting green turtles is exceeded by a MMIII action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take shall cease, pending reinitiation of consultation.
- New information reveals effects of a MMIII action that may affect listed species or critical habitat in a manner or to an extent not considered in the BO.
- A MMIII action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in the BO.
- A new species is listed or critical habitat designated that may be affected by a MMIII action.

The 2005 BO recommended a discretionary conservation action for the USAF to support eradicating all species of rats from Eniwetak Islet and maintaining this islet as a rodent-free environment to encourage sea turtle incubation and hatchling success. The USAF will take steps to eradicate rodents on Eniwetak Islet or Gellinam Islet, depending on the results of a rodent population assessment. The USAF, RTS, and USAG-KA will coordinate with the USFWS before implementing a plan for rodent eradication. If protocols are established and the rodents are eradicated, the USAF, in conjunction with USAG-KA, will monitor the islet to ensure that it remains without rodents for at least two years.

In addition, the USAF and USAG-KA will inspect all project-related cargo and vehicles transiting between islets in the Kwajalein Atoll in order to prevent the further spread of rodents for the duration of the flight-test program (USGSC, 2015). The USAF may conduct a risk analysis of sea turtle exposure to DU and Be at Illeginni, using rats as surrogates and analyzing for DU and Be in their organs, per USFWS conservation recommendations contained in the 2005 BO (USFWS, 2005).

USFWS recommended future studies that will be considered to address data gaps are: additional field surveys to determine species presence, compiling images of RV impact and recovery sites, and coral sampling for uranium uptake. The possibility of using hydrophones for future studies at KMISS will be considered and there will be further analysis of existing hydrophone data collected at Illeginni.

Other relevant mitigation and conservation measures are as follows (Teledyne 2005, 2011; USGSC, 2015):

- USAG-KA personnel would conduct a helicopter or fixed-wing aircraft overflight of the impact vicinity three times over the week preceding a flight test and as close to launch as safely practical to survey for marine mammals and sea turtles. The final overflight would be within one day of the proposed launch. If personnel observe marine mammals or sea turtles in the vicinity, they would report such findings to the USAG-KA Environmental Office.
- Vessel operations would not involve any intentional discharges of fuel, toxic wastes, or plastics and other solid wastes that could harm marine life.
- To avoid impacts on coral heads, sensor rafts would not be located in waters less than 10 ft (3 m) deep.

- During ocean travel to and from impact and test support areas, ship personnel would monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators would also adjust their speed based on expected animal densities, and on lighting and turbidity conditions.
- If the USAF were to ever to consider land impacts in the future, field screening and soil testing for Be and DU would need to be done to determine the distribution of these substances following any land impact. Testing results that exceed UES criteria would require remediating and removing soil.
- Site recovery and cleanup would be performed for shallow water impacts. To minimize long-term risks to marine life, all visible project-related debris would be recovered during post-test operations, including debris in shallow lagoon or ocean waters by range divers. In all cases, recovery and cleanup would be conducted in a manner to minimize further impacts on biological resources.
- Should any missile components or debris impact areas of sensitive biological resources (i.e., coral reef), a USFWS or NMFS biologist would be allowed to provide guidance and/or assistance in recovery operations to minimize impacts on such resources. To the greatest extent practicable, when moving or operating heavy equipment on the reef during post-test clean up, protected marine species including invertebrates will be avoided or effects to them will be minimized. This may include movement of these organisms out of the area likely to be affected.
- Post-test overflights of the impact area would be conducted to survey for dead or injured cetaceans and sea turtles. Although unlikely, any dead or injured marine mammals or sea turtles sighted would be reported to the USAG-KA Environmental Office, who would then inform NMFS and USFWS. USAG-KA aircraft pilots otherwise flying in the vicinity of the impact and test support areas would also report any opportunistic sightings of dead or injured marine mammals or sea turtles.
- Within one day following testing, NMFS and USFWS biologists would be allowed to assist USAG-KA in recovering and rehabilitating any injured sea turtles found.
- During post-test recovery and cleanup, should USAG-KA personnel observe endangered, threatened, or other species requiring consultation moving into the area, work would be delayed until such species were out of harm's way or leave the area.
- In all cases, recovery and cleanup operations would be conducted in a manner to minimize further harm to biological resources.

The 2015 consultation with NMFS for the MMIII flight test program resulted in a 2015 BO prepared by NMFS. Incidental take may occur in the form of loss of up to 117 top shell snails or loss of up to 49,645 colonies within the 15 species of UES consultation corals as a result of project-related payload impacts. NMFS determined the level of anticipated take for the MMIII flight test program is not likely to result in the jeopardy of any of the UES consultation species expected to be taken. This BO contained nondiscretionary conservation measures and nondiscretionary reasonable and prudent measures, with implementing terms and conditions aimed at minimizing effects on corals and top shell snails. These are captured in the 2015 MMIII DEP renewal.

Additionally, NMFS recommended additional studies and capabilities development for USAG-KA as follows:

- USAF continue to work with NMFS staff to conduct additional marine surveys around Illeginni Islet to develop a comprehensive understanding of the distribution and abundance of species there.

- USAF continue to work with NMFS staff to conduct marine surveys at additional sites around all of the USAKA islets and in the mid-atoll corridor to develop a more comprehensive understanding of the distribution and abundance of species and habitats at USAKA.
- USAF conduct regular (monthly or quarterly if possible) surveys of the KMISS, the ocean target area off Illeginni, and the RMI broad ocean area to develop a better understanding of the distribution and abundance of marine mammals and other species in the area.
- USAF adapt the KMISS to support acoustic monitoring for marine mammals in the target area, and to install hydrophones off the ocean side of Illeginni for similar marine mammal monitoring.
- USAG-KA develop capacity and procedures for responding to marine mammal and turtle strandings.
    - Acquire required permits and training to perform necropsies and/or to take and transport tissue samples.
    - Develop professional relations with qualified federal agencies and universities to capitalize on samples and information gained at USAKA.
    - Develop mechanisms to collect and disseminate the information.

2.0 DESCRIPTION OF ACTIVITY ENVIRONMENTAL SETTING

Kwajalein Atoll is located in the western chain of the RMI in the West Central Pacific Ocean. The atoll is dotted with a string of approximately 100 islets that enclose the world's largest lagoon (1,100 square miles (square mi) [2,849 square km]). Kwajalein Atoll is located 2,300 mi (3,700 km) west/southwest of Hawaii. Lagoon depths are typically 120 to180 feet (37 to 55 m). The reefs and islets of the atoll consist of coral rock and sediments lying atop submarine volcanoes that were active over 150 million years ago. As the volcanoes gradually subsided, coral reefs slowly grew upward to the ocean surface The land surfaces of the Marshall Islands formed some 2,000 to 5,000 years ago, a period when sea levels rose and dropped, exposing the reef islets that create the lagoon. The islands are dynamic structures that continue to move, grow, and retreat in response to changing seas and vegetation, and have been modified by human habitation since shortly after their emergence above sea level, with particularly rapid change in recent years. (USAG-KA HPP, 2006)

Gagan Islet is located on the northeast side of the Kwajalein Atoll and is bounded on the south and west by the lagoon and on the north and east by the Pacific Ocean. The KMISS is a deep ocean sensor array located approximately 3.2 to 8.6 nmi (5.9 km to 15.9 km) east of Gagan Islet. The array consists of hydrophones located at deep ocean depths between 7,000 and 12,000 ft (2,134 to 3,658 m). Built in 1996, the array has been degrading since 2002 and refurbishment was completed in 2015. (USASMDC/AFGSC, 2014)

3.0 ENVIRONMENTAL AREAS POTENTIALLY AFFECTED BY ACTIVITY

(Intent: Addresses all areas with the potential to be affected by the activity. States only those areas possibly affected. Does not discuss how the area will be protected. Environmental areas addressed in the UES: air quality, water quality and reef protection, drinking water quality, endangered species and wildlife resources, ocean disposal, material and waste management, and cultural resources.)

3.1 Air Quality

MMIII and Fuze Modernization RVs contain varying quantities of hazardous materials, including Be and DU. Both Be and DU can present toxicity health concerns, primarily when inhaled as hazardous air pollutants (HAPs). Although DU also has some radioactive properties, it is not a radiological health concern. Long-term environmental sampling and monitoring of RV impact areas have shown that air concentrations of Be and uranium (U) have not exceeded UES standards. Following several MMIII RV tests at Illeginni Islet, air concentrations of Be did not exceed 1×10^{-5} micrograms per cubic meter ($\mu g/m^3$). Additionally, air concentrations of U at Illeginni did not exceed 8.0×10^{-5} $\mu g/m^3$ or 2.7×10^{-17} microcuries per milliliter (as derived from U-238). Such concentrations are at or near background levels, and thus present no health-related concerns. (Robison et al, 2013) Although there may be a temporary elevation in airborne Be and DU levels, the pollutants would be blown out to sea.

As of October 2016, the USAFGSC requested that land impacts at Illeginni Islet be removed from consideration because Minuteman III flight testing would no longer target Illeginni Islet.

3.2 Water Quality and Reef Protection

MMIII and Fuze Modernization RVs will impact in the ocean at the KMISS site near Gagan Islet, Turbidity may be temporarily increased. Some RV debris, including small amounts of Be and DU and other contaminants may be released into the ocean area. Vessel operations would not involve intentional discharges of fuel, toxic wastes, or plastics or other solid wastes that could harm marine life.

3.3 Endangered Species and Wildlife Resources

The surrounding ocean waters of the KMISS are home to a number of threatened, and endangered species, and other protected species. There are 31 cetacean (whale and dolphin), 5 sea turtle, 2 fish, 19 coral, and 2 mollusk species requiring consultation that could potentially be affected by the MMIII and Fuze Modernization flight tests. There is no designated critical habitat for any of these species present within project areas evaluated for these programs. (USAFGSC, 2015)

Cetaceans are the only marine mammals documented in the planned impact areas. Cetaceans, sea turtles, and fish may be found in deeper off-shore waters. Many of the cetacean species occurring in the RMI have the potential to occur around near the KMISS. (USAFGSC, 2015)

Within the KMISS impact area, adult corals and mollusks do not occur, while cetaceans, sea turtles, and fish, including scalloped hammerhead sharks, may be encountered. Thirty-one species of cetaceans may occur in the deep ocean waters near USAG-KA KMISS. These species are sometimes seasonal in occurrence because of unique migration patterns. Seven ESA-listed cetaceans have the potential to occur in the KMISS area. Due to the migratory nature of cetaceans, it is difficult to determine the densities of each of the species at any particular moment. (USAFGSC, 2015)

Site preparation, placement of portable camera stands, the impact of the MMIII and Fuze Modernization RVs, and post-impact clean-up could affect protected species and habitats, both terrestrial and marine. Noise, airborne vibration, and underwater shock waves from the RV impacts would predictably startle birds and other wildlife resources on land or water and could affect behavior and hearing sensitivity. Preparation activities on Gagan should be conducted with awareness of the possible presence of shorebirds and their eggs.

3.4 Material and Waste Management

RV debris may contain small amounts of hazardous materials and heavy metals. Ocean waters at KMISS could receive contamination from hazardous materials due to accidental spills of fuels and lubricants from vehicles or ships used during the placement of equipment, debris clean-up, and post-impact monitoring activities.

4.0 ANALYSIS OF EFFECT OF ACTIVITY ON ENVIRONMENTAL AREAS IN THE ABSENCE OF ENVIRONMENTAL CONTROLS

(Intent: Referring to each of the areas in Section 3, provides the consequences of not having environmental controls for that area.)

4.1 Air Quality

In the absence of controls, no impacts to air quality will be expected from KMISS impacts.

4.2 Water Quality and Reef Protection

In the absence of environmental controls, no impacts will be expected from MMIII RV impacts at KMISS.

4.3 Endangered Species and Wildlife Resources

In the absence of environmental controls the test and clean-up activities could result in impacts to fish, corals, sea turtles, migratory birds, and loss of habitat for sea turtles, and seabirds and shorebirds. Without monitoring during vessel movements, impacts could result to marine mammals or sea turtles near KMISS.

4.4 Material and Waste Management

If not removed, MMIII and Fuze Modernization RV impact debris could impair the terrestrial areas and the shallow marine environment. If not prevented, spills of equipment fuels, lubricants, and hazardous materials could contaminate the land, groundwater, and reef or ocean waters, and pose a health threat to wildlife resources and personnel.

5.0 TECHNICAL DESCRIPTION AND ANALYSIS OF ENVIRONMENTAL CONTROLS USED IN ACTIVITY

(Intent: Presents the methods to be employed to protect the areas discussed in Section 3 and 4.)

5.1 Air Quality

Pre-test preparations and support would include the use of mobile and non-road sources of air emissions. Emission sources could include a combination of vessels, aircraft, trucks, backhoes, and/or portable power generators. Emission of criteria pollutants and greenhouse gases from these sources would be minor and temporary. There should not be any exceedance of UES air quality standards, no new permanent stationary sources of emissions, and therefore no required changes to the DEP for air emissions [*DEP: Air Emissions from Major, Synthetic Minor, and Industrial Boiler Stationary Sources,* USAKA, DEP-11-001.0, 2013]. Equipment setup on Gagan Islet, if any, should require little or no soil excavation; thus, there should be no fugitive dust inhalation concerns.

5.2 Water Quality and Reef Protection

For inadvertent MMIII and Fuze Modernization RV impacts on the reef that result in craters being formed, recovery and cleanup operations in shallow waters could require the movement of a backhoe or other equipment out onto the reef flats to the impact site. The action of driving heavy equipment and personnel on foot could further harm or kill protected mollusks, sponges, and hard corals along the reef. To minimize adverse effects, LLNL, USAG-KA, and/or RTS personnel would coordinate with the USFWS and NMFS to determine access corridors to the crater site in order to avoid accidental impacts to protected and sensitive biological resources. Any dredging or filling activities would require a project description sheet (*DEP: Dredging and Filling*, DEP-10-002.0, Figures 1 and 2, USAKA, 2011) to be submitted to the USAG-KA Environmental Engineer. For deeper waters in the ocean or lagoon, a ship with divers is used. Because craters form only in shallow waters less than 10 ft (3.0 m) deep, and no other damage to coral formations has been observed below 20 ft (6.1 m) (USAF, 2004), RV impacts and post-test recovery operations in the deeper waters of the atoll lagoon and on the ocean side are much less damaging. In all cases, recovery and cleanup operations would be conducted in a manner to minimize any further impacts.

5.3 Endangered Species and Wildlife Resources

General

Actions would be taken to minimize disturbance to sensitive resources, such as posting signs designating sensitive areas on the islet, and providing all personnel with information on the need to protect sensitive species. Prior to their arrival, personnel would be briefed on the need to respect and protect sensitive islet resources and to avoid harassment of sensitive species. Onsite supervisors would ensure that personnel comply with the protection objectives. Personnel would be instructed to stay on existing roads and paths where possible, avoid areas designated as avian nesting or roosting habitat, and to avoid all contact with any nest that may be encountered. Operational and emergency lighting would be shielded and pointed down to minimize the potential for impacts to migratory birds and sea turtles.

Terrestrial

After MMIII and Fuze Modernization RV impacts, USAF and biologists would survey the impact area and the near-shore waters within four (4) days after the test for any injured wildlife or damage to sensitive habitats. In addition, USFWS and/or NMFS biologists would provide guidance to USAG-KA in the recovery and rehabilitation of any injured migratory birds or sea turtles found. During inspections, biologists would assess any sea turtle mortality. The USAF would submit a report to USAG-KA at the end of each calendar year involving shallow water impacts that describes any sea turtle take that may have occurred. The USAG-KA Environmental Engineer would then forward the report to the USFWS Pacific Islands Fish and Wildlife Office.

To minimize long-term risks to birds and marine life, all visible RV debris would be recovered. This could include the recovery of visible debris in the shallow ocean waters by RTS divers. Should any debris impact in areas of sensitive biological resources (i.e., coral reef), then USFWS and NMFS biologists would provide guidance and/or assistance in recovery operations to minimize impacts on such resources.

Ocean and Reef

For impacts at KMISS, there should be minimal risk of impacts to the coral reef and marine life. Coral reef impact would be inadvertent and is not expected. As a precaution to minimize potential impacts on marine mammals and sea turtles, USAG-KA and/or RTS personnel would conduct helicopter or fixed-wing aircraft over-flights of the KMISS area at least three times over the week prior to the flight test. If personnel observe marine mammals and/or sea turtles in the impact vicinity, they would report such findings to the USAG-KA Environmental Engineer, the RTS Range Directorate, and the Flight Test Operations Director for consideration in approving the launch. During travel to and from Gagan Islet and the KMISS area, ship personnel would monitor for marine mammals and sea turtles to avoid potential ship strikes and report any observations to the USAG-KA Environmental Engineer. Vessel operators also would adjust their speed based on expected animal densities, and on lighting and turbidity conditions. Vessel operations would not involve intentional discharges of fuel, toxic wastes, or plastics or other solid wastes that could harm marine life. To minimize impacts during post-test operations, NMFS and USFWS could provide guidance or assistance, or both, during recovery and cleanup. In all cases, recovery and cleanup would be conducted in a manner to minimize further harm to consultation species.

Sensors on rafts would be located in the surrounding ocean waters. To prevent collision with coral heads the rafts would be located in no less than 10 feet of water. The rafts would be positioned as close to launch time as safely practical. The position of the rafts would be maintained by use of on-board battery powered electric motors. No anchors would be used to maintain raft positions. After completion of the flight test, the rafts would quickly be recovered.

For RV ocean impacts in the KMISS area, post-test operations would include a helicopter or fixed-wing aircraft overflight of the impact area by USAG-KA and/or RTS personnel within several hours after the test to survey for any dead or injured marine mammals and sea turtles. The USAG-KA Environmental Engineer would be notified of any findings and the information then forwarded to the NMFS, Pacific Islands Regional Office.

Exposure to Contaminants

With the general exception of one MMIII test RV per year, the RVs do not contain any ordnance and, therefore, do not present a risk of perchlorate contamination from impacts. The one RV per year that would contain small amounts of high explosives would detonate in an airburst or upon contact in deep ocean waters. Detonation of the RV would consume the explosives, thus eliminating any perchlorate contaminants. As a result, the risk of marine species and migratory birds to be harmed by RV contaminants is low.

Sonic Boom Overpressures

As each descending test RV approaches Kwajalein Atoll at hypersonic velocity, sonic booms are initially generated over a very broad area of the open ocean northeast of the Atoll and continue in a southwesterly direction towards the designated target area, where the sonic boom footprint narrows to just a few miles on either side of the flight path. At the ocean surface, the in-air sound pressure levels for the sonic booms vary from 91 decibels (dB) at the eastern-most range and increase to 150 dB at the western-most range, close to the point of impact. Equivalent underwater overpressure levels range from 117 to 176 dB. In the KMISS area, the sonic boom footprint would occur almost entirely over open ocean. The duration for sonic boom overpressures produced by the RVs ranges from 40 milliseconds where the boom is strongest to 124 milliseconds where it is weakest.

Sonic boom overpressures may affect ESA-listed cetaceans, sea turtles, or scalloped hammerheads in the open ocean. Underwater sound levels would not exceed thresholds for injury or death, Temporary Threshold Shift (TTS), or Permanent Threshold Shift (PTS) for any consultation species. Only four flight tests would be conducted annually for MMIII, with an additional four RV impacts over four years for the Fuze Modernization program. Potential exposure to sonic boom overpressures occurs within a limited area and for short duration (40 to 124 milliseconds). Consultation cetaceans, sea turtles, and scalloped hammerheads along the projected flight paths occur in low densities and patchy distributions. Although loud sounds may cause consultation species to quickly react, briefly altering their normal behavior, these sounds would not cause long-term effects; and the sound levels created by a sonic boom are not likely to be sensed by a scalloped hammerhead due to the short duration of the sound and the generally poor hearing ability of the shark.

On Gagan Islet, in-air sound pressure levels for an RV impact would peak around 150 dB. Such noise levels are expected to cause some startle and temporary flush responses in migratory birds.

Direct Contact and Shock/Sound Wave from the Impact of Missile Components

An RV impacting in the ocean at the KMISS would result in underwater shock/sound waves comparable to the splashdown of the MMIII rocket motors in the BOA, but with much greater force because of the vehicle's hypersonic velocity at the time of impact. Whether or not the test RV contains a high explosives package (generally only once a year) makes little difference in the formation of shock/sound waves. The resulting underwater waveform in either case would last only about 10 to 30

milliseconds. As the shock/sound wave radiates away from the impact point, sound levels would decrease, as would the risk for injury or auditory effects.

Population estimates for marine mammal species are not available for the Kwajalein Atoll waters. However, when applying relatively conservative data from surveys conducted around the Hawaiian Island Pacific Region, the probability for an RV underwater shock/sound wave to induce PTS in cetaceans in the ocean is less than 3.4×10^{-5} per impact event; for TTS, the probability increases to approximately 6.8×10^{-3} per RV impact event. Probabilities inducing PTS and TTS in sea turtles would be considerably less. Animal densities in the ocean areas of Kwajalein Atoll, however, are expected to be lower and therefore the probabilities would be lower. (USAFGSC, 2015)

5.4 Material and Waste Management

Other than the use of fuels and lubricants for operating transportation and other support equipment, there would be limited use of hazardous materials at USAG-KA in support of MMIII pre-test preparations. Accidental spills from support equipment operations would be contained and cleaned up in accordance with the Kwajalein Environmental Emergency Plan (KEEP) requirements. All hazardous and non-hazardous wastes would be properly disposed of in accordance with the UES.

Following the RV's breakup on impact, hazardous materials contained in the RV are rapidly diluted in ocean waters and/or sink to the ocean floor.

An inadvertent RV impact in shallow water (less than 10 ft [3.0 m] deep) would form a smaller crater, generally 10 to 15 ft (3.0 to 4.6 m) wide and 2 to 4 ft (0.6 to 1.2 m) deep. At impact, the RV generally disintegrates, releasing small quantities of heavy metals including Be, cadmium, chromium, lead, DU, and asbestos. Soil sampling at Illeginni Islet has shown that concentrations of Be and U in soil in some parts of the relatively small deposition area of Illeginni Islet do exceed their natural background concentrations in coral atoll soils, a result of prior MMIII RV land impacts (Robison et al, 2006). However, the latest observed soil concentrations on the islet do not exceed the US Environmental Protection Agency (USEPA) Regional Screening Levels (RSLs) for residential levels for assessing the need for soil cleanup under the UES (Robison, et al, 2013). To date, the last MMIII RV land impact at Illeginni Islet occurred in 2003. In October 2016, USAFGSC requested that land impacts at Illeginni Islet be removed from consideration because Minuteman III flight testing would no longer target Illeginni Islet. Land impacts at Illeginni Islet therefore are not required for at least the next 5 years , the duration of this DEP.

For test RV ocean impacts, recovery operations generally are not attempted at depths greater than 100 ft (30 m). or shallow water impact at Gagan Islet, precautions are taken to secure the area from inadvertent traffic until recovery operations are completed. Cleanup and recovery procedures are conducted in accordance with established procedures identified in LLNL's *Minuteman III Recovery Plan for USAKA/RTS Illeginni Island* (Yakuma, 2012).

6.0 DISPERSION MODEL FOR MODELING AIR SOURCES

(Intent: Applicable if an air source is being built or emissions are related to or will result from the activity.)

The activities associated with MMIII activities will not involve operation of permanent major stationary sources and their related air emissions. Air modeling will not be required for the activities described in this NCA.

7.0 ANALYSIS OF WASTE DISCHARGE FOR POINT-SOURCE WASTE DISCHARGES TO WATER

(Intent: Explains source and content of any waste that will be part of a point source discharge. Every effort should be made to not create a point source discharge; explains how it will be avoided.)

The activities associated with MMIII activities as described in this NCA will not generate point-source discharges; therefore, analysis of waste discharges will not be required.

8.0 INFORMATION FOR HAZARDOUS WASTE TREATMENT, STORAGE, OR DISPOSAL FACILITIES

(Intent: Treatment, storage and disposal of hazardous waste are prohibited at USAG-KA/RTS. The text should reaffirm that such will not take place with the activity. If hazardous waste will be created due to the activity, it should be identified and how it will be removed from USAG-KA.)

Hazardous waste will not be treated, permanently stored, or disposed of at USAG-KA. All spills will be cleaned-up in accordance with the KEEP and mission specific emergency response plans.

Any hazardous waste recovered and removed will be properly containerized and shipped to Kwajalein for final shipment to the United States for proper disposal, in accordance with UES Section 3-6.6.5. Any RV debris will be packaged and shipped to CONUS for analysis and disposal.

9.0 BIOLOGICAL ASSESSMENT IF ENDANGERED RESOURCES MAY BE AFFECTED

(Intent: Addresses strictly endangered resources, as defined by UES §3-4. Endangered resources at USAG-KA are all marine. Explains precautions to protect endangered resources.)

Biological Assessments (BA) were prepared (2005 and 2015) to determine the extent to which the MMIII flight tests and supporting activities may affect special status species. In its 2005 BO of the effects of the MMIII flight test program on nesting habitat for green turtles (*Chelonia mydas*) at Illeginni Islet, the USFWS supported the determination that MMIII test and post-test cleanup activities (along with reasonable and prudent measures and conservation measures, including the protection of sea turtle nesting habitat on Eniwetak Islet) are not likely to jeopardize the continued existence of the species. Since the only change in the action is to extend the number of years of tests and to discontinue land impacts at Illeginni Islet, and there are no changes to the conditions used in the USFWS consultation for green sea turtles, the USAF will abide by the 2005 BO through 2030 and consultation will not be reinitiated with the USFWS.

The 2015 BA was provided to NMFS to aid in the agency's development of their BO of the continued MMIII tests at USAG-KA. The 2015 BO is appended to the DEP. Effects on mollusks in the near-shore marine environment also are possible, but are considered minimal due to low risk of reef impacts. Acoustical impacts on marine mammals are also possible; however, the ocean areas that could be affected are extremely limited. Effects on coral and reef fish in the near-shore marine environment

also are possible, but are considered minimal due to low risk of reef impacts; if affected, no jeopardy to the species at USAG-KA would result.

10.0 INFORMATION ON RECEIVING-WATER QUALITY FOR WATER DISCHARGES

(Intent: Discusses the quality of water where a point source (including stormwater) is being introduced. Only existing Class B waters can receive point sources (water classification maps, UES Appendix 3-2A).)

Water discharges are not associated with this activity; therefore information on receiving water quality is not required.

11.0 INFORMATION ON MARINE LIFE, CURRENTS, AND OTHER CHARACTERISTICS OF OCEAN DISPOSAL SITE

(Intent: Applicable for ocean disposal activities.)

There will be no intentional ocean disposal associated with the flight tests described in this NCA and companion DEP. Material and debris resulting from routine tests conducted at or near USAG-KA are not considered ocean disposal under the standards of the UES §3-5.5(a)(3).

12.0 INFORMATION ON MARINE LIFE AND ENVIRONMENT IN DREDGING OR FILLING AREAS

(Intent: Applies if doing dredging or filling activities in waters of the RMI.)

Dredging and shoreline reinforcement are not anticipated for preparation or as a consequence of MMIII test RV impacts; therefore, associated information on marine life and environment in dredging and filling areas is not required.

13.0 SPECIES AND NUMBERS OF MIGRATORY BIRDS AND OTHER WILDLIFE RESOURCES AND HABITAT THAT MAY BE TAKEN

(Intent: Provides complete discussion for migratory birds, wildlife resources, and habitats that may be "taken" because of the activity. "Take" and "taking" are defined in the UES.)

The RV impacts, equipment noise, and the presence of personnel could temporarily affect migratory birds and wildlife resources. Consultation with the USFWS for the MMIII flight tests is not warranted as there is no substantive change from the 2005 BO, which is appended to the DEP. Additionally, USFWS personnel were present to observe and document impacts from the Advanced Hypersonic Weapons (AHW) Demonstration Test, which included an RV land impact on Illeginni in November 2011. In the USFWS Trip Report (USFWS, 2011), USFWS personnel stated there were no observed impacts to sea turtle resources and no impacts to other wildlife resources from the test were reported.

Equipment noise-related impacts could include displacement of wildlife, and short-term disruption of daily/seasonal behavior. No migratory birds or other wildlife resources are expected to be harmed by the proposed MMIII test flights and their related pre- and post-test activities. Efforts will be made to minimize disturbance to sensitive resources, such as posting signs designating sensitive areas on the islet, and providing personnel with information on the need to protect and avoid harassment of sensitive species. Personnel will be instructed to avoid areas designated as avian nesting or roosting habitat.

14.0 NOTIFICATION

(Intent: Provides emergency notification and any other type of notifications that are applicable to the activity.)

14.1 Emergency Notifications

Within 24 hours of discovery of an emergency environmental condition, USAG-KA shall notify the public affected or potentially affected by the condition and the Appropriate Agencies by the most expeditious means available. Emergency environmental conditions are those that pose an immediate threat to human health and safety, incidental take of protected species or habitats, and unplanned impacts to sensitive natural and cultural resources. Within 10 days following emergency notification, USAG-KA shall submit written notification of the event to the Appropriate Agencies that contains, at a minimum, the relevant information described in UES §2-7.2.2.

14.2 Public Notifications

Public notifications shall be made by USAG-KA to advise the public of an activity or action that USAG-KA has taken or is planning. Public notification shall be made through means that are widely available and consulted by the public at USAG-KA and the RMI. This normally includes publication in *The Kwajalein Hourglass* and *The Marshall Islands Journal,* posters or bulletins displayed in public places, announcements on the Kwajalein Range Services Newsline and/or on public television.

15.0 RECORDS KEEPING

(Intent: States how long and where records will be stored.)

The NCAs; Environmental Comments, and Recommendations (ECRs); and DEPs permitting MMIII and Fuze Modernization flight test activities at USAG-KA shall be preserved for the duration of the activity plus 10 years or for 10 years after expiration of the DEP, whichever is less.

16.0 RESOLUTION OF NON-COMPLIANT AREAS

(Intent: Fully explains areas of noncompliance and how the activity will or will not correct the noncompliance.)

Currently, there are no known non-compliant activities associated with the US Government MMIII and Fuze Modernization flight tests at USAG-KA in the RMI, as described in this NCA.

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APPENDIX B

USFWS BIOLOGICAL OPINION 2005

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850
Phone: (808) 792-9400 FAX: (808) 792-9580

In Reply Refer To:
PN-04-246

Colonel Jeffrey C. Smith
U.S. Army, Deputy Chief of Staff, Engineer
U.S. Army Space and Missile Defense Command
P.O. Box 1500
Huntsville, Alabama 35807-3801

Dear Colonel Smith:

Subject: Biological Opinion on the Effects of the Minuteman III Modification on Nesting Habitat for the Green turtle (*Chelonia mydas*).

Dear Colonel Smith:

This responds to your September 15, 2004, request for consultation under section 3-4.5.3 (Procedures for Consultation on Endangered Resources) of the U.S. Army at Kwajalein Atoll (USAKA) Environmental Standards (UES) (8th edition) for the proposed Draft Environmental Assessment (DEA) Minuteman III Modifications (MMII), August 24, 2004. The U.S. Air Force (USAF) is the action agency for this project and is proposing to modify MMIII flight tests in which the re-entry vehicle (RV) portion of the MMIII missile terminates in either the Pacific Ocean (Kwajalein Bight), the shallow marine environment near Illeginni Islet, or on Illeginni Islet, a USAKA-controlled area at Kwajalein Atoll, Republic of the Marshall Islands (RMI). The proposed project is to increase the number of flight tests from 3 or 4 per year by two additional flight tests in fiscal years 2005 and 2006; and beginning in 2006, Mark 12 RVs would be replaced with Mark 21 RVs. This document represents the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) on the effects of the proposed project on the green turtle (*Chelonia mydas*), a federally listed threatened species under the U.S. Endangered Species Act, and USAKA Species of Concern for which consultation is triggered under the UES (section 3-4.5.3).

This BO is based on the following information: 1) the USAF August 24, 2004 DEA; 2) biological literature (see Literature Cited section at the end of the document); and 3) other information sources. Our log number for this consultation is PN-04-246. Copies of pertinent materials and documentation are maintained in an administrative record in our Pacific Islands Fish and Wildlife Office in Honolulu, Hawaii.

Consultation History

August 24, 2004: The USAF released the DEA to the public on August 24, 2004. The DEA serves as the Notice of Proposed Action (NPA) for a Document of Environmental Protection (DEP) and the Biological Assessment (BA) for species consultation under the UES.

September 15, 2004: The Space and Missile Defense Command initiates consultation under the UES based on its determination that the proposed MMIII project may adversely affect green turtle (*Chelonia mydas*) nesting habitat at Illeginni Islet, Kwajalein Atoll, Republic of the Marshall Islands.

BIOLOGICAL OPINION

Description of the Proposed Action

This project description summarizes information taken from the August, 2004 DEA. The proposed action is a modification of an existing program in which MMIII missiles launched from Vandenberg Air Force Base, California, cross the central North Pacific, and impact within the Mid-Atoll Corridor Impact Area, USAKA, Republic of the Marshall Islands. This area includes a broad area of the mid-section of Kwajalein Atoll. The intent of the flight test is to target either the vicinity of Illeginni Isletor the deep ocean east reef locations. Most RVs targeted for the vicinity of Illeginni will impact in the deep ocean area south of Illeginni. A small number of RV flights may impact in the vicinity of Illeginni Island or the reef flats over the life of the program. The action proposes to modify the existing MMIII program with: new hardware for the Mark 21 RV; new electronic signal generators; changes to software programs and data collection systems; modifications to system test and evaluation hardware/software; personnel training; and an evaluation of the modified MMIII missile flight test.

Under normal circumstances, approximately three or four MMIII test flights are conducted each year. Four additional flight tests may be conducted in 2005 and 2006, with two tests scheduled between June and August, 2005, and two tests scheduled between February and September, 2006. RVs may contain quantities of hazardous materials that include high explosives, Beryllium (Be), Depleted Uranium (DU), and batteries. Only one RV per year is planned to contain high explosives, and would be targeted for the vicinity of Illeginni Island. A small number of RV flights may impact in the vicinity of Illeginni Island or the reef flats over the life of the program. RVs that impact on Illeginni Islet, or in the shallow nearshore marine environment near Illeginni, will form a crater. Sediments are displaced by the RV and ejected, along with RV debris, up to 100 meters (m) from the crater.

Debris is recovered when RVs impact on Illeginni Islet, or in the shallow marine environment, within approximately 152 to 305 m from the shoreline, or when RVs impact in the ocean at depths less than 30 m. RVs that impact in the ocean at depths greater than 30 m are not recovered.

Debris is excavated from impact sites with the use of a backhoe. Excavated material is screened and RV debris is recovered. RV impact holes are back-filled with displaced coralline algae, mollusc sediments, rubble and rocks. The DEA indicates that some RV debris (small fragments millimeters in size) will never be recovered from the environment.

Conservation Measures

The following list of activities represent actions that USAKA and the USAF will undertake to avoid or minimize impacts to green turtle nesting habitat at Illeginni Islet. The Service believes implementation of these actions will result in significant steps towards offsetting sea turtle nesting habitat losses at Illeginni Islet.

1.a. USAKA, in coordination with the USAF, RMI and USFWS, will support establishment of a sea turtle nesting preserve at Eniwetak Islet.

1.b. USAKA will initiate consultation with the RMI to establish protocols to ensure that unauthorized personnel will not have access to Eniwetak. The protocols will address such issues as periodic inspections, removal of trespassers, sanctions for violation of access restrictions and public awareness activities. Public awareness activities may include public meetings, advertisements (newspaper and radio), or other media and signage at Eniwetak.

1.c. USAKA will monitor beaches at Eniwetak Islet for sea turtle nesting success. Inspections for sea turtle nests, egg incubation and hatchling success will be made on a monthly basis during peak nesting periods (May – November).

1.d. USAKA will maintain nesting beaches at Eniwetak Islet by removing marine debris or other hazards that may impede female haul-out, nesting, egg incubation, and hatchling migration to the ocean.

1.e. USAKA, USAF and DOE/LLNL will inspect beach areas for active nests at Illeginni prior to each RV impact. If eggs are discovered, they will be moved to Eniwetak Islet, in coordination with the USFWS and USAKA Environmental Office. Protocols for relocating eggs from nests at Illeginni to nests at Eniwetak will be provided by the USFWS to USAKA upon request.

Status of the Species/Critical Habitat

Information in this section is taken from the *Recovery Plan for U.S. Pacific Populations of the Green Turtle* (NMFS and USFWS, 1998), unless otherwise noted.

Species Description

The green turtle (*Chelonia mydas*) is the largest member of the marine turtle family CHELONIIDAE and is found throughout the Pacific, Indian, and Atlantic oceans and the Mediterranean Sea. Green turtles are distinguished from other sea turtles by their smooth carapace with four pairs of lateral scutes, a single pair of prefrontal scutes, and a lower jaw-edge that is coarsely serrated. Adult green turtles may weigh more than 100 kilograms (kg) and exceed one meter in carapace length. The common name of this species refers to the green color of its subdermal fat. The carapace color of adult turtles ranges from light to dark brown, sometimes with an olive cast, radiating or wavy lines, and/or dark blotches. The plastron typically is yellowish to orange, and in the east Pacific often has a grayish cast.

The major taxonomic split within this species is between populations in the Atlantic/Mediterranean and populations in the Pacific/Indian oceans. Although the populations of green turtle in the East Pacific have traditionally been referred to as a distinct subspecies (*C. mydas agassizii*), this distinction as yet has no documented genetic basis. Nevertheless, mitochondrial DNA studies have revealed fixed or near-fixed genotypic differences among nesting populations. This genetic substructure underlies the natal-beach homing behavior of reproductive female turtles. For management and conservation purposes, each nesting population must be treated as an independent demographic unit.

The green turtle was listed in 1978 as threatened under the Endangered Species Act (Act) throughout its Pacific range because of overexploitation, habitat loss, lack of regulation and adequate enforcement, and evidence of declining numbers. Populations nesting in Florida and on the Pacific coast of Mexico are classified as endangered under the Act. The green turtle is also classified as endangered worldwide by the International Union for the Conservation of Nature and Natural Resources, and it is listed in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Because of its status as a federally and internationally protected species, green turtles were included among other sensitive animals afforded special protection at USAKA under the UES in 1995. In 1998, the National Marine Fisheries Service and the U.S. Fish and Wildlife Service completed a recovery plan for the U.S. Pacific populations of the species.

Life history

Throughout their range, adult green turtles typically are resident in foraging areas (*e.g.* seagrass or macro-algae habitats). Periodically, turtles migrate long distances to breeding areas where copulation and nesting take place. Mating usually terminates when nesting has commenced. Based on growth rates observed in wild green turtles, females are thought to reach sexual maturity at 25 years of age or later (Eckert, 1993). Reproductive females generally nest every year, but may skip years. Adult males may migrate and breed every year. Females emerge from the sea to nest 25-35 days after copulation. Green turtles may lay up to six clutches in one season, and each clutch may contain about 100 eggs. After the female has laid the eggs and covered them, the eggs incubate in the soil for up to two months (mean = 64.5 days Balazs

1980). Hatchlings are photopositive and may be disoriented from their search for the sea by artificial light.

Green turtles prefer areas where surface water temperatures are no lower than about 20Ecentigrade (C) in the coldest month; for example, during warm spells (*e.g.*, El Niño), green turtles may be found considerably north of their normal distribution. Based on the behavior of post-hatchlings and juveniles raised in captivity, it is presumed that those in pelagic habitats live and feed at or near the ocean surface, and that their dives do not normally exceed several meters in depth (NMFS and USFWS, 1998). The maximum recorded dive depth for an adult green turtle was 110 meters (NMFS and USFWS, 1998), while subadults routinely dive 20 meters for 9-23 minutes, with a maximum recorded dive of 66 minutes (NMFS and USFWS, 1998). Additionally, it is presumed that drift lines or surface current convergences are preferential zones due to increased densities of likely food items. In the western Atlantic, drift lines commonly contain floating *Sargassum* capable of providing small turtles with shelter and sufficient buoyancy to raft upon (NMFS and USFWS, 1998).

Sea turtle gender is primarily determined by nest temperature (Mrosovsky and Yntema 1980; Yntema and Mrovosky 1980; and Morreale et al., 1982). Clutches produced between 27EC and 31EC are usually mixed gender. Eggs incubated when average temperatures fall below 27EC during the middle trimester produce males, while females are usually produced when temperatures exceed 31EC (Alvarado and Figueroa, 1987).

Most green turtles appear to have a nearly exclusive herbivorous diet, consisting primarily of sea grass and algae (Wetherall *et al*., 1993). In some areas, such as along the eastern Pacific coast, green turtles display carnivory, feeding on molluscs and polychaetes, fish, fish eggs, and jellyfish. In the Hawaiian Islands, green turtles are site specific, feeding consistently in the same areas on preferred substrates, which vary by location and between islands (NMFS and USFWS, 1998).

Population Dynamics

The absolute number of green turtles in any population is difficult to assess. The size of a population typically can only be measured as the relative abundance of nesting females. Because an individual female may only nest once every two or more years, even these measures are very rough estimates.

Historical and recent accelerated rates of exploitation of green turtles have lead to significant declines in their distribution and resulted in fewer and smaller remaining breeding sites. In the western Pacific, the only major (greater than 2,000 nesting females) populations of green turtles occur in Australia and Malaysia. Smaller colonies occur in the insular Pacific islands of Polynesia, Micronesia, and Melanesia (Wetherall *et al.*, 1993) and at French Frigate Shoals (FFS) and scattered locations in the Hawaiian Archipelago (Balazs, 1995). In the Marshall Islands, Bikar Atoll may support between 100 and 500 nesting females (Puleloa and Kilma, 1992), and between 25 and 100 nests may occur at Erikub, Jemo and possibly Ailinginae Atolls

(Puleloa and Kilma, 1992). Other atolls may support low level nesting (less than 25 nests) activities, but little information is available concerning current breeding success in these areas.

Although attempts have been made to model the population dynamics of green turtles, few data are available that describe key life history traits, such as growth rates, recruitment, and mortality that influence the population variability and stability of this species (Chaloupka and Musick 1997).

Status and Distribution

Green turtles are declining throughout the Pacific Ocean as a direct consequence of overexploitation and habitat loss (Eckert, 1993). Recovery efforts are hampered by the lack of information about the numbers, distribution, and migration patterns of turtles in most U.S. Pacific populations. Although quantitative assessment of declines also is limited, the continuing decline in this species is the result primarily of harvesting of eggs and adults by humans and nesting habitat due to human development-related activities. Furthermore, nesting sites will not be replenished by the recruitment of turtles from other nesting sites because of the species high fidelity to natal beaches. In the green turtle recovery plan, this directed take is identified as a "major problem" throughout U.S. Pacific territories and the Freely Associated States (FAS: *i.e.*, Republic of the Marshall Islands, Federated States of Micronesia and the Republic of Palau). Severe exploitation of turtles and their eggs in recent decades throughout their range reflects important socio-cultural and economic changes in the Pacific (and throughout the green turtle's range). Specifically, these changes include: 1) erosion of traditional restrictions limiting the number of turtles taken by increased use of island residents; 2) modernized hunting gear; 3) easier boat access to remote islands; 4) extensive commercial exploitation for turtle products in both domestic markets and international trade; and 5) loss of the spiritual/cultural significance of turtles.

Continued poaching, incidental take by sport and commercial fishing gear, and the incidence and severity of tumors caused by a fibropapilloma disease in Hawaii, all act to compromise the green turtle's recovery. Fibropapilloma is often fatal and its etiology is unknown.

Environmental Baseline

The environmental baseline describes the status of the species and factors affecting the environment of the species or critical habitat in the proposed action area contemporaneous with the consultation in process. In this case, the baseline includes RMI, local, and private actions that affect the species at the time the consultation begins. Unrelated Federal actions that have already undergone consultation are also a part of the environmental baseline. Federal actions within the action area that may benefit listed species or critical habitat are also included in the environmental baseline.

Status of species within the action area

In the Marshall Islands, sea turtle nesting generally occurs between May and November, with some exceptions of nesting observed in December. At Illeginni Islet, the western shoreline (inter-islet reef flat) and northwestern shoreline (lagoon facing) are suitable nesting locations for green turtles (USFWS and NMFS, 2000). Three nest pits were observed at the western shoreline by Service and NMFS biologists in 1996 (USFWS and NMFS, 1996).

Factors affecting species environment within the action area

Few data are available with which to assess population dynamics for this or any sea turtle species. The Marshall Islands population of green turtles is at risk from human harvest of adults, juveniles and eggs; incidental take by fishing gear; marine debris; egg and hatchling predation by rats; and loss of nesting habitat due to human encroachment and construction in areas previously used by sea turtles (McCoy, 2004). The vast majority of green turtles nesting in the Marshall Islands may be highly sensitive to any perturbations that take place at existing nesting sites.

Existing activities that affect green turtles at Illeginni Islet include: 1) RV's have been documented to impact and contaminate sea turtle nesting habitat at Illeginni Islet; 2) general USAKA operations (*e.g.*, maintenance of existing infrastructure, refurbishment activities and heli-pad) which may interrupt attempts by female green turtles to haul-out and nest on the islet; 3) release of hazardous materials during the detonation of unexploded ordnance at the designated ordnance burn site (western end of islet) which may disturb egg incubation, sea turtle haul-out, or hatchling migration to the ocean; 4) the harvest of green turtle eggs, juveniles and adults by humans for subsistence purposes; and 5) egg and hatchling predation by rats (*Rattus* sp).

Effects of the Action

Turtle nesting habitat may be destroyed if an RV impacts at Illeginni or during post-impact cleanup-related activities (USAF, 2004). In the event an RV impacts on or heavy equipment traverses across turtle nesting habitat, it is possible that turtle eggs may be severely damaged or destroyed, and that the suitability of the habitat for future successful nesting may be eliminated by associated physical changes to that habitat.

The overall effect of the action would not benefit green turtles and other wildlife on Illeginni Islet. RV impacts and recovery activities are expected to result in degradation to shoreline areas that support such habitat, affecting the ability of sea turtle nesting activities to stabilize. Without the action, it is feasible that sea turtle nesting may stabilize, particularly if other negative influences could be eliminated or controlled in concert. These activities may result in take in the form of harm or harassment of green turtles by precluding females from haul-out and nesting, preventing normal embryonic development, disturbing or destroying turtle nests, and compromising hatchling growth and success.

Certain components of the RV are comprised of Depleted Uranium (DU), a heavy metal, and Beryllium (Be). When an RV impacts on Illeginni Islet or the shallow nearshore marine environment, it breaks up. As heavy metals mix into the Illeginni environment, they may present an exposure risk, primarily to animals. Exposure to toxic levels of heavy metals has been documented in test animals to result in growth anomalies, tumors, pneumonitis, hypersensitivity, cancer and death (T.C. Pellmar *et.al*., 1999; Hoffman *et al*., 2003; Klaassen *et al*., 1986; and Lewis 1998).

Soil sampling for Be was conducted at an RV impact site in 1992 that resulted in the identification of Be concentrations of about 5 parts per million, very near background levels. Though Be and DU are known to be highly insoluble (USAF, 2004), sea turtles have not been evaluated for toxic exposure to DU or BE, and it is feasible that the health of nesting females, embryos, and hatchlings at Illeginni may be degraded, resulting in reduced ability of the animal to resist diseases, successfully evade predators, forage or reproduce.
.
The USFWS and NMFS have recently collected tissue samples of organisms in the vicinity of Illeginni Islet. The samples are being currently analyzed at the Lawrence Livermore National Laboratories (LLNL). Evaluation of these samples is the beginning of a process to determine the potential for toxic exposure of DU and BE to sea turtles.

Finally, a single RV landing on Illeginni can produce a crater approximately 15 feet deep and 25 feet across and eject sediments (*e.g*, primarily coral rubble) up to 100 m from the crater across the islet. Just one such event has the potential to essentially render viable sea turtle nesting habitat permanently unsuitable for successful nesting, and injure or kill hatchlings at Illeginni Islet.

Cumulative Effects of Non-Federal Activities

Cumulative effects include the effects of future RMI, local, or private actions that are reasonably certain to occur in the action area considered in this BO. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 3-4.5.3 of the UES.

Though Illeginni Islet is a USAKA-leased islet and closed to public access, it is possible that humans may gain access to the islet and harvest eggs or adult green sea turtles.

Conclusion

After reviewing the current status of the green turtle, the environmental baseline for the action area, the effects of the proposed shoreline stabilization, and the cumulative effects, it is the Service's biological opinion that the proposed action (along with the reasonable and prudent measures/and conservation measures) is not likely to jeopardize the continued existence of this species. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 3-4.8.1 of the UES prohibits the take of endangered and threatened species, respectively. Incidental take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. Harass is defined as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

The measures described below are non-discretionary, and must be undertaken so that they become binding conditions. Because USAKA has command over all United States Government activities at USAKA-controlled islands, the Mid-Atoll Corridor, and USAKA-controlled activities within the RMI, these measures will be implemented by USAKA. However, the USAF must support implementation of these measures in coordination with USAKA. Furthermore, the USAF has a continuing duty to regulate the activity, in coordination with USAKA, covered by this incidental take statement. If the USAF (1) fails to support implementation of the terms and conditions or (2) fails to adhere to the terms and conditions of the incidental take statement, USAKA and the RMI may seek to enforce the terms. In order to monitor the impact of incidental take, the USAF must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement.

Amount or Extent of Incidental Take

The Service anticipates incidental take to occur in the form of harm or harassment to the breeding success or loss of up to three green turtle nests or injury or loss of up to 300 hatchlings per year as a result of project-related RV impacts at Illeginni Islet.

Effect of the Take

The Service does not believe that this level of incidental take is likely to result in jeopardy to the species or destruction or adverse modification of critical habitat, as critical habitat is not designated in the project area. The level of take is not likely to result in jeopardy because the overall effect of the action will likely affect no more than three green turtle nests or 300 hatchlings per year at Illeginni Islet. Furthermore, these losses are expected to be offset by the implementation of conservation measures to protect green sea turtle nesting habitat at Eniwetak Islet. It is expected that about three sea turtle nests with an anticipated production of up to 300 green sea turtle hatchlings per year will be protected in perpetuity at Eniwetak Islet.

Reasonable and Prudent Measures

The reasonable and prudent measures given below, with their implementing terms and conditions, are designed to minimize the impacts of incidental take that might otherwise result from the proposed actions. If, during the course of the actions, the level of incidental take is exceeded, the action agency is required to reinitiate consultation and review the reasonable and prudent measures provided in this biological opinion. In addition, the Army must cease the activities that caused the taking; must immediately provide an explanation of the causes of the taking; and must review with the Service the need for possible modification of the reasonable and prudent measures. The Army will offset unavoidable impacts through the implementation of the conservation measures as described in the Project Description.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the impacts on green turtles.

(1) Minimize the number of nests destroyed.
(2) Monitor and report any incidental take that occurs.

Terms and Conditions

In order to be exempt from the prohibitions of section 3-4.8.1 of the UES, the USAF must comply with the following terms and conditions, which implement reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

In order to implement reasonable and prudent measure 1 above, the following term and condition applies:

1. The USAF will target the RVs away from the known sea turtle nesting areas within the Mid-Atoll Corridor Impact Area.

In order to implement reasonable and prudent measure 2 above, the following terms and conditions apply:

2.a. The USAF will submit an annual report by December 31 of each year to USAKA for the MMIIIRV test flights, if any, that would have impacted in the vicinity of Illeginni Island. The USAKA Environmental Management Office will forward the report to the PIFWO Field Supervisor at the above address documenting take of green turtle and suggesting ways to further minimize incidental take at Illeginni Islet.

2.b. The USAF will work with the USAKA Environmental Management Office to inspect the RV impact zones to assess sea turtle mortality after each mission.

The PIFWO believes no more than 3 nests per year will be precluded from reaching complete incubation (*i.e*., hatching). The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of this BO and review of the reasonable and prudent measures provided. The USAF must immediately provide an explanation of the causes of the taking and review with the USFWS the need for possible modification of the reasonable and prudent measures.

Conservation Recommendations

Federal agencies may carry out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or develop information. When recommendations are provided, they relate only to the proposed action and do not necessarily represent complete fulfillment of an agency's responsibilities for the species.

1.a. The USAF may support eradication of all species of rats from Eniwetak and maintain this islet as a rodent free environment to encourage incubation and hatchling success.

1.b. The USAF may conduct a risk analysis of sea turtle exposure to DU and Beat Illeginni. Rats (*Rattus* sp) that occur within the vicinity of sea turtle nesting sites may be used as surrogates to supplement this analysis. The analysis should evaluate concentrations of DU or Be in the kidney, liver, bone and lung tissue.

This concludes consultation on the action described in the August 24, 2004 Draft EA for the Minuteman III Modification. Reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained and if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions concerning this BO, please contact Marine Ecologist Kevin Foster (phone: 808/792-9420; fax: 808/792-9581).

Sincerely,

Gina Shultz
Acting Field Supervisor

cc: NMFS- PIRO
EPA-San Francisco
USAF
USAKA
RMI-EPA

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APPENDIX C

NMFS BIOLOGICAL OPINION 2015

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Formal Consultation under the Environmental Standards for United States Army Kwajalein Atoll Activities in the Republic of the Marshall Islands

Biological Opinion

And
Informal Consultation under Section 7 of the Endangered Species Act

Action Agencies:	Department of the Army, US Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT) – Huntsville AL and US Air Force Global Strike Command (AFGSC) – Barksdale Air Force Base, LA Activity: Continued Implementation of the Minuteman III Intercontinental Ballistic Missile (ICBM) Testing Program at the Reagan Test Site (RTS), US Army Kwajalein Atoll (USAKA), Republic of the Marshall Islands during fiscal years (FY) 2016 through 2030
Consulting Agency:	National Marine Fisheries Service, Pacific Islands Region
NMFS File No. (PCTS):	PIR-2015-9650
PIRO Reference No.:	I-PI-15-1250-AG
Approved By:	Michael D. Tosatto Regional Administrator, Pacific Islands Region
Date Issued:	JUL 29 2015

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Acronyms

ARSTRAT	Army Forces Strategic Command, US Army
BA	Biological Assessment
BMP	Best Management Practices
CFR	Code of Federal Regulations
CITES	Convention on International Trade in Endangered Species of Wild Fauna and
DPS	Distinct Population Segment
ESA	Endangered Species Act
FR	Federal Register
ft	Foot or Feet
FY	Fiscal Year
IUCN	International Union for Conservation of Nature
ITS	Incidental Take Statement
kg	Kilogram
km	Kilometer
KMISS	Kwajalein Missile Impact Scoring System
LLNL	Lawrence Livermore National Laboratory
LIDSS	LLNL Independent Diagnostic Scoring System
LOA	Letter of Authorization
m	Meter
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NLAA	Not Likely to Adversely Affect
nm	Nautical Miles
NMFS	National Marine Fisheries Service (aka NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
NWHI	Northwest Hawaiian Islands
PIFSC	Pacific Islands Fisheries Science Center
PIRO	Pacific Islands Regional Office
RMI	Republic of the Marshall Islands
ROV	Remotely Operated Vehicle
RTS	Ronald Reagan Ballistic Missile Test Site (aka Regan Test Site)
RV	Reentry Vehicle
SMDC	Space and Missile Defense Command, US Army
UES	USAKA Environmental Standards
US	United States
USAG-KA	US Army Garrison - Kwajalein Atoll
USAKA	US Army Kwajalein Atoll
USFWS	US Fish and Wildlife Service
VAFB	Vandenberg Air Force Base, California

Introduction

As described in more detail in the description of the proposed action below, the proposed action involves launching missiles from Vandenberg Air Force Base (VAFB), California. Those missiles would fly across international waters, and terminate within the Republic of the Marshall Islands (RMI) (Figure 1).

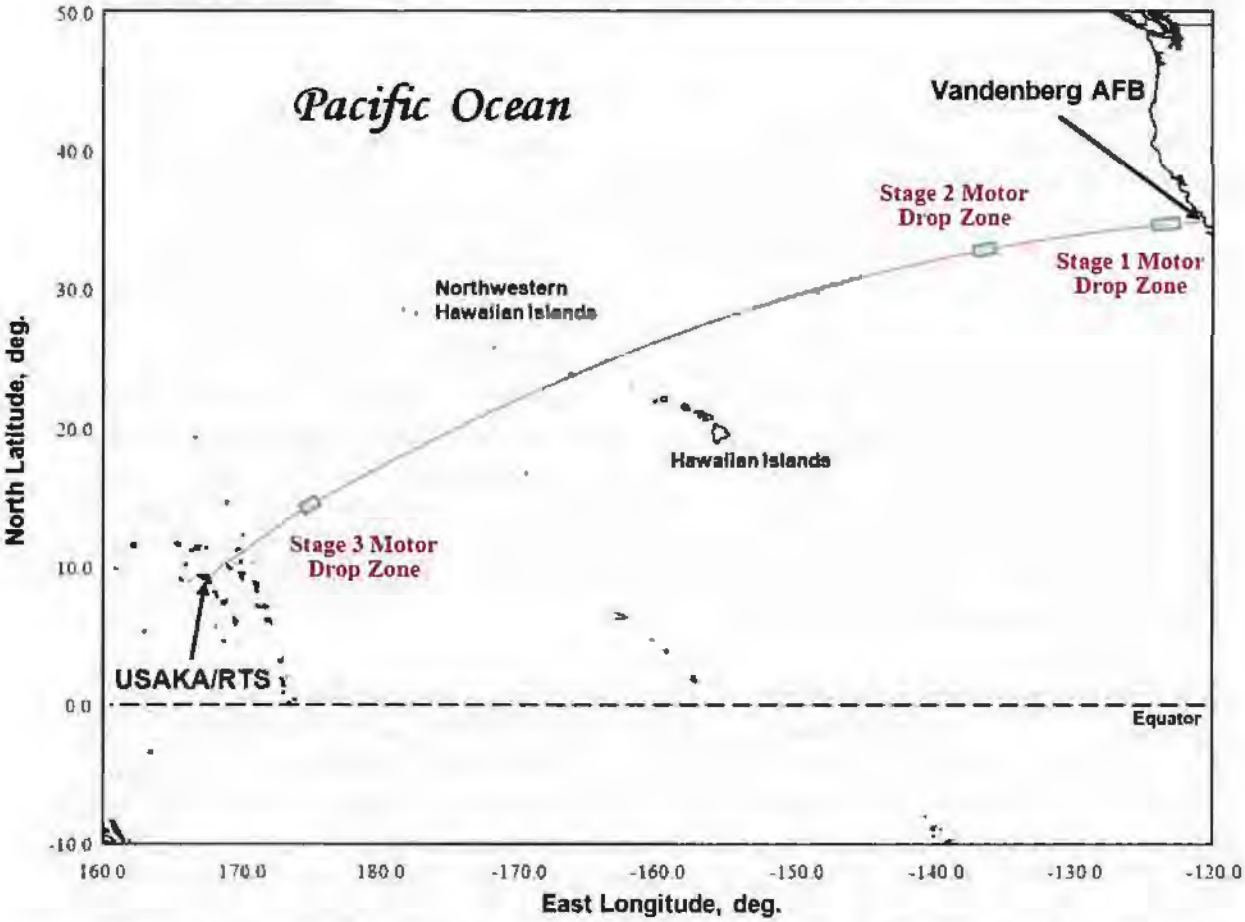

Figure 1. Over-Ocean Flight Path and Motor Drop Zones for Minuteman III Flight Tests

The Endangered Species Act (ESA) would apply for the portions of the action that would take place in and over United States (US) territory and international waters, but not for the portions of the action that would take place within the RMI. The Government of the RMI has agreed to allow the US Government to use certain areas of Kwajalein Atoll (collectively referred to as US Army Kwajalein Atoll or USAKA). "USAKA" is defined as "...the [USAG-KA]-controlled islands and the Mid-Atoll Corridor, as well as all USAKA-controlled activities within the [RMI], including the territorial waters of the RMI" (UES at 1-1). The USAG-KA controls 11 islets around the atoll. The relationship between the US Government and the Government of the RMI is governed by the Compact of Free Association (Compact), as Amended in 2003 (48 USC 1681). Section 161 of the Compact obligates the US to apply the National Environmental Policy Act of 1969 (NEPA) to its actions in the RMI as if the RMI were a part of the US. However, the ESA does not apply within the RMI. Instead, the Compact specifically requires the US Government to develop and apply environmental standards that are substantially similar to

several US environmental laws, including the ESA and the Marine Mammal Protection Act (MMPA). The standards and procedures described in the Environmental Standards and Procedures for USAKA Activities in the RMI (aka USAKA Environmental Standards or UES) were developed to satisfy that requirement. Therefore, the US Government must apply the UES to its activities within the RMI. Because the ESA and UES both apply to this action, this biological opinion was written in a manner that considers and complies with the standards of both documents.

Section 7(a)(2) of the ESA of 1973, as amended (16 U.S.C. 1536(a)(2)) requires each Federal agency to insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. To "jeopardize the continued existence" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). A Federal agency is required to consult formally with the National Marine Fisheries Service (NMFS) for marine species or their designated critical habitat or with the United States Fish and Wildlife Service (USFWS) for terrestrial and freshwater species or their designated critical habitat when that agency's action "may affect" an ESA-listed species. Federal agencies are exempt from the requirement for formal consultation if they have received from NMFS or USFWS written concurrence with a determination that an action "may affect, but is not likely to adversely affect" ESA-listed species or their designated critical habitat (see ESA Section 7 Implementing Regulations; 50 CFR 402).

The UES requires the US Government, in this case US Army Space and Missile Defense Command/Army Forces Strategic Command (SMDC/ARSTRAT) and the US Air Force Global Strike Command (AFGSC), hereafter referred to as the USA/USAF, to consult or coordinate with the NMFS and the USFWS to conserve species and habitats of special concern at USAKA. Section 3.4 of the UES establishes the standards and procedures to be followed "...to ensure that actions taken at USAKA will not jeopardize the continued existence of these species or result in destroying or adversely changing the habitats on which they depend." Section 3.4 is derived primarily from the regulations implementing the ESA, other US regulations, and wildlife protection statutes of the RMI. As such, the list of USAKA consultation species includes all species present in the RMI that are listed under the ESA (including those that are candidates or are proposed for listing), all marine mammals protected under the MMPA, and all species and critical habitats as designated under RMI law. However, no critical habitat has yet been designated in the RMI.

Under the UES, "The final biological opinion shall contain the consulting agency's opinion on whether or not the action is likely to jeopardize the continued existence of a species or to eliminate a species at USAKA, or to eliminate, destroy, or adversely modify critical habitats in the RMI" (UES at 3-4.5.3(e)). Although the UES does not specifically define jeopardy, the Compact clearly intends that the UES provide substantially similar environmental protections as the ESA. We interpret this to include adoption of the ESA definition of jeopardy, as described above, and this review relies upon the ESA definition of jeopardy to reach its final conclusions.

This document represents our biological opinion (Opinion) of the effects on marine species protected under the ESA and the UES that may result from the continued implementation of the Minuteman III (MMIII) Intercontinental Ballistic Missile (ICBM) Testing Program at the Reagan Test Site (RTS) at Kwajalein Atoll, RMI during fiscal years (FY) 2016 through 2030. This Opinion is based on the review of: the USA/USAF March 2, 2015, Biological Assessment (BA) for the proposed action (USA/USAF 2015); recovery plans for U.S. Pacific populations of ESA-listed marine mammals and sea turtles; published and unpublished scientific information on the biology and ecology of ESA-listed marine species, UES-consultation marine species, and other marine species of concern in the action area; monitoring reports and research in the region; biological opinions on similar actions; and relevant scientific and gray literature (see Literature Cited).

1 Consultation History

This consultation excludes the launch activities and other related actions at VAFB. Those activities are covered under the current programmatic consultation under Section 7 of the ESA, between the USAF and the USFWS (USFWS 2011), and under the current letter of authorization (LOA) for marine mammal takes between March 2014 and March 2019, issued by NMFS under the MMPA (79 FR 10016). No ESA-listed species are included in the MMPA LOA. Therefore there is no corresponding Section 7 consultation with us for VAFB activities. The Air Force determined that launch activities would not affect the Guadalupe fur seal, which is listed as threatened under the ESA. The action area for this consultation begins about 25 nautical miles (nm - 46 km) off shore from VAFB where the sonic boom of the accelerating missiles would reach the ocean surface, and extends across the Pacific Ocean to the west, along a relatively narrow band of ocean area directly under the flight path of the missiles, out to the reentry vehicle (RV) impact areas at Kwajalein Atoll, RMI.

Acting on behalf of the USAF, SMDC initiated consultation with NMFS and USFWS for the Minuteman III Modification Program in 2004. On January 11, 2005, the USFWS issued a no-jeopardy Opinion regarding effects on nesting green sea turtles at Illeginni Islet. The USFWS Opinion included an incidental take statement for the annual loss of no more than three green sea turtle nests, or injury or loss of up to 300 hatchlings, per year as a result of RV impacts at Illeginni Islet. On May 16, 2005, we issued a letter of concurrence (LOC) with the USAF's "not likely to adversely affect" determination for sea turtles and marine mammals under our jurisdiction. It is important to note that sea turtles are under the jurisdiction of the USFWS while in terrestrial habitats, whereas they are under our jurisdiction when in marine habitats. Therefore, any impacts on hauled-out or nesting adult turtles, eggs in nests, or hatchlings before they reach the water, were considered in the 2005 USFWS Opinion, not in our LOC.

In July 2011, the USAF entered into pre-consultation discussions with us and USFWS for the continued implementation of the Minuteman III Modification Program through the year 2030. Between July 2011 and March 2015, numerous meetings and teleconferences were held between the agencies to discuss the action, its potential environmental effects, and possible mitigation measures. Because the only change in the action is to extend the number of years of tests, the USAF has elected to forego re-initiation of consultation with the USFWS for terrestrial impacts on green sea turtles. Instead, it will abide by the 2005 USFWS Opinion through 2030, and any continuing adverse effects on those turtles or their nests on Illeginni Islet continue to be covered

under that Opinion, not in the current consultation between USA/USAF and NMFS, which addresses the potential effects on our trust resources in marine habitats.

In addition to the USAF extending the life of the program, several new species under NMFS jurisdiction have been added to the list of consultations species that may be affected by the proposed action. On October 20, 2009, we received a petition to list 83 species of coral under the ESA. Per the UES at that time, any of the petitioned corals that are found in the RMI immediately became consultation species. On September 10, 2014, we published a final rule to list, as threatened, 20 of the petitioned coral species (15 in the Pacific) (79 FR 53852). In addition to the RMI corals that became listed, the RMI government elected to retain as UES-consultation species several of the petitioned corals that were not listed under the ESA. On July 3, 2014, we announced a final rule to list four of six Distinct Population Segments (DPS) of the scalloped hammerhead shark (79 FR 38214). The Indo-West Pacific DPS (which includes the RMI) was listed as threatened. On March 23, 2015, we proposed to list green sea turtles as 11 DPS. The Central West Pacific and Central South Pacific DPS, which include the RMI, are proposed for listing as endangered (80 FR 15271). On March 12, 2015, we received from USA/USAF a consultation request and BA for the proposed action, stating that they had determined that the Minuteman III Program may affect 59 marine ESA and/or UES consultation species (Tables 1 and 2), and requested consultation for those species.

Table 1. Marine consultation species likely to be adversely affected by the proposed action

Scientific Name	Species	ESA	MMPA	CITES	RMI
	Fish				
Cheilinus undulatus	Humphead Wrasse			X	X
	Corals				
Acanthastrea brevis	No Common Name			X	X
Acropora aculeus	No Common Name			X	X
A. aspera	No Common Name			X	X
A. dendrum	No Common Name			X	X
A. listeri	No Common Name			X	X
A. microclados	No Common Name			X	X
A. polystoma	No Common Name			X	X
Alveopora verriliiiana	No Common Name			X	X
Cyphastrea agassizi	No Common Name			X	X
Heliopora coerulea	No Common Name			X	X
Leptoseris incrustans	No Common Name			X	X
Montipora caliculata	No Common Name			X	X
Pavona venosa	No Common Name			X	X
Turbinaria reniformis	No Common Name			X	X
T. stellulata	No Common Name			X	X
	Mollusks				
Tectus niloticus	Top Shell Snail				X

In the BA, USA/USAF further determined that the proposed action was likely to adversely affect the 17 marine UES consultation species listed in Table 1, and that the proposed action was not likely to adversely affect (NLAA) 42 consultation species (Table 2). Formal consultation was initiated on that date, resulting in this Opinion. On June 24, 2015, USA/USAF requested to add the ESA-listed Guadalupe fur seal (*Arctocephalus townsendi*) to the consultation, and determined that the proposed action would be NLAA this species. Therefore, we added the Guadalupe fur seal to the list of species in Table 2, and included them in the consultation on that date.

Table 2. Marine consultation species not likely to be adversely affected by the proposed action					
Scientific Name	**Species**	**ESA**	**MMPA**	**CITES**	**RMI**
	Sea Turtles				
Caretta caretta	Loggerhead Sea Turtle	Endangered		X	X
Chelonia mydas	Green Sea Turtle	Threatened		X	X
Dermochelys coriacea	Leatherback Sea Turtle	Endangered		X	X
Eretmochelys imbricata	Hawksbill Sea Turtle	Endangered		X	X
Lepidochelys olivacea	Olive Ridley Sea Turtle	Threatened		X	X
	Marine Mammals				
Arctocephalus tawnsendi	Guadalupe fur seal	Threatened	X	X	
Balaenaptera acutorastrata	Minke Whale		X		
B. borealis	Sei Whale	Endangered	X	X	
B. edeni	Bryde's Whale		X	X	
B. musculus	Blue Whale	Endangered	X	X	X
B. physalus	Fin Whale	Endangered	X	X	
Berardius bairdii	Baird's Beaked Whale		X	X	
Delphinus capensis	Long-beaked Common Dolphin		X		
D. delphis	Common Dolphin		X		X
Eubalaena japonica	North Pacific Right Whale	Endangered	X	X	
Feresa attenuata	Pygmy Killer Whale		X		
Globicephala macrorynchus	Short-finned Pilot Whale		X		
Grampus griseus	Risso's Dolphin		X		
Indopacetus pacificus	Longman's Beaked Whale aka -Tropical Bottlenose Whale		X		
Kogia breviceps	Pygmy Sperm Whale		X		
K. sima	Dwarf Sperm Whale		X		
Lagenodelphis hosei	Fraser's Dolphin		X		
Lagenorynchus obliquidens	Pacific White-sided Dolphin		X		
Lissodelphis borealis	Northern Right Whale Dolphin		X		
Megaptera novaeangliae	Humpback Whale	Endangered	X	X	
Mesoplodon densirostris	Blainville's Beaked Whale		X		
Orcinus orca	Killer Whale		X		
Peponocephala electra	Melon-Headed Whale		X		
Phocoenoides dalli	Dall's Porpoise		X		
Physeter macrocephalus	Sperm Whale	Endangered	X	X	X
Pseudorca crassidens	False Killer Whale		X		X
Stenella attenuata	Spotted Dolphin		X		X
S. coeruleoalba	Striped Dolphin		X		X
S. longirostris	Spinner Dolphin		X		X
Steno bredanensis	Rough-toothed Dolphin		X		
Tursiops truncatus	Bottlenose Dolphin, Pacific		X		
Ziphius cavirostris	Cuvier's Beaked Whale		X		
	Fish				
Sphyrna lewini	Scalloped Hammerhead Shark	Threatened			
	Corals				
Acropora speciosa	No Common Name				X
A. tenella	No Common Name				X
A. vaughani	No Common Name				X
Pavona cactus	No Common Name				X
	Mollusks				
Pinctada margaritifera	Black-Lip Pearl Oyster				X

2 Description of the Proposed Action and Action Area

The proposed action is described in detail in the USA/USAF BA. The purpose of the tests is to ensure the safety, accuracy, and reliability of the MMIII system. Over the remaining life of the MMIII system, the USAF would conduct 4 flight tests annually through FY 2030, with 1 additional flight test per year (total of 5) during FY 19, 20, 21, and 22, for a maximum of 64 flights and 100 reentry vehicles (RV) that would impact in the RTS. During that time, a maximum of 5 RV may be targeted at land targets on Illeginni Islet. The missiles would be launched from existing facilities at Vandenberg Air Force Base (VAFB), California, fly high above the Pacific Ocean, and terminate either in the Kwajalein Missile Impact Scoring System (KMISS) area east of Gagan Islet, or in the vicinity of Illeginni Islet, at Kwajalein Atoll, RMI (Figures 1, 3, & 4).

Each Minuteman III missile consists of a 3-booster launch vehicle with guidance and instrumentation equipment, and a reentry system that carries 1 to 3 RV (Figure 2). The Reentry System (RS) is the payload section of the MMIII missile. The RS carries 1 to 3 test RV under a 2-piece shroud that streamlines the missile and protects the RV. Test RV contain no fissile materials, but they do contain varying quantities of hazardous materials, including batteries, high explosives, asbestos, and small amounts of heavy metals, including depleted uranium (USA/USAF 2015). Typically, 1 test RV per year would contain high explosives. Each MMIII test flight consists of three phases: 1) Launch; 2) Over-Ocean Flight; and 3) Terminal Flight and Impact in the RMI.

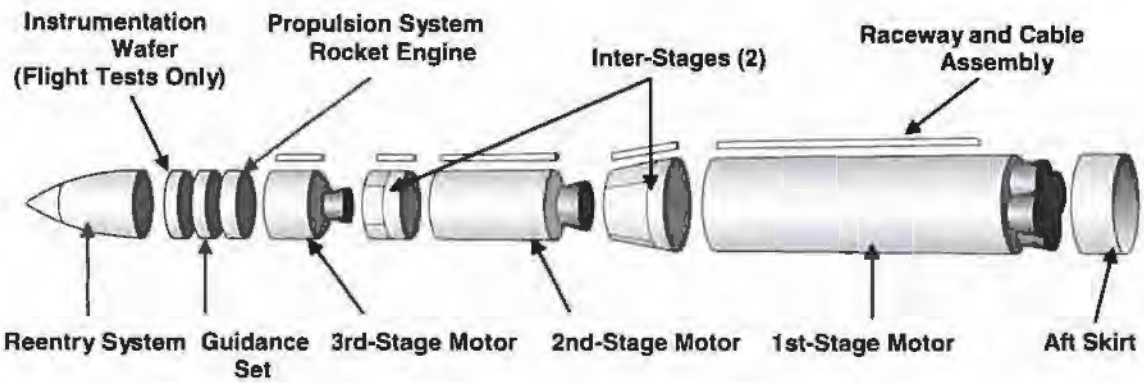

Figure 2. Minuteman III Missile

Launch: Each MMIII missile would be launched from VAFB and enter an over-ocean flight phase within seconds after the launch. As described above in the Consultation History Section, launch activities at VAFB are covered under existing programmatic consultations, and therefore are not considered here.

Over-Ocean Flight: Each missile would arc west over the ocean, generating a sonic boom about 25 nm (46 km) off the coast. The solid propellant motors would burnout and fall away from the vehicle in sequence, along with various fairings, adapters, and other components from the launch vehicle. The expended motors weigh between 1,105 and 4,902 pounds (501 and 2,224 kg) each, and would hit the ocean surface at about 195 to 230 ft (59 to 70 m) per second (USA/USAF 2015). As described later, the third-stage motor breaks-up before impact. However, the first-

and second-stage motors would be largely intact when they hit the water. The first-stage motor drop zone is about 95 to 140 nautical miles (nm; 176 to 259 kilometers (km)) off the California coast, about 40 to 90 nm beyond the western boundary of critical habitat that was designated for leatherback sea turtles in 2012. The second-stage motor drop zone is about 785 to 835 nm (1,454 to 1,546 km) off the coast; about 1,600 nm east-northeast of designated critical habitat for Hawaiian monk seals in the Northwest Hawaiian Islands (NWHI) (Figure 1). As the missile travels along a flight path well north of the main Hawaiian Islands, it reaches apogee at several hundred miles above the Earth. Prior to apogee, the third-stage motor will separate from the payload section, follow a ballistic trajectory, break into several pieces during reentry, and splash down in the open ocean about 50 to 600 nm (93 to 1,111 km) northeast of the RMI (Figure 3). There are 6 thrust-termination (TT) port assemblies in the forward end of the third-stage motor that are blown out when desired missile velocity is reached.

TT port assemblies will fly about 110 to 280 nm (204 to 519 km) downrange of the third-stage debris. Each of the TT port assemblies contains three components. The components are less than 1 ft (0.3 m) in diameter, with a mass under 1 pound (0.5 kg), and low ballistic coefficients. In other words, they are light and un-aerodynamic. They will likely flutter and drift off-course, hence the large drop zone area. The kinetic energy of each component at impact would be between about 10 and 22 foot-pounds (13.1 and 30.1 joules). After separation from the third-stage motor, the post-boost vehicle maneuvers to aim the RV at its/their designated target point(s). The post-hoost vehicle releases the RV, then breaks into several pieces during its reentry, and splashes down in its drop zone in the broad ocean area (BOA) northeast of Kwajalein Atoll (Figure 3).

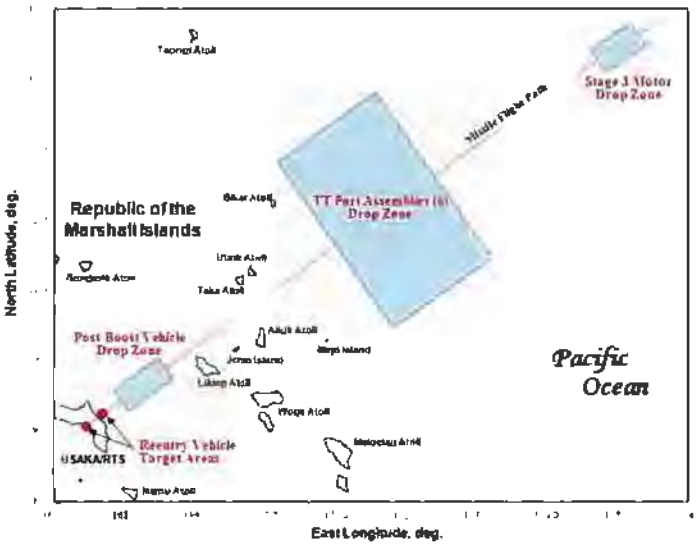

Figure 3. Minuteman III flight path and drop zones in the Marshall Islands.

3. Terminal Flight and Impact in the RMI: For simplicity, pre- and post-test preparation and recovery activities at the RTS are included in this phase along with the final stages of flight.

Pre-Test Preparations and Support - The RTS and USAG-KA (collectively known as US Army Kwajalein Atoll or USAKA) maintains an extensive array of missile tracking radars and optical sensors on several of the islets in support of numerous missions, including the MMIII program. These sensors provide tracking, sensing, and other technical and logistical support. Depending on the mission, additional sea-, air-, and satellite-based sensors (optical and radar systems) may be employed to track missiles and collect data. Test support is provided primarily by government personnel and contractors based at USAG-KA. Within days of each flight test at Illeginni, a landing craft utility vessel (LCU) would transport personnel and equipment from Kwajalein Islet to Illeginni. After set-up, personnel would be removed from Illeginni prior to the

flight test. Portable camera stands would be set up on the western end of the islet to record the flight test, and up to 17 Lawrence Livermore National Laboratory (LLNL) Independent Diagnostic Scoring System (LIDSS) rafts with onboard optical or acoustic sensors would be temporarily placed in the lagoon and/or ocean waters within about 2,600 ft (792 m) of the islet. The LIDSS rafts float on two rubber pontoons about 20 inches (0.5 m) in diameter, and 16 ft (4.9 m) long, with about 10 inches (0.25 m) submerged. The rafts would be deployed from the LCU, in waters no less than 10 ft (3 m) deep. No anchors would be used. The rafts maintain positions using global positioning systems (GPS) and onboard battery-powered trolling motors. Rafts would also be deployed at the KMISS area for Air Burst RV flights only. Optical and electronic sensors and system support equipment are already in place on Gagan Islet and in the offshore ocean waters for flight tests at the KMISS. Fixed underwater acoustic sensors are installed on the seafloor offsbore to score the precision of RV impacts on the range.

Terminal Flight and Impact - Most flights would carry 1 RV. However, flights that target the ocean area off Illeginni may carry up to 2, and flights targeting the KMISS may carry up to 3. No more than 1 RV would target land on Illeginni Islet over the period covered by this consultation. After separating from the post-boost vehicle, the RV would fall toward its/their assigned target(s) in the KMISS or in the vicinity of Illeginni Islet (Figure 4).

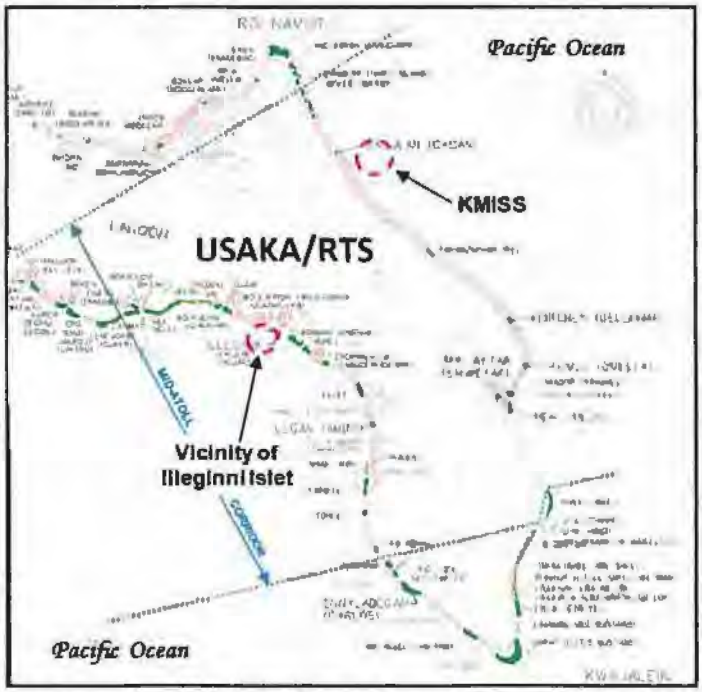

Figure 4. General Target Areas for Reentry Vehicle Impacts at USAKA/RTS.

The RV targeting the KMISS would land at least 3 nm (5.5 km) to the east of Gagan Islet in ocean waters between 6,900 and 12,000 ft (2,100 and 3,700 m) deep. Those targeting the ocean area off Illeginni Islet would land about 0.4 nm (0.8 km) southwest of the islet in water about 1,000 ft (305 m) deep. Typically, a single RV each year would contain high explosives (HE) for conducting an airburst test where the RV is detonated at a predetermined altitude above the water in the KMISS or south of Illeginni. The majority of those tests are done southwest of Illeginni Islet, but they also occasionally occur on the KMISS. Should Illeginni Islet be targeted, the RV would be aimed to strike near the center of the islet. The USAF estimates that there is a 10 to 20% risk that a land impact test might miss slightly and strike shallow water at the waterline along either the lagoon or ocean shoreline.

Post-Test Recovery and Cleanup Operations - RV that impact in the deep ocean waters are not recovered, and no post-test recovery and clean-up activities are anticipated for flight tests at tbe KMISS. After each flight test at Illeginni, USAG-KA personnel would return to the islet, by LCU from Kwajalein Islet, with cleanup and recovery equipment. They would first secure the

area, and recover the LIDSS rafts. For a land or near shore RV impact, no assessment or cleanup would occur until ordnance personnel from the range inspect the impact area, and other personnel stabilize fugitive dust and disturbed soil by wetting and washing the site. Once the site is cleared for safe entry, test support personnel would conduct an impact assessment of the site and initiate cleanup and recovery operations. Debris from an RV impact on land would be recovered. Post-test recovery operations at Illeginni Islet require the manual cleanup and removal of any visible RV debris, including hazardous materials (e.g., DU). Excavated material is screened and the collected RV debris is washed before packaging for shipment back to Kwajalein Islet and the US. A crater formed by the RV impact would be backfilled using a backhoe or grader, and surrounding structures would be repaired, as necessary. Both LLNL and USAG-KA personnel are usually involved in these operations.

Lagoon and reef flats are not intentionally targeted. In the unlikely event of an unintentional strike in these areas, cleanup and recovery would be conducted similarly to land operations when tide conditions and water depth permit. Ejecta (rubble) from the crater would range from small (inch) size up to large (ft) size pieces scattered on the reef flat. Rubble larger than one inch is predicted to be found in a 5- to 10-ft (1.5 to 3 m) radius around the crater rim, with most of the RV debris found within the crater. Manual operations to remove RV debris from the crater and cleanup the rubble and would be necessary. A backhoe may be used to excavate the crater. Excavated material would be screened for debris, and the crater may be backfilled with substrate and coral ejecta from around the crater. Before this work, LLNL and USAG-KA personnel would coordinate with the USFWS and NMFS to identify and use access corridors to reduce impacts on protected and sensitive biological resources. In the unlikely event of a RV impact in the near shore waters of the lagoon, a dive team from USAG-KA would conduct underwater searches for RV debris. First, a remotely operated vehicle (ROV) would be deployed from a ship to locate the debris field on the lagoon bottom, then divers in scuba gear would manually retrieve all recoverable debris. No crater is expected at depths beyond 10-ft deep. On the ocean side, searches for debris would be attempted in waters out to depths of 50 to 100 ft (15 to 30 m), following procedures similar to those for a lagoon recovery.

2.1 Interrelated/Interdependent Actions

Military training and testing at Kwajalein Atoll has been ongoing since World War II. Testing of missile programs at Kwajalein began in 1959 for the Nike Zeus missile program. The Minuteman (MM) I program began in 1962, MMII began in 1965, and MMIII began in 1970. In addition to the MM program, anti-ballistic missile, and other missile development and testing take place at the RTS, along with other military training and testing activities, and commercial missile launches. If it were not for these numerous activities, it is doubtful that the facilities at USAG-KA and RTS would be required. Therefore actions to develop and maintain USAG-KA and RTS facilities and infrastructure, and to support the various missions, are interrelated and/or interdependent with the training and testing activities that occur at the USAG-KA and RTS. However, much of the infrastructure and facilities are designed to support numerous programs and missions, with few being project-specific. Therefore, support activities that are solely attributable to the MMIII testing program constitute a small portion of the total that occur at USAG-KA and RTS in support of the site's numerous missions. Further, per the Document of Environmental Protection (DEP) procedures outlined in the UES, any USAG-KA and RTS actions that may affect the USAKA environment require structured environmental review, with

coordination and/or consultation as appropriate. Based on this, we expect that interrelated or interdependent actions that may be solely attributable to the MMIII testing program would be virtually inseparable from the routine activities at USAG-KA and RTS, and any impacts those actions may have would be considered through the DEP procedures outlined in the UES.

2.2 Action Area

As described above in the consultation history, the action area for this consultation begins about 25 nm (46 km) offshore from VAFB, California, where the sonic boom of the accelerating missiles would reach the ocean surface. The action area extends from there, across the Pacific Ocean to the west-southwest, along a relatively narrow band of ocean area directly under the flight path of the missiles, where the sonic boom and spent missile components are expected to impact the surface (Figures 1 & 3). The action area also includes the area of and around Kwajalein Atoll, RMI where RV would impact the target areas (Figure 4), as well as the areas immediately around support vessels and sensor rafts used to monitor the RV impacts, and the down-current extent of any plumes that may result from discharges of wastes or toxic chemicals such as fuels and/or lubricants associated with the machinery used for this activity.

3 Species and Critical Habitats Not Likely to be Adversely Affected

As explained above in Section 1, SMDC determined that the proposed action was not likely to adversely affect (NLAA) the 43 consultation species listed in Table 2, and would have no effect on critical habitats designated under the ESA and/or the UES. With the exception that we have determined that the proposed action may affect, but is NLAA critical habitat that has been designated under the ESA for Hawaiian monk seals and for leatherback sea turtles, this section serves as our concurrence under section 7 of the ESA of 1973, as amended (16 U.S.C. §1531 *et seq.*), and under section 3-4.5.3(d) of the UES, 13th Edition, with SMDC's determination.

The UES does not specifically define the procedure to make a NLAA determination. However, the Compact clearly intends that the UES provide substantially similar environmental protections as the ESA. We interpret this to include adoption of the ESA NLAA determination process. In order to determine that a proposed action is not likely to adversely affect listed species, under the ESA, we must find that the effects of the proposed action are expected to be insignificant, discountable, or beneficial as defined in the joint USFWS-NMFS Endangered Species Consultation Handbook. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs; discountable effects are those that are extremely unlikely to occur; and beneficial effects are positive effects without any adverse effects (USFWS & NMFS 1998). As described in Section 2, test flights have 3 distinct phases: Launch; Over-Ocean Flight; and Terminal Flight and Impact in the RMI. Each phase has potential stressors, listed below, that are based on what the missile is doing, and on activities done to support the test.

Launch: As described above in the Consultation History Section, launch activities at VAFB are covered under existing programmatic consultations.

Over-Ocean Flight: The potential stressors during over-ocean flight are:
a. Exposure to elevated noise levels;
b. Impact by falling missile components; and

c. Exposure to hazardous materials.

Terminal Flight and RV Impact in the RMI: The potential stressors during terminal flight, RV impact, and preparation and restoration work at Kwajalein Atoll are:
a. Exposure to elevated noise levels;
b. Impact by falling missile components;
c. Exposure to hazardous materials;
d. Disturbance from human activity and equipment operation; and
e. Collision with vessels.

Each of these stressors are addressed below to determine whether or not individuals of any of the ESA-listed and UES-protected marine species considered in this consultation are likely to be adversely affected by that stressor. The species that may be exposed to stressors during each phase, and their likely response to exposure are based on the biological and/or ecological characteristics of each species. Any incidence where a stressor has more than a discountable risk of causing an adverse effect on any individual of the ESA- and/or UES-protected species will result in that stressor and those species being considered in the following biological opinion.

a. Exposure to elevated noise levels: While in flight between VAFB and Kwajalein Atoll, the missile and the RV would travel at velocities that cause sonic booms. High-intensity in-water noise would be created when large missile components, such as spent rocket motors and the RV impact the ocean's surface (splash-down). Also, generally, once a year, 1 RV would carry high explosives that would be detonated above the water's surface (airburst). All of these events would cause impulsive sound sources. High intensity noises can adversely affect marine life. Effects vary with the frequency, intensity, and duration of the sound source, and the hearing characteristics of the affected animal. Effects may include: physical injury, including permanent hearing damage (a.k.a. permanent threshold shift or PTS); temporarily hearing damage (a.k.a. temporary threshold shift or TTS); and behavioral impacts such as temporarily masked communications or acoustic environmental cues and modified behaviors.

Sound is a mechanical disturbance consisting of minute vibrations that travel through a medium, such as air or water, and is generally characterized by several variables. Frequency describes the sound's pitch and is measured in hertz (Hz) or cycles per second. Sound level describes the sound's loudness. Loudness can be measured and quantified in several ways, but the logarithmic decibel (dB) is the most commonly used unit of measure, and sound pressure level (SPL) is a common and convenient term used to describe intensity. Sound exposure level (SEL) is a term that is used to describe the amount of sound energy a receiver is exposed to over time. The dB scale is exponential. For example, 10 dB yields a sound level 10 times more intense than 1 dB, while a 20 dB level equates to 100 times more intense, and a 30 dB level is 1,000 times more intense. Sound levels are compared to a reference sound pressure, based on the medium, and the unit of measure is the micro-Pascal (μPa). In water, sound pressure is typically referenced to a baseline of 1 μPa (re 1 μPa), vice the 20 μPa baseline used for in-air measurements. As a rule of thumb, 26 dB must be added to an in-air measurement to convert to an appropriate in-water value for an identical acoustic source (Bradley and Stern 2008). Root mean square (RMS) is the quadratic mean sound pressure over the duration of a single impulse. RMS is used to account for both positive and negative values so that they may be accounted for in the summation of pressure

levels (Hastings and Popper 2005). This measurement is often used in the context of discussing behavioral effects, in part because behavioral effects, which often result from auditory cues, may be better expressed through averaged units rather than by peak pressures. For brevity, all further references to sound level assume dB_{rms} re 1 μPa, unless specified differently.

Transmission loss (attenuation of sound intensity over distance) varies according to several factors in water, such as water depth, bottom type, sea surface condition, salinity, and the amount of suspended solids in the water. Sound energy dissipates through mechanisms such as spreading, scattering, and absorption (Bradley and Stern 2008). Spreading refers to the apparent decrease in sound energy at any given point on the wave front because the sound energy is spread across an increasing area as the wave front radiates outward from the source. In unbounded homogenous water, sound spreads out spherically, losing as much as 7 dB with each doubling of range. Toward the other end of the spectrum, sound may expand cylindrically when vertically bounded such as by the surface and substrate, losing only about 3 dB with each doubling of range. Scattering refers to the sound energy that leaves the wave front when it "bounces" off of an irregular surface or particles in the water. Absorption refers to the energy that is lost through conversion to heat due to fiction. Irregular substrates, rough surface waters, and particulates and bubbles in the water column increase scattering and absorption loss. Shallow nearshore water around Illeginni where RV may impact, is vertically bounded by the seafloor and the surface, but is considered a poor environment for acoustic propagation because sound dissipates rapidly due to intense scattering and absorption. The unbounded deep open ocean waters where the motors and KMISS-targeted RV would impact is considered a good acoustic environment where spherical spreading would predominate in the near field.

In the absence of location-specific transmission loss data, equations such as RL = SL – #Log(R) (RL = received level (dB); SL = source level (dB); # = spreading coefficient; and R = range in meters (m)) are used to estimate RL at a given range (isopleth). Spherical spreading loss is estimated with spreading coefficient of 20, while cylindrical spreading loss is estimated with spreading coefficient of 10. Spreading loss in near shore waters is typically somewhere between the two, with absorption and scattering increasing the loss. RL = SL – 20Log(R) was used here to estimate ranges in deep open ocean water, and RL = SL – 15Log(R) was used to estimate ranges in the lagoon and reef flat areas around Illeginni.

Under the ESA, we consider significant behavioral disturbance and temporary hearing impacts as the onset of adverse effects. The current thresholds used by us to estimate the onset of injury in cetaceans and pinnipeds from exposure to in-water sound is ≥ 180 dB and ≥ 190 dB, respectively. The threshold for the onset of behavioral disturbance and possible temporary hearing impacts for all marine mammals from a single exposure to impulsive in-water sounds is ≥ 160 dB. Ongoing research suggests that these thresholds are both conservative and simplistic (detailed in Southall *et al.* 2007 and NOAA 2013). The draft revised thresholds for marine mammals uses two metrics: 1) exposure to peak sound pressure levels (SPL_{peak}) and 2) exposure to accumulated sound exposure levels (SEL_{cum}). Single exposures to impulsive in-water sounds at ≥ 201 dB_{peak} (or 180 dB SEL_{cum}), and 195 dB_{peak} (or 165 dB SEL_{cum}) are the proposed thresholds for the onset of injury and temporary hearing impacts, respectively for the most sensitive marine mammal hearing group (high-frequency cetaceans) (NOAA 2013). Currently, no acoustic thresholds have been established for sea turtles. However, because sea turtles are

thought to be less acoustically sensitive/dependent than marine mammals, the draft revised marine mammal thresholds are applied here with the expectation that this approach would be conservative for sea turtles. The criteria currently used by us to estimate the onset of adverse effects on fish due to exposure to high intensity sounds also uses two metrics: 1) exposure to 206 dB_{peak}; and 2) exposure to 187 dB SEL_{cum} for fish 2 gram or larger, or 183 dB SEL_{cum} for fish under 2 grams (Stadler and Woodbury 2009). Corals and mollusks can react to exposure to intense sound, but they lack specific hearing receptors, and are not known to communicate acoustically. They are thought to be acoustically insensitive, but could be affected by concussive forces if exposed to very intense sound sources such as an underwater detonation.

Sonic booms: Exposure to sonic booms would have insignificant effects on any of the species considered in this consultation. Each flight would generate a single sonic boom off the coast of California and a maximum of 3 in the RMI as the RV approach their targets. The sonic boom would begin soon after launch and cease when the missile leaves the atmosphere. Upon reentry into the atmosphere, the RV would create a sonic boom before impact. Sound attenuates with distance from the source due to spreading and other factors. The higher the missile climbs, the quieter the sonic boom would be at the Earth's surface. Similarly, the greater the distance either side of the centerline of the flight path, the quieter the sonic boom. Therefore, the sound intensity would be loudest directly below the missile or RV when the component is closest to the surface. Additionally, Laney and Cavanagh (2000) report that sound waves arriving at the air/water interface at an angle less steep than 13.3° from of the vertical will not normally propagate into water. This means that within the footprint of the sonic boom, only those marine animals within 13.3° of directly below the source could be expected to hear the sonic boom. Also, once in the water, the sounds of a sonic boom would attenuate with distance.

At the Earth's surface, the predicted MMIII sonic boom footprint is a flattened bell shape, about 25 nm deep, with the wide end (about 77 nm wide) at the western end (Tooley *et al.* 2004). The duration of a sonic boom at any given point within the footprint would be less than 0.25 second. The loudest in-water RL would be about 175 dB that could occur within a 26 nm crescent, about 1.5 nm deep, centered on the missile's track, along the eastern edge of the footprint, about 25 nm (46 km) west of the launch site (USA/USAF 2015). From there, the sound level would fall off sharply with distance down course or distance either side of the centerline of the flight path. The predicted footprint of a RV sonic boom is a blunt triangular shape, about 85 nm deep, pointed at the target with the wide end (about 140 nm wide) at the northeastern end. At the Earth's surface, the sonic boom from a RV would build in intensity until the RV impacts the surface. At the northeast end, the sonic boom would be about 117 dB, with a duration of about 0.12 second. At its strongest, near the target, the sonic boom would be about 176 dB, with a duration of about 0.04 second (USA/USAF 2015).

To put this into context, at its loudest, exposure to a sonic boom would be analogous to being near a single shot from a medium caliber rifle. The in-air source levels of a single shot from of a 22 caliber rifle is about 140 dB @ 1 m, while a shot from a big hunting rifle and some big pistols can be as loud as 175 dB @ 1 m (ASHA 2011). The corresponding in-water sound levels would be 166 and 201 dB re 1 μPa @ 1 m, respectively. Further, the source levels of the large commercial ships that commonly transit the shipping lanes off the coast of California and other parts of the world are frequently at levels above those expected to be imparted to the water by

sonic booms. McKenna *et al.* (2012) report source levels of 177 to 188 dB for large commercial ships, and Erbe *et al.* (2012) estimate source levels between 181 dB and 191 dB for medium to large vessels. Although these sources are broadband and non-impulsive, they are a continuous sound sources against which a brief sonic boom at a similar or lower sound level would be virtually indistinguishable. Although shipping traffic around Kwajalein is typically much lower than that near California, large shipping and military vessels regularly transit the waters of the RMI.

In summary, at its loudest (176 dB), an in-water sonic boom exceeds no thresholds for injury in any of the species considered in this consultation, and it is well below the new proposed threshold for the onset of temporary hearing impacts in the most sensitive marine mammals. Assuming spherical spreading, a 176 dB source would attenuate to 160 dB (current threshold for the onset of behavioral disturbance and possible TTS in marine mammals) at less than 23 ft (7 m), and the range to the 150 dB threshold for the onset of behavioral disturbance in fish would be about 66 ft (20 m). Based on the best available information, we believe that marine mammals, sea turtles, and fish identified above in Tables 1 & 2 are the only consultation species that occur off the coast of California and near Kwajalein Atoll that could hear and respond to the noise. We further believe that, at most, an exposed individual may experience temporary behavioral disturbance in the form of slight changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, the exposure is expected to have insignificant effects.

Exposure to splash-down noise would have insignificant effects on any of the species considered in this consultation. Three spent rocket motors, a maximum of 3 RV, and various smaller/lighter missile components would fall into the ocean for each flight. The motors and RV are the only components of sufficient size and velocity to create significant noise levels on splash-down. The remaining components have low ballistic coefficients (they fly through the air poorly) and have low kinetic energy on impact due to combinations of low density and irregular shapes.

Of the 3 motors, the first stage is the largest and the one expected to make the most noise on impact; a brief (less than 1 second) impulse of 229 dB @ 1m (Tooley *et al.* 2004, USA/USAF 2015). To be conservative, the radius of impact for the first stage motor is applied here for all 3 motor splash-downs. All 3 motors would fall into deep open ocean waters. The first two would splash-down in temperate waters between the US mainland and well east of the Hawaiian Islands. The third would splash-down in tropical waters well east of the Marshall Islands. Cetaceans, sea turtles, and adult scalloped hammerhead sharks are the only consultation species that may be affected by this stressor. Assuming spherical spreading and a 229 dB SL, the range to the 180 and 160 dB isopleths around each splash-down would be at about 282 m and 2,820 m, respectively. As stated above, the current thresholds are considered highly conservative. When the draft revised thresholds described above are applied (201 and 195 dB), the ranges to the threshold isopleths fall to 25 m and 50 m respectively. The best information available to describe the abundance and distribution of the cetaceans, sea turtles, and scalloped hammerhead sharks considered in this consultation, supports the understanding that these animals are widely scattered, and their densities are very low in the open ocean areas where the motors would

splash-down. We know of no information to suggest that the splash-down zones are in areas of any significance that would cause any congregations of these species.

Up to three RV may impact the deep waters around Kwajalein Atoll with each flight. In the KMISS, the RV would impact about 3 nm east of atoll, off Gagan Islet. RV that target the ocean south west of Illeginni Islet would impact deep water about 870 yards (790 m) southwest from the islet, and about 470 m from outer edge of the fringing reef. Each RV in-water impact is expected to cause very a brief impulsive sound with a source level of about 250 dB. Assuming spherical spreading and a 250 dB SL, the range to the 180 and 160 dB isopleths around each RV impact would be at about 3,200 m and 32,000 m, respectively. As stated above, the current thresholds are considered highly conservative. When the draft revised thresholds for marine mammals are applied (201 and 195 dB), the ranges to the threshold isopleths fall to 280 m and 560 m respectively. The isopleth for the 206 dB exposure threshold for fish would at about 158 m from the impact, and the RL at the reef slope off Illeginni would be about 196 dB.

The USA/USAF compared marine mammal density information from Hawaii, and sea turtle density information from Guam, against the expected range of effect around falling missile components to estimate the probability of effect. Their modeling suggests that the probability of exposing marine mammals to a TTS-level exposure for a test flight would be between 1 in 1,727 and 1 in 122,699 (USA/USAF 2015). Based on the low annual number of splash-downs, their wide spacing, their small area of effect (< 100 m), and the expected low densities of the consultation species in the affected areas, we believe that the risk of exposure to splash-down acoustic effects in the open ocean and in the KMISS approaches discountable for all of the species considered in this consultation. In the unlikely event of an open-ocean exposure, the effect is expected to be limited to a temporary behavioral modification in the form of slight changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, the exposure is expected to have insignificant effects.

For RV impacts in the ocean south of Illeginni, sea turtles, scalloped hammerhead sharks, and humphead wrasse that may be along the outer edge of the fringing reef may be exposed to a brief pulse of sound approaching 196 dB_{peak}. At most, we expect that an exposed individual may experience a temporary behavioral disturbance, in the form of slight changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, the exposure is expected to have insignificant effects. Being much less acoustically sensitive, any exposed corals or mollusks that may be on the outer reef edge are expected to be unaffected by RV impact noise. The USAF would further reduce the likelihood of adverse effects by conducting at least three prelaunch overflights of the planned impact area to search for protected marine species during the week in advance of the launch, and to report the search results to Vandenberg for inclusion in their launch decision analysis. Based on the best available information, exposure to splash-down noise is expected to have insignificant effects for all species considered in this consultation.

Exposure to air-burst noise would have insignificant effects on any of the species considered in this consultation. Typically, once a year, a single RV would carry high explosives (HE) that

would be detonated above the water's surface southwest of Illeginni. The specific SL of the air-burst was not provided. However, USA/USAF (2015) reports that the energy of the HE detonation would be less than that of a conventional (non-explosive) impact on the surface. Based on this expectation, and on the assessment of the effects of an RV impact off of Illeginni presented above, we believe that, at most, an individual exposed to air-burst noise may experience temporary behavioral disturbance in the form of slight changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, the exposure is expected to have insignificant effects.

b. Impact by falling missile components: It is discountable that any of the species considered in this consultation would be hit by falling missile components or RV in ocean target areas, or to be close enough to an impact site to be significantly affected by concussive forces. It is also discountable that the humphead wrasse or any of the species identified in Table 2 would be hit by a falling RV or ejecta, or be significantly affected by concussive forces during the single planned RV strike on Illeginni Islet. However, the RV strike on Illeginni Islet may adversely affect the species identified in Table 1, other than the humphead wrasse. Therefore, the potential effects of this stressor on those species are considered below in the effects of the action section (Section 6).

Three spent rocket motors, a maximum of 3 RV, and various smaller/lighter missile components would fall into the ocean for each flight. To be struck by a missile component, an animal would have to be at, or very close to the surface, and directly under the component when it hits. USA/USAF (2015) reports that the first stage motor is about 19 ft (6 m) long, 6 ft (2 m) in diameter, and is the largest component. The second and third stage motors, are 9 and 6 ft (3 and 2 m) in length, respectively, with a diameter of 4.3 ft (1.3 m) for both. The inter-stage assemblies are about the size of the third stage motor, and the remaining components are much smaller. Therefore, the total area covered by direct impact from missile components per flight would be less than 270 ft^2 (30 yd^2, 25 m^2). Concussive forces would slightly extend the range for potential injury. USA/USAF (2015) reports that a falling RV would have the greatest concussive force, with injury likely for any animal within 10 ft (3.1 m) of the impact, which is far within the range of potential acoustic effects around a splash-down as described above.

The best available information to estimate protected species density in the splash down areas is the marine mammal density information from Hawaii and the sea turtle density information from Guam. The USA/USAF compared that information against the expected range of effect around missile components falling into the ocean to estimate the probability of being within the range of injurious concussive force (USA/USAF 2015). Their modeling suggests that the probability of exposing marine mammals to direct impact or injurious concussive force for a test flight would be between 1 in 32,679,739 and 1 in 2,320,185,615 and the probability of exposing green sea turtles (at near-shore densities) to be 1 in 1,836,257, and hawksbills to be 1 in 8,921,088. We expect that the probability of exposure to direct impact or injurious concussive force for other turtle species would be somewhere between those of the green and hawksbill sea turtles. No density information is available for scalloped hammerhead sharks, but their density is believed to be low. Based on that and the expectation that they would be well below the surface most of the time, we believe that the probability of their exposure to direct impact or injurious concussive

force would as low or lower than those described above. The corals considered in this consultation are restricted to shallow nearshore waters well away from missile components falling into the ocean. Therefore, that stressor would have no effect on them. Based on the best available information, we believe that it is discountable that any of the species considered in this consultation would be exposed to missile components falling into the ocean.

The single planned RV strike on Illeginni Islet has a 20% probability of striking the shoreline, along either side of the islet, where it would launch fragments and crater ejecta outward to 300 feet (91 m) into nearshore marine waters, and cause a ground borne shock wave that could fracture corals within 123 ft (37.5 m) of the impact. Of the species identified in Table 2, only green and hawksbill sea turtles may occur close enough to the potential impact site to be affected by these stressors. Therefore we and the USA/USAF believe that, with the exception of green and hawksbill sea turtles, it is discountable that any of those species would be exposed to the RV strike on Illeginni Islet. Although green and hawksbill sea turtles may occur around Illeginni Islet, they do so infrequently and in low numbers, and typically in waters closer to the reef edge, where they spend the majority of their time under water. Therefore, we consider it unlikely that either turtle species would be close enough to shore to be within the range of shock wave effects, and that any exposure to ejecta would be in the form of relatively slow moving material sinking to the bottom near the animal. In the unlikely event of a turtle being within the ejecta zone during the impact, at most, an exposed animal may experience temporary behavioral disturbance in the form of slight changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, the exposure is expected to have insignificant effects.

The USA/USAF estimated that juvenile humphead wrasse on the lagoon side, and adults on the ocean side might be within the range of the shockwave and/or the ejecta, and therefore may be adversely affected by the RV strike. This estimate was based on a NMFS Preliminary Estimate Report based on surveys made at numerous sites around USAKA, but not of the potentially impacted sites (NMFS 2014a). However, since that report was issued, our divers made surveys in the potentially affected areas. No adult or juvenile humphead wrasse were observed in the either area, and neither were the deep branching corals, bushy algae, or sea grass beds that are typical juvenile humphead wrasse shelter habitat (Kolinski pers. comm. 2015). The adults that were observed at Illeginni in the previous surveys were in seaward reef habitats at depths exceeding 15 ft (5 m) (NMFS 2014a). Therefore, we believe that it is discountable that juvenile humphead wrasse are in the Illeginni action area, and that at most, any adults present in the action area during a land impact may experience temporary behavioral disturbance in the form of slight changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the animal's fitness, and would return to normal within moments of the exposure. Therefore, the exposure is expected to have insignificant effects.

c. Exposure to hazardous materials: For all of the species considered in this consultation, exposure to action-related hazardous materials is expected to have insignificant effects. During over-ocean flight, the splash-down of missile components would introduce relatively small quantities of propellants (ammonium perchlorate, aluminum, polybutadiene-acrylic acid-acrylonitrile, polybutadiene-carboxyl terminated, perfluorohexane, strontium perchlorate, monomethylhydrazine, and nitrogen tetroxide), hydraulic fluids, battery acid, explosives, and

heavy metals into marine waters. The inside of spent rocket motor casings would contain a residual coating of propellant residues (aluminum oxide and burnt hydrocarbons). The amount of other toxic substances, such as battery acid, hydraulic fluids, explosive residues and heavy metals is small (USA/USAF 2015). The affected areas would be very small locations within the drop zones indicated in Figures 1 & 3, and the hazardous materials within the missile component debris would sink quickly to the seafloor at depths of multiple thousands of feet; well away from protected marine species. Materials leaked at the surface and in the water column as the debris sinks would be quickly diluted by the enormous relative volume of sea water, aided by the debris' movement through the water column and by ocean currents, thus never accumulating to levels expected to elicit a detectable response should a protected species be exposed to the material in the upper reaches of the water column. On the seafloor, the materials would leak or leach into the water and be rapidly diluted by ocean currents, or leach into bottom sediments. However, it is discountable that any of the consultation species would encounter the diluted materials near the seafloor, or in the bottom sediments.

Test RV contain no fissile materials, but do contain small amounts of hazardous materials, including batteries, asbestos, beryllium, cadmium, chromium, lead, and depleted uranium, (USA/USAF 2015). In general, only one test RV per year would contain high explosives. RV that impact in the KMISS or off Illeginni Islet will fragment on impact and sink thousands of feet to the ocean floor. As with the booster components, materials that are released at the surface, and in the water column as the RV fragments sink, would be quickly diluted by the enormous relative volume of sea water, aided by the fragments' movement through the water column and by ocean currents. Over-water HE air-bursts south-southwest of Illeginni Islet or on the KMISS disintegrate the RV into small fragments and aerosolizes much of the structure including much of the toxic material contained within it. Because of the hypersonic velocity of the RV at the time of detonation, the resulting debris impacts a focused area of the ocean below the air-burst. The prevailing trade winds typically blow from northeast to south west across the atoll. The 3-mile distance from shore for the KMISS air-burst virtually eliminates the risk of air-burst particulates from reaching the atoll, while the prevailing winds act to blow particulates away from the atoll and its fringing reef for air-bursts southwest Illeginni. Pulverization of the RV acts to speed dilution rates. Based on the best available information, in-water concentrations from RV water impacts and air-bursts are expected to never reach levels that would elicit a detectable response should protected species be exposed to them in the water column. On the seafloor, the materials would slowly leach into the water and be rapidly diluted by ocean currents, or leach into bottom sediments where it is discountable that any of the consultation species would encounter them.

If the single possible land-targeting event occurs, the RV would scatter RV debris including hazardous material on Illeginni Islet and on adjacent marine substrate, and may mobilize a small amount of toxic residue that may exist in Illeginni's soils. When an RV strikes land at Illeginni Islet, it disintegrates into small fragments and aerosolizes some of the structure and the toxic material contained within it. It also creates a crater 7 to 10 ft (2.1 m to 3.0 m) deep and 20 to 30 ft (6.1 to 9.1 m) in diameter. Although not planned, a RV shallow water impact could occur either side of the islet. Prior tests have shown that no craters are formed in waters deeper than 10 ft (3.0 m), but at that depth, a crater 2 to 4 ft (0.6 to 1.2 m) deep and 10 to 15 ft (3.0 to 4.6 m) across is typically formed. Ejecta from an on-land crater is typically scattered within 328 ft of the crater, in an arc about 120° wide, centered on the flight path. Post-flight land impact clean-

up and restoration activities include personnel washing the impact site with water, then searching for and collecting RV debris from the crater and ejecta field for proper disposal off Illeginni. The crater soils will be screened the through a fine mesh. The ejecta field will be manually searched for recognizable debris. This includes underwater searches, of the lagoon floor or on the ocean side out to depths of 50 to 100 feet, by divers and ROV. After debris removal, the crater is backfilled. Only trace amounts of hazardous material is expected to remain following the clean-up and restoration activities, and the low solubility of that material prevents significant concentrations building up in marine waters because the dissolved material would be quickly diluted and carried away by ocean/lagoon currents. Based on the best available information, in-water concentrations from RV land impacts are expected to never reach levels that would elicit a detectable responses should protected species be exposed to the material in the water column.

d. Disturbance from human activities and equipment operation: Many of the activities done to complete pre-flight preparations and post-flight restoration work at Kwajalein Atoll, would take place in marine waters inhabited by protected marine species covered by this consultation. Those activities may affect any of the species considered in this consultation should those species encounter or be directly impacted by ongoing activities. However, none of the planned activities would intentionally contact marine substrates or consultation species, except those activities taken to restore in-water areas that may be impacted by the single planned land strike at Illeginni Islet. Impact restoration actions that may be taken in marine waters around Illeginni Islet may adversely affect species identified in Table 1 (with the exception of the humphead wrasse for the reasons presented above), but not any of the species identified in Table 2. The sessile species in Table 2 (4 corals and black-lip pearl oyster) are not likely to occur in the area where they could be affected. Similarly, the motile species in Table 2, either do not occur in the area that may be impacted (marine mammals and 3 oceanic turtles), or they are expected to temporarily leave the area with no measurable effect on their fitness (green and hawksbill turtles and scalloped hammerhead sharks). The potential effects of in-water restoration activities on the corals and top shell snails in Table 1 will be considered later in the Effects of the Action Section.

For all other operations (vessel movement, dive operations, deployment and recovery of the LIDSS rafts, etc.) the most likely reaction to exposure to the activities, would be a short-term avoidance behavior, where motile species such as marine mammals, sea turtles, and fish temporarily leave the immediate area with no measurable effect on their fitness, then return to normal behaviors within minutes of cessation of the activity. Sessile organisms such as mollusks may temporarily close their shells or adhere more tightly to the substrate, also returning to normal behaviors within minutes of cessation of the activity. Corals are not expected to have any measurable reaction to short-term non-contact activities. Planned protective measures would reduce the potential for this interaction by watching for and avoiding protected species during the execution of pre-flight preparations and post-flight restoration work. Based on the best available information, project-related disturbance may infrequently cause an insignificant level of behavioral disturbance for the species identified in Table 2, but may adversely affect the species identified in Table 1, except humphead wrasse.

e. Collision with vessels: It is discountable that any of the species considered in this consultation would experience a collision with a project-related vessel. A limited number of vessel trips would be required around Kwajalein Atoll to support the activities done to complete pre-flight

preparations and post-flight restoration work for each of the 4 to 5 missile tests annually. Sea turtles and cetaceans breathe air and must surface to breathe. They are also known to rest or bask at the surface. Therefore, when at or near the surface, turtles and cetaceans are at risk of being struck by vessels or their propellers as the vessels transit between Kwajalein Islet, the KMISS, and Illeginni Islet. Corals could also be impacted if a vessel runs aground or drops anchors on the reef. Conversely, scalloped hammerhead sharks, and humphead wrasse do respire with gills and as such do not need to surface and are only infrequently near the surface. They are also agile and capable of avoiding oncoming vessels.

The conservation measures that are part of this action include requirements for vessel operators to watch for and avoid marine protected species, including adjusting their speed based on animal density and visibility conditions. Additionally, no action-related anchoring is planned and vessel operators are well trained to avoid running aground. Therefore, based on the best available information we consider the risk of collisions between project-related vessels and any of the consultation species identified in Tables 1 & 2 to be discountable.

Critical habitat: The flight path of MMIII test flights crosses designated critical habitat for leatherback sea turtles off the coast of California, and designated and proposed revised critical habitat for Hawaiian monk seals in the Northwest Hawaiian Islands (NWHI) and the Main Hawaiian Islands (MHI). There is no designated critical habitat within the RMI. Therefore, the proposed action may affect the designated and proposed revised critical habitat identified above, but would have no effect on designated critical habitat in the RMI.

The single primary constituent element (PCE) identified as essential for the conservation of leatherback sea turtles in marine waters off the U.S. West Coast is: The occurrence of prey species of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks. Preferred prey consist primarily of scyphomedusae of the order Semaeostomeae (e.g., Chrysaora, Aurelia, Phacellophora, and Cyanea) (aka Jellyfish) (77 FR 4170). Under normal circumstances, the first stage booster would impact about 40 to 90 nm beyond the western boundary of leatherback critical habitat. However, the unlikely event of a launch failure could result in a missile falling into designated critical habitat for leatherback sea turtles.

A falling missile could kill jellyfish in the immediate area of the splash-down. However, assuming even distribution of jelly fish across the area, the numbers lost due to a splash-down would be insignificant compared to the total available in area, and the loss would have no lasting effect on the availability of prey in the area. Hazardous materials within the missile, including unburnt propellant, may affect water quality in the immediate area around the splash-down. However, as described above, hazardous materials within missile debris would sink quickly to the seafloor, likely to depths of multiple thousands of feet. Any hazardous materials leaked at the surface and in the water column as the debris sinks would be quickly diluted by the enormous relative volume of sea water, aided by the debris' movement through the water column and by ocean currents. The leaching rate of unburned solid propellant in ocean water is very low. That material would sink to the deep seafloor where it would be quickly diluted by ocean currents as it slowly dissolves over years. The concentrations of hazardous material are expected to remain below levels that would elicit a detectable response in the turtles or their prey should they be

exposed to the material in the water column. Therefore, based on the best available information, potential launch failures are expected to have insignificant effects on leatherback designated critical habitat.

Designated, and proposed revised, critical habitat for Hawaiian monk seals is outside the area of effect for MMIII testing. The second stage booster would impact the ocean about 1,600 nm (1,800 km) east-northeast of that critical habitat, and the missile would be close to its apogee, beyond the atmosphere, when it crosses over the NWHI. The third stage booster and other missile components would impact the surface about 1,200 nm (2,200 km) or more southwest of that critical habitat. Therefore, it is discountable that MMIII flight tests would affect designated, and proposed revised, critical habitat for Hawaiian monk seals.

Considering the information presented above, and in the best scientific information available about the biology and expected behaviors of the marine species considered in this consultation, we agree that exposure to the proposed action would have insignificant effects, or the likelihood of exposure would be discountable for the consultation species identified in Table 2 and the humphead wrasse. Further, we have determined that the proposed action would have insignificant effects on designated critical habitat for the leatherback sea turtle off the coast of California, and impacts on designated, and proposed revised critical habitat for the Hawaiian monk seal in the NWHI and the MHI would be discountable.

Therefore, we concur with your determination that conducting the proposed MMIII testing is NLAA the consultation species identified in Table 2, and would have no effect on designated critical habitat in the RMI. We have also determined that the proposed MMIII testing is NLAA humphead wrasse, and ESA-designated or proposed critical habitats. Those species and critical habitats will be considered no further in this consultation.

4 Status of the Species

This section presents biological or ecological information for the UES consultation species that the proposed action is likely to adversely affect. As stated above in Section 1, USA/USAF determined that the proposed action was likely to adversely affect the 17 marine UES consultation species listed in Table 1. However, as described above in Section 3, along with the species identified in Table 2, we have determined that the proposed action in not likely to adversely affect humphead wrasse. Therefore, the humphead wrasse and the species listed in Table 2 will be considered no further in this consultation,

As described above in the introduction, the jeopardy analyses in this Opinion considers the risk of reducing appreciably the likelihood of survival and recovery of UES-protected marine species within USAKA. As such, subsections 4.1 through 4.16 provide species-specific descriptions of distribution and abundance, life history characteristics (especially those affecting vulnerability to the proposed action), threats to the species, and other relevant information as they pertain to these animals within USAKA. Factors affecting these species within the action area are described in more detail in the Environmental Baseline (Section 5).

4.1 *Acanthastrea brevis* (Coral)

A. brevis is broadly distributed across the Indo-Pacific region, occurring in 46 of 133 ecoregions defined by Veron (2014). As a candidate species for listing under the ESA, *A. brevis* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.1.1 Distribution and Abundance

The reported range of *A. brevis* is from the Red Sea and eastern Africa to Madagascar, through the Indo-Pacific region, and eastward to the central Pacific Ocean out to American Samoa. It ranges as far north as Luzon Island in the Philippines and the Northern Mariana Islands, to the south down to New Guinea and possibly Northern Australia. *A. brevis* is reported as uncommon (Veron 2014). Within the area potentially impacted at Illeginni, *A. brevis* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies per square meter (colonies/m^2). It has been observed at Illeginni, 5 other of the 11 USAKA islands, and at 23 of 35 sites within the MAC (NMFS 2014).

4.1.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. brevis is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. The zooxanthellae allow scleractinian corals to gain most of their food through photosynthesis during the day, switching to more capture of microscopic prey with nematocysts on their tentacles at night. Corals also absorb significant amounts of microorganic compounds and free nutrients (Bythell, 1990; Grover et al. 2008). However, the dominant feeding mode varies among species and some species can shift among them as needed Grottoli et al. 2006).

A. brevis colonies are typically submassive clumps that are attached to hard substrate. It occurs in reef habitats, at depths down to about 66 ft (20 m). The reproductive characteristics of *A. brevis* are undetermined, but both of its congeners that have been studied are hermaphroditic broadcast spawners; releasing gametes of both sexes (Brainard *et al.* 2011).

4.1.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. Little specific information is available to describe the susceptibility of *A. brevis* to these threats. However, the genus *Acanthastrea* is reported as highly susceptible to bleaching, where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard *et al.* 2011). The susceptibility of

Acanthastrea spp. to acidification is unknown. However, in most corals studied, acidification impairs growth, as well as impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles for some species (Anthony *et al.* 2008). The susceptibility and impacts of disease and predation on the genus *Acanthastrea* are not known. The effects of land-based toxins and nutrients on *A. brevis* are largely unknown, but may pose significant threats to this species at local scales. One of its congeners, *A. echinata* is reported to have one of the lowest sediment rejection rates of studied corals, but was able to clear most sediment within 24 hours without regard to particle size. Collection and trade are not considered threats to this genus (Brainard *et al.* 2011). As described above, *A. brevis* is likely highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects across its range.

4.1.4 Conservation of the Species

A. brevis is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.2 *Acropora aculeus* (Coral)

A. aculeus is broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *A. aculeus* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.2.1 Distribution and Abundance

The reported range of *A. aculeus* is from the entire east coast of Africa and Madagascar, across the Indian Ocean, through Indonesia and French Polynesia to Pitcairn Island in the southeastern Pacific Ocean, and from Japan, down through the Marianas, south along the Northeastern and Northwestern coasts of Australia (Veron 2014). *A. aculeus* is reported as usually common in the central Indo-Pacific, and uncommon elsewhere (Veron 2014). Within the area potentially impacted at Illeginni, *A. aculeus* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, at 3 more of the 11 USAKA islands, and at 3 of 35 sites within the mid-atoll corridor (MAC) (NMFS 2014).

4.2.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. aculeus is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. The zooxanthellae allow scleractinian corals to gain most of their food through photosynthesis during the day, switching to more capture of microscopic prey with nematocysts on their tentacles at night. Corals also absorb significant amounts of microorganic compounds and free nutrients (Bythell, 1990; Grover *et al.* 2008).

However, the dominant feeding mode varies among species and some species can shift among them as needed Grottoli *et al.* 2006).

A. aculeus typically forms flat-topped, clumping, or tabular corymbose colonies formed by horizontal branches. Colonies are attached to hard substrate, and are particularly abundant in shallow lagoons and protected waters, at depths from low tide down to about 66 ft (20 m). *A. aculeus* is a hermaphroditic spawner that participates in mass broadcast spawning. (Brainard *et al.* 2011).

4.2.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. *A. aculeus* has moderately high susceptibility to thermal stress induced "bleaching" where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard *et al.* 2011). Acidification experiments have demonstrated negative effects on *Acropora* calcification, productivity, and impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles (Anthony *et al.* 2008). The susceptibility and impacts of disease on *A. aculeus* are not known, but its genus is considered moderately to highly susceptible to disease. The crown of thorns seastar (*Acanthaster planci*) preferentially preys on members of the genus *Acropera*, and the dead areas of the coral are rapidly overgrown by algae. Land-based toxins and nutrients are reported to have deleterious effects on *A. aculeus* depending on the substance, concentration, and duration of exposure. The genus *Acropora* has been heavily involved in international trade, and *A. aculeus* is likely included in this trade (Brainard *et al.* 2011). As described above, *A. aculeus* is highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects across its range.

4.2.4 Conservation of the Species

A. aculeus is listed in CITES Appendix II, has been retained as a consultation species under the UES, by the RMI Government.

4.3 *Acropora aspera* (Coral)

A. aspera is a broadly distributed Indo-Pacific staghorn coral. As a candidate species for listing under the ESA, *A. aculeus* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.3.1 Distribution and Abundance

A. aspera is distributed in tropical waters from central east Africa and northern Madagascar to the Arabian Gulf and Oman, across the Indian Ocean and the Indo-Pacific region, past Samoa to Jarvis Island in the east-central Pacific Ocean, and from central Japan, south along the Northeastern and Northwestern coasts of Australia (Veron 2014). *A. aspera* has been reported as sometimes common, but is classified as vulnerable and decreasing on the IUCN Red List. Within the area potentially impacted at Illeginni, *A. aspera* is estimated to be aggregated in

shallow inshore habitats with aggregation areas no greater than 40 m^2, and at a density of up to 5.08 colonies/m^2. It has been observed at 5 of the 11 USAKA islands and at 1 of 35 sites within the MAC (NMFS 2014).

4.3.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. aspera is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. The zooxanthellae allow scleractinian corals to gain most of their food through photosynthesis during the day, switching to more capture of microscopic prey with nematocysts on their tentacles at night. Corals also absorb significant amounts of microorganic compounds and free nutrients (Bythell, 1990; Grover et al. 2008). However, the dominant feeding mode varies among species and some species can shift among them as needed Grottoli *et al.* 2006).

A. aspera is a branching coral that occurs in water depths from low-tide down to at least 33 ft (10 m). It has multiple growth forms, which are influenced by exposure to wave energy. Colonies on exposed forereefs may have short and stout branches, while colonies in deeper protected waters may develop tree-like branches. It can be found attached to hard substrate as well as loose colonies on unconsolidated sediment. *A. aspera* reproduces both sexually and asexually. It is a hermaphroditic spawner; releasing gametes of both sexes. It also reproduces through fragmentation, where broken pieces continue to grow to form new colonies (Brainard *et al.* 2011).

4.3.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. *A. aspera* is highly susceptible to thermal stress induced "bleaching" where the coral expels its zooxanthellae and was identified as one of the most susceptible species on the Great Barrier Reef (Done *et al.* 2003). The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard *et al.* 2011). Increased ocean acidity is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates. It can increase the susceptibility to thermal stress, and tends to decrease growth and calcification rates (Anthony *et al.* 2008). The susceptibility and impacts of disease on *A. aspera* are not known, but its genus is considered moderately susceptible to disease. The crown of thorns seastar (*Acanthaster planci*) preferentially preys on *A. aspera*, and the dead areas of the coral are rapidly overgrown by algae (Sonoda and Paul 1993). Land-based toxins and nutrients are reported to have deleterious effects on *A. aspera* depending on the substance, concentration, and duration of exposure. The genus *Acropora* has been heavily involved in international trade, and *A. aspera* is likely included in this trade (Brainard *et al.* 2011). As described above, *A. aspera* is highly susceptible to effects

attributed to anthropogenic climate change, and is likely being adversely affected by those effects across its range.

4.3.4 Conservation of the Species

A. aspera is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.4 *Acropora dendrum* (Coral)

A. dendrum is broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *A. dendrum* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.4.1 Distribution and Abundance

The reported range of *A. dendrum* is from the southern tip of Sri Lanka, through the Indo-Pacific region, and eastward to the Tuamotus in the southeastern Pacific Ocean. It ranges as far north as central Japan, to the south through the Philippine Islands, down across the northern coast of Australia to the Coral Sea. *A. dendrum* is reported as uncommon to rare (Veron 2014). Within the area potentially impacted at Illeginni, *A. dendrum* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, at 6 more of the 11 USAKA islands, and at 5 of 35 sites within the MAC (NMFS 2014).

4.4.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. dendrum is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. The zooxanthellae allow scleractinian corals to gain most of their food through photosynthesis during the day, switching to more capture of microscopic prey with nematocysts on their tentacles at night. Corals also absorb significant amounts of microorganic compounds and free nutrients (Bythell, 1990; Grover et al. 2008). However, the dominant feeding mode varies among species and some species can shift among them as needed Grottoli et al. 2006).

A. dendrum colonies are typically corymbose plates that are attached to hard substrate, with widely-spaced tapering branches. It occurs in upper reef slope environments at depths down between 16 and 66 ft (5 to 20 m). *A. dendrum* is a hermaphroditic spawner; releasing gametes of both sexes. It also reproduces through fragmentation, where broken pieces continue to grow to form new colonies (Brainard *et al.* 2011).

4.4.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. Little specific information is available to describe the susceptibility of *A. dendrum* to these threats. However, the genus *Acropora* is ranked as one of the most severely susceptible to bleaching, where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard *et al.* 2011). Acidification experiments have demonstrated negative effects on *Acropora* calcification, productivity, and impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles (Anthony *et al.* 2008). The susceptibility and impacts of disease on *A. dendrum* are not known, but its genus is considered moderate to highly susceptible to disease. The crown of thorns seastar (*Acanthaster planci*) and corallivorous snails preferentially prey on *Acropora spp.*, and the dead areas of the coral are rapidly overgrown by algae. Land-based toxins and nutrients are reported to have deleterious effects on *Acropora spp.* depending on the substance, concentration, and duration of exposure. The genus *Acropora* has been heavily involved in international trade, and *A. dendrum* is likely included in this trade (Brainard *et al.* 2011). As described above, *A. dendrum* is likely highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects across its range.

4.4.4 Conservation of the Species

A. dendrum is listed in CITES Appendix **II**, and has been retained as a consultation species under the UES, by the RMI Government.

4.5 *Acropora listeri* (Coral)

A. listeri is broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *A. listeri* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.5.1 Distribution and Abundance

The reported range of *A. listeri* is from the Red Sea, central east Africa and northern Madagascar, Diego Garcia, and southern Sri Lanka in the Indian Ocean, through the central Indo-Pacific region, past Samoa and eastward to the Tuamotus in the southeastern Pacific Ocean. It ranges as far north as central Japan, to the south through the Philippines, down across the northern coast of Australia to the Coral Sea. *A. listeri* is reported as uncommon (Veron 2014). Within the area potentially impacted at Illeginni, *A. listeri* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at 4 of the 11 USAKA islands and at 2 of 35 sites within the MAC (NMFS 2014).

4.5.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. listeri is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically

cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. The zooxanthellae allow scleractinian corals to gain most of their food through photosynthesis during the day, switching to more capture of microscopic prey with nematocysts on their tentacles at night. Corals also absorb significant amounts of microorganic compounds and free nutrients (Bythell, 1990; Grover et al. 2008). However, the dominant feeding mode varies among species and some species can shift among them as needed Grottoli et al. 2006).

A. listeri colonies are typically clumps or corymbose plates that are attached to hard substrate, with thick branches of irregular length. It occurs in highly active shallow subtidal reef environments at depths down to about 49 ft (15 m). *A. listeri* is a hermaphroditic spawner; releasing gametes of both sexes. It also reproduces through fragmentation, where broken pieces continue to grow to form new colonies (Brainard *et al.* 2011).

4.5.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. Little specific information is available to describe the susceptibility of *A. listeri* to these threats. However, the genus *Acropora* is ranked as one of the most severely susceptible to bleaching, where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard *et al.* 2011). Acidification experiments have demonstrated negative effects on *Acropora* calcification, productivity, and impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles (Anthony *et al.* 2008). The susceptibility and impacts of disease on *A. listeri* are not known, but its genus is considered moderate to highly susceptible to disease. The crown of thorns seastar (*Acanthaster planci*) and corallivorous snails preferentially prey on *Acropora spp.*, and the dead areas of the coral are rapidly overgrown by algae. Land-based toxins and nutrients are reported to have deleterious effects on *Acropora spp.* depending on the substance, concentration, and duration of exposure. The genus *Acropora* has been heavily involved in international trade, and *A. listeri* is likely included in this trade (Brainard *et al.* 2011). As described above, *A. listeri* is likely highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects across its range.

4.5.4 Conservation of the Species

A. listeri is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.6 *Acropora microclados* (Coral)

A. microclados is broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *A. microclados* became a consultation species under UES section 3-4.5.1

(a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.6.1 Distribution and Abundance

The reported range of *A. microclados* is from the Red Sea and northern Madagascar, the Chagos Archipelago in the central Indian Ocean, through the Indo-Pacific region, and eastward to the central Pacific Ocean out to Pitcairn Island. It ranges as far north as the Ryukyu Islands of Japan, and to the south down along the eastern and western coasts of Australia. *A. microclados* is reported as uncommon to common (Veron 2014). Within the area potentially impacted at Illeginni, *A. microclados* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, all of the other USAKA islands, and at 34 of 35 sites within the MAC (NMFS 2014).

4.6.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. microclados is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. Scleractinian corals act as plants during the day and as animals at night, or in some combination of the two. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. Corals also feed by consuming prey that is captured by the nematocysts (Brainard *et al.* 2011).

A. microclados colonies are typically corymbose plates that are attached to hard substrate, with short, uniform, evenly spaced tapered branchlets. It occurs on upper reef slopes and subtidal reef edges at depths of 16 to 66 ft (5 to 20 m). Like other corals, *A. microclados* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. *A. microclados* is a hermaphroditic spawner; releasing gametes of both sexes. It also reproduces through fragmentation, where broken pieces continue to grow to form new colonies (Brainard *et al.* 2011).

4.6.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is a potential effect of anthropogenic climate change. Little specific information is available to describe the susceptibility of *A. microclados* to these threats. However, the genus *Acropora* is ranked as one of the more susceptible to bleaching, where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard *et al.* 2011). Acidification experiments have demonstrated negative effects on *Acropora* calcification, productivity, and impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles (Brainard *et al.* 2011). The susceptibility and impacts of disease on

A. microclados are not well understood, but subacute dark spots disease has been reported in this species, and its genus is considered moderate to highly susceptible to disease. The crown of thorns seastar (*Acanthaster planci*) and corallivorous snails preferentially prey on *Acropora spp.*, and the dead areas of the coral are rapidly overgrown by algae. Land-based toxins and nutrients are reported to have deleterious effects on *Acropora spp.* depending on the substance, concentration, and duration of exposure. The genus *Acropora* has been heavily involved in international trade, and *A. microclados* is likely included in this trade (Brainard *et al.* 2011). As described above, *A. microclados* is likely highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects on a global level.

4.6.4 Conservation of the Species

A. microclados is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.7 Acropora polystoma (Coral)

A. polystoma is broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *A. polystoma* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.7.1 Distribution and Abundance

The reported range of *A. polystoma* is from the Red Sea to central Africa and Madagascar, and the Chagos Archipelago in the central Indian Ocean, through the Indo-Pacific region, eastward to the Tuamotus in the southeastern Pacific Ocean. It ranges as far north as the south of Taiwan, through the South China Sea and the Philippines, and to the south down along the northern coast of Australia and the Coral Sea. *A. ploystoma* is reported as uncommon to common (Veron 2014). Within the area potentially impacted at Illeginni, *A. ploystoma* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, all of the other USAKA islands, and at 34 of 35 sites within the MAC (NMFS 2014).

4.7.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. polystoma is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. The zooxanthellae allow scleractinian corals to gain most of their food through photosynthesis during the day, switching to more capture of microscopic prey with nematocysts on their tentacles at night. Corals also absorb significant amounts of microorganic compounds and free nutrients (Bythell, 1990; Grover et al. 2008). However, the dominant feeding mode varies among species and some species can shift among them as needed Grottoli et al. 2006).

A. polystoma colonies are typically clumps or corymbose plates that are attached to hard substrate, with tapered branches of similar length. It occurs in highly active intertidal to shallow subtidal reef tops and edges with strong wave action and/or high currents, at depths down to about 33 ft (10 m). *A. polystoma* is a hermaphroditic spawner; releasing gametes of both sexes. It also reproduces through fragmentation, where broken pieces continue to grow to form new colonies (Brainard *et al.* 2011).

4.7.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. Little specific information is available to describe the susceptibility of *A. polystoma* to these threats. However, the genus *Acropora* is ranked as one of the most severely susceptible to bleaching, where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard *et al.* 2011). Acidification experiments have demonstrated negative effects on *Acropora* calcification, productivity, and impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles (Anthony *et al.* 2008). The genus *Acropora* is considered moderate to highly susceptible to disease, and *A. polystoma* has been reported to experience severe white-band/white plague disease. The crown of thorns seastar (*Acanthaster planci*) and corallivorous snails preferentially prey on *Acropora spp.*, and the dead areas of the coral are rapidly overgrown by algae. Land-based toxins and nutrients are reported to have deleterious effects on *Acropora spp.* depending on the substance, concentration, and duration of exposure. The genus *Acropora* has been heavily involved in international trade, and *A. polystoma* is likely included in this trade (Brainard *et al.* 2011). As described above, *A. polystoma* is likely highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects across its range.

4.7.4 Conservation of the Species

A. polystoma is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.8 Alveopora verrilliana (Coral)

A. verrilliana is broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *A. verrilliana* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.8.1 Distribution and Abundance

The reported range of *A. verrilliana* is from the eastern Madagascar and Diego Garcia in the Indian Ocean, through the Indo-Pacific region, and eastward to the Tuamotus and French Polynesia in the southeastern Pacific Ocean. It ranges as far north as the Ryuku Islands of Japan, down to the south, about midway along the east and west coasts of Australia. *A. verrilliana* is reported as rare to uncommon (Veron 2014). Within the area potentially impacted at Illeginni, *A. verrilliana* is estimated to occur in small aggregations on submerged hard pavement reef areas, at

a density of up to 0.16 colonies/m^2. It has been observed at Illeginni, at 3 more of the 11 USAKA islands, and at 10 of 35 sites within the MAC (NMFS 2014).

4.8.2 Life History Characteristics Affecting Vulnerability to Proposed Action

A. verrilliana is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. The zooxanthellae allow scleractinian corals to gain most of their food through photosynthesis during the day, switching to more capture of microscopic prey with nematocysts on their tentacles at night. Corals also absorb significant amounts of microorganic compounds and free nutrients (Bythell, 1990; Grover et al. 2008). However, the dominant feeding mode varies among species and some species can shift among them as needed Grottoli et al. 2006).

A. verrilliana colonies are attached to hard substrate and typically composed of clumps of short irregularly divided knob-like branches with corallites that have palisades of conspicuous vertical spines. It is typically reported in shallow reef habitats, at depths down to about 10 to 131 ft (3 to 40 m), but has also been reported on steep slopes at 66 to 262 ft (20 to 80 m) in the Red Sea. *A. verrilliana* is a hermaphroditic broadcast spawner; releasing gametes of both sexes (Brainard *et al.* 2011).

4.8.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. Little specific information is available to describe the susceptibility of *A. verrilliana* to these threats. However, the genus *Alveopora* is reported as highly susceptible to bleaching, where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard *et al.* 2011). The susceptibility of the genus *Alveopora* to acidification is unknown. However, in most corals studied, acidification impaired growth, as well as impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles for some species (Anthony *et al.* 2008). The susceptibility and impacts of disease and predation on the genus *Alveopora* are not known. The effects of land-based toxins and nutrients on the genus *Alveopora* are largely unknown, but may pose significant threats to this species at local scales. Collection and trade are not considered threats to this genus (Brainard *et al.* 2011). As described above, *A. verrilliana* is likely highly susceptible to effects attributed to anthropogenic climate change, and is likely being adversely affected by those effects across its range.

4.8.4 Conservation of the Species

A. verrilliana is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.9 *Cyphastrea agassizi* (Coral)

C. agassizi is found primarily in the Indo-Pacific. As a candidate species for listing under the ESA, *C. agassizi* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.9.1 Distribution and Abundance

The reported range of *C. agassizi* is from Indonesia to the Hawaiian Islands in the central Pacific Ocean, and from southern Japan and the Northern Mariana Islands, south to Northeastern Australia. *C. agassizi* is reported as uncommon (Veron 2014). Within the area potentially impacted at Illeginni, *C. agassizi* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, at 6 more of the 11 USAKA islands, and at 14 of 35 sites within the MAC (NMFS 2014).

4.9.2 Life History Characteristics Affecting Vulnerability to Proposed Action

C. agassizi is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. Scleractinian corals act as plants during the day and as animals at night, or in some combination of the two. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. Corals also feed by consuming prey that is captured by the nematocysts (Brainard *et al.* 2011).

C. agassizi typically forms deeply grooved massive colonies attached to hard substrate. It occurs in shallow reef environments of back- and fore-slopes, lagoons and outer reef channels at depths of about 7 to 66 ft (2 to 20 m). Like other corals, *C. agassizi* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. The reproductive characteristics of *C. agassizi* are undetermined, but its congeners include a mix of hermaphroditic spawners and brooders (Brainard *et al.* 2011).

4.9.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is a potential effect of anthropogenic climate change. *Cyphastrea* are considered generally resistant to bleaching, but elevated temperatures may still cause mortality within this genus (Brainard *et al.* 2011). The effects of increased ocean acidity are unknown for this genus, but in general, increased ocean acidity is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates for many

corals. It also can induce bleaching more so than thermal stress, and tends to decrease growth and calcification rates. The specific susceptibility and impacts of disease on *C. agassizi* are not known, but some of its congeners have been infected with various "band" diseases. As such, it appears that *C. agassizi* is susceptible (Brainard *et al.* 2011). The susceptibility of *C. agassizi* to predation is unknown. The effects of land-based pollution on *C. agassizi* are largely unknown, but it may pose significant threats at local scales. This coral light to moderately exploited in trade at the genus level (Brainard *et al.* 2011). As described above, the genus *Cyphastrea* is considered generally resistant to bleaching, but mortality due to elevated temperatures, which may be attributable to anthropogenic climate change, may still occur. As such, this species may be currently adversely affected by those effects on a global level.

4.9.4 Conservation of the Species

C. agassizi is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.10 *Heliopora coerulea* (Coral)

H. coerulea is a very broadly distributed Indo-Pacific coral. It is considered the oldest living coral species. *H. coerulea* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.10.1 Distribution and Abundance

The reported range of *H. coerulea* is from southern east Africa to the Red Sea, across the Indian Ocean to American Samoa in central Pacific Ocean, and from Japan, south to Australia (Brainard *et al.* 2011). Colonies of *H. coerulea* are often patchy in their distribution, but can dominate large areas. Within the area potentially impacted at Illeginni, *H. coerulea* is estimated to be scattered across submerged hard pavement reef areas, including intertidal and/or inshore rocky areas, at a density of up to 0.53 colonies/m^2. It has been observed at Illeginni, at all of the other USAKA islands, and at 32 of 35 sites within the MAC (NMFS 2014).

4.10.2 Life History Characteristics Affecting Vulnerability to Proposed Action

H. coerulea is a non-scleractinian stony coral. Stony corals are sessile, colonial, marine invertebrates. Unlike the calcium carbonate skeleton of scleractinian corals, the skeleton of *H. coerulea* consists of aragonite, and it is blue instead of white. As with scleractinian corals, the individual unit of a coral colony is called a polyp, which is typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense, but instead of living in "cups on the surface of the coral, *H. coerulea* polyps live in tubes within the skeleton. Each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue called the coenenchyme. As with other corals, *H. coerulea* acts as a plant during the day and as an animal at night, or in some combination of the two. The soft tissue harbors mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. Corals also feed by consuming prey that is captured by the nematocysts (Brainard *et al.* 2011).

H. coerulea is a massive coral that typically forms castellate blades. It occurs in water depths from the intertidal zone down to about 197 ft (60 m). It is most abundant from the shallow reef

crest down to forereef slopes at 33 ft (10 m), but is still common down to 60 ft (20 m). Like other corals, *H. coerulea* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. *H. coerulea* colonies have separate sexes. Fertilization and early development of eggs begins internally, but the planula larvae are brooded externally under the polyp tentacles. Larvae are considered benthic, as they normally distribute themselves by crawling away vice drifting in the plankton (Brainard *et al.* 2011).

4.10.3 Threats to the Species

Brainard *et al.* (2011) suggest that *H. coerulea* is a hardy species. They report that it is one of the most resistant corals to the effects of thermal stress and bleaching, and although there is no specific research to address the effects of acidification on this species, it seems to have survived the rapid acidification of the oceans during the Paleocene-Eocene Thermal Maximum acidification. They also report that disease does not appear to pose a substantial threat, and that adult colonies are avoided by most predators of coral. However, the externally brooded larvae are heavily preyed upon by several species of butterflyfish. Although *H. coerulea* tends to prefer clear water with low rates of sedimentation, Brainard *et al.* (2011) report that sediment appears to pose no significant threat to the species. Land-based sources of pollution may pose significant threats at local scales. Collection and trade appear to be the biggest threat to this species. *H. coerulea* has been reported as one of the top 10 species involved in international trade. Its morphology and natural color make it highly desirable (Brainard *et al.* 2011). As described above, *H. coerulea* does not appear to be particularly susceptible to effects attributed to anthropogenic climate change, but it is likely being adversely affected by international trade.

4.10.4 Conservation of the Species

H. coerulea is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.11 *Leptoseris incrustans* (Coral)

L. incrustans is broadly distributed across the Indo-Pacific region. *L. incrustans* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.11.1 Distribution and Abundance

The reported range of *L. incrustans* includes the western Red Sea, central east Africa and Madagascar, and Diego Garcia in the central Indian Ocean; the Indo-Pacific region from the Ryukyu Islands, through the Philippines and Indonesia, to the northern coast of Australia; and eastward around New Guinea to most of the central Pacific, to include the Marianas, Hawaii, French Polynesia to Pitcairn's Island, Samoa, and most of the islands between. *L. incrustans* has been reported as uncommon (Veron 2014). Within the area potentially impacted at Illeginni, *L. incrustans* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at 6 of the 11 USAKA islands, and at 25 of 35 sites within the MAC (NMFS 2014).

4.11.2 Life History Characteristics Affecting Vulnerability to Proposed Action

L. incrustans is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. Scleractinian corals act as plants during the day and as animals at night, or in some combination of the two. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. Corals also feed by consuming prey that is captured by the nematocysts (Brainard *et al.* 2011).

L. incrustans typically forms encrusting colonies attached to hard substrate. It occurs in shallow reef environments at depths of about 7 to 66 ft (2 to 20 m), as well as in the mesophotic zone between 160 and 260 ft (50 and 80 m). Like other corals, *L. incrustans* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. The reproductive characteristics of *L. incrustans* are undetermined, but one of its congeners is gonochoric (separate sexes) (Brainard *et al.* 2011).

4.11.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is a potential effect of anthropogenic climate change. The genus *Leptoseris* is listed as having no bleaching response (Brainard *et al.* 2011). The effects of increased ocean acidity are unknown for this genus, but in general, increased ocean acidity is thought to adversely affect fertilization, larval settlement, and zooxantbellae acquisition rates for many corals, and it tends to decrease growth and calcification rates. The susceptibility and impacts of disease and predation on *L. incrustans* are not known. The effects of land-based pollution on the genus *Leptoseris* are largely unknown, but it may pose significant threats at local scales. Collection and trade are not considered a significant threat to this species (Brainard *et al.* 2011). Although this genus is considered resistant to bleaching, anthropogenic climate change may still adversely affect *L. incrustans* on a global level.

4.11.4 Conservation of the Species

L. incrustans is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.12 *Montipora caliculata* (Coral)

M. caliculata is broadly distributed across the Indo-Pacific region. It became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.12.1 Distribution and Abundance

The reported range of *M. caliculata* includes the eastern Red Sea, central east Africa and Madagascar, and Diego Garcia in the central Indian Ocean; the Indo-Pacific region from the Ryukyu Islands, through the Philippines and Indonesia, to the north and northeastern coasts of

Australia; and eastward around New Guinea to most of the central Pacific, to include the Marianas, the Marshalls, Samoa, French Polynesia and Pitcairn Island, and most of the islands between. *M. caliculata* has been reported as uncommon to common (Veron 2014). Within the area potentially impacted at Illeginni, *M. caliculata* is estimated to be scattered across submerged hard pavement reef areas, including intertidal and/or inshore rocky areas, at a density of up to 0.14 colonies/m^2. It has been observed at Illeginni, at all but one of the other USAKA islands, and at 31 of 35 sites within the MAC (NMFS 2014).

4.12.2 Life History Characteristics Affecting Vulnerability to Proposed Action

M. caliculata is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. The zooxanthellae allow scleractinian corals to gain most of their food through photosynthesis during the day, switching to more capture of microscopic prey with nematocysts on their tentacles at night. Corals also absorb significant amounts of microorganic compounds and free nutrients (Bythell, 1990; Grover et al. 2008). However, the dominant feeding mode varies among species and some species can shift among them as needed Grottoli et al. 2006).

M. caliculata typically forms massive colonies attached to hard substrate. It occurs in most shallow reef environments at depths down to about 66 ft (20 m). The reproductive characteristics of *M. caliculata* are undetermined, but of the 35 of its congeners that have been studied, all are hermaphroditic broadcast spawners (Brainard *et al.* 2011).

Based on the description of the proposed action and the life history characteristics of *M. caliculata*, colonies growing on the substrate around the sinkers of buoy-type AtoN could be affected by the return of sinkers and chains that would be reset.

4.12.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. The genus *Montipora* is considered to have a relatively high bleaching response to thermal stress, but *M. caliculata* is considered to have a moderate response (Brainard *et al.* 2011). The effects of increased ocean acidity are unknown for *M. caliculata*. However, a congener demonstrated a significant reduction in growth rate during experimental exposure to anticipated acidification levels. In general, increased ocean acidity is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates for many corals, and it tends to decrease growth and calcification rates (Anthony *et al.* 2008). The specific susceptibility and impacts of disease and predation on *M. caliculata* are not known, but the genus *Montipora* is considered moderately susceptible to diseases such as black band disease and white syndrome, and the genus is a preferred prey of the

crown of thorns seastar (*Acanthaster planci*). The effects of land-based pollution on *M. caliculata* are largely unknown, but the genus is considered "sediment intolerant" with substantial variation in sediment intolerance among species. Land-based pollution may pose significant threats at local scales. The genus *Montipora* is also heavily exploited in the international aquarium trade (Brainard *et al.* 2011). As described above, the genus *Montipora* is susceptible to effects of thermal stress, which may be attributable to anthropogenic climate change. As such, this species is likely being adversely affected by those effects across its range.

4.12.4 Conservation of the Species

M. caliculata is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.13 *Pavona venosa* (Coral)

P. venosa is a broadly distributed Indo-Pacific. It became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.13.1 Distribution and Abundance

The reported range of *P. venosa* extends down the eastern shore of the Saudi Arabian, into the Red Sea, down to central Africa and Madagascar, across the Indian Ocean to include the Chagos Archipelago and Sri Lanka, through the Indo-Pacific region, eastward to the Tuamotus in the southeastern Pacific Ocean. It ranges as far north as the Ryukyu Islands, through the South China Sea and the Philippines, and to the south down along the east and west coasts of Australia and the Coral Sea. *P. venosa* has been reported as common. Within the area potentially impacted at Illeginni, *P. venosa* is estimated to be scattered across submerged hard pavement reef areas, mostly below the intertidal zone and very shallow water habitats, at a density of up to 0.08 colonies/m^2. It has been observed at Illeginni, all of the other USAKA islands, and at 16 of 35 sites within the MAC (NMFS 2014).

4.13.2 Life History Characteristics Affecting Vulnerability to Proposed Action

P. venosa is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. The zooxanthellae allow scleractinian corals to gain most of their food through photosynthesis during the day, switcbing to more capture of microscopic prey with nematocysts on their tentacles at night. Corals also absorb significant amounts of microorganic compounds and free nutrients (Bythell, 1990; Grover et al. 2008). However, the dominant feeding mode varies among species and some species can shift among them as needed Grottoli et al. 2006).

P. venosa typically forms massive to encrusting colonies attached to hard substrate. It occurs in shallow reef environments at depths of about 7 to 66 ft (2 to 20 m). The reproductive

characteristics of *P. venosa* are unknown, but six of its congeners are gonochoric (separate sexes) spawners; releasing gametes of both sexes that become fertilized in the water (Brainard *et al.* 2011).

4.13.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. *P. venosa* has moderate to high susceptibility to thermal stress induced "bleaching" where the coral expels its zooxanthellae. The physiological stress and reduced nutrition from bleaching are likely to have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard *et al.* 2011). In general, increased ocean acidity is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates for many corals. It can increase the susceptibility to thermal stress, and tends to decrease growth and calcification rates (Anthony *et al.* 2008). No studies have examined the direct impacts of ocean acidification on *P. venosa*, but some evidence suggests that the genus *Pavona* has some degree of tolerance to acidification (Brainard *et al.* 2011). The specific susceptibility and impacts of disease on *P. venosa* are not known, but susceptibility is considered to be low (Brainard *et al.* 2011). There are a medium number of reports of acuter white disease for the genus *Pavona*. The susceptibility of *P. venosa* to predation is considered to be low, but there is no specific information. Members of the genus *Pavona* have varied susceptibility to predation by the crown of thorns seastar (*Acanthaster planci*). There is no specific information about the effects of land-based pollution on *P. venosa*, but it may pose significant threats at local scales. International trade includes the genus *Pavona*, but at relatively low levels (Brainard *et al.* 2011). As described above, *P. venosa* is susceptible to effects of thermal stress, which may be attributable to anthropogenic climate change. As such, this species is likely being adversely affected by those effects across its range.

4.13.4 Conservation of the Species

P. venosa is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.14 *Turbinaria reniformis* (Coral)

T. reniformis is very broadly distributed across the Indo-Pacific region. *T. reniformis* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.14.1 Distribution and Abundance

The reported range of *T. reniformis* includes the Persian Gulf, the Red Sea, and most of the Indian Ocean basin, through the Indo-Pacific region, and eastward to the central Pacific Ocean out to Samoa and the Cook Islands. It ranges as far north as central Japan, down through the Philippines, around New Guinea, and down along the east and west coasts of Australia, and also down the Marianas, the Marshalls, and east to the Line Islands. It has been reported as common (Veron 2014). Within the area potentially impacted at Illeginni, *T. reniformis* is estimated to occur in small aggregations on submerged hard pavement reef areas, at a density of up to 0.16

colonies/m^2. It has been observed at Illeginni, at 5 more of the 11 USAKA islands, and at 9 of 35 sites within the MAC (NMFS 2014).

4.14.2 Life History Characteristics Affecting Vulnerability to Proposed Action

T. reniformis is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. Scleractinian corals act as plants during the day and as animals at night, or in some combination of the two. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. Corals also feed by consuming prey that is captured by the nematocysts (Brainard *et al.* 2011).

T. reniformis colonies are attached to hard substrate and typically form large lettuce-like assemblages of plates. The plates tend to be very convoluted in shallow active water, whereas they are broad and flat in deeper calmer waters. It has been reported from the surface down to over 130 ft (0 to 40 m), commonly on forereef slopes at 33 ft (10 m) and deeper, but it prefers turbid shallow protected waters where it forms massive and extensive stands. Like other corals, *T. reniformis* feeds on tiny free-floating prey that is captured by the tentacles of the individual coral polyps that comprise the colony. *T. reniformis* is a gonochoric (separate sexes) spawner; releasing gametes of one sex or the other that become fertilized in the water (Brainard *et al.* 2011).

4.14.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is a potential effect of anthropogenic climate change. Susceptibility of *Turbinaria spp.* to thermal stress induced bleaching (where the coral expels its zooxanthellae) varies regionally, and among species, but ranges between low to moderate. The physiological stress and reduced nutrition from bleaching may have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony. However, *T. reniformis* has shown the potential to reduce bleaching impacts through increased heterotrophic feeding rates (Brainard *et al.* 2011). The susceptibility of *T. reniformis* to acidification appears to be lower than that of other genera of scleractinian corals tested. However, in most corals studied, acidification impaired growth, as well as impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles for some species (Brainard *et al.* 2011). Susceptibility and impacts of disease on *T. reniformis* are not known, but both white syndrome disease and black lesions have affected members of this genus. Adult colonies of *Turbinaria spp.* are rarely eaten by the crown of thorns seastar (*Acanthaster planci*), but the gastropod nudibranch (*Phestilla sibogae*) both feeds upon, and infects *Turbinaria spp.* with disease. *T. reniformis* appears to tolerate high turbidity and sedimentation, as well as low-salinity events, but land-based toxins and nutrients may have deleterious effects on a regional scale, depending on the substance, concentration, and duration of exposure. The genus *Turbinaria* has been heavily exploited in international trade, and *T.*

reniformis is likely included in this trade (Brainard *et al.* 2011). As described above, *T. reniformis* may be susceptible to some effects attributed to anthropogenic climate change, and as such could be currently adversely affected by those effects on a global level.

4.14.4 Conservation of the Species

T. reniformis is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.15 Turbinaria stellulata (Coral)

T. stellulata is very broadly distributed across the Indo-Pacific region. As a candidate species for listing under the ESA, *T. stellulata* became a consultation species under UES section 3-4.5.1 (a), and retained that status, per the wishes of the RMI Government, after we determined that listing under the ESA was not warranted.

4.15.1 Distribution and Abundance

The reported range of *T. stellulata* includes the Red Sea and most of the Indian Ocean basin, through the Indo-Pacific region, and eastward to the central Pacific Ocean out to Samoa and the Cook Islands. It ranges as far north as central Japan, down through the Philippines, around New Guinea, and down along the east and west coasts of Australia, and also down the Marianas, the Marshalls, and east to the Line Islands. It has been reported as common (Veron 2014). Within the area potentially impacted at Illeginni, *T. stellulata* is estimated to occur in small aggregations on submerged hard pavement reef areas, at a density of up to 0.16 colonies/m^2. It has been observed at Illeginni, at 5 more of the 11 USAKA islands, and at 9 of 35 sites within the MAC (NMFS 2014).

4.15.2 Life History Characteristics Affecting Vulnerability to Proposed Action

T. stellulata is a scleractinian (stony) coral. Stony corals are sessile, colonial, marine invertebrates. A living colony consists of a thin layer of live tissue over-lying an accumulated calcium carbonate skeleton. The individual unit of a coral colony is called a polyp. Polyps are typically cylindrical in shape, with a central mouth that is surrounded by numerous small tentacles armed with stinging cells (nematocysts) that are used for prey capture and defense. Individual polyps secrete a cup-like skeleton (corallite) over the skeletons of its predecessors, and each polyp is connected to adjacent polyps by a thin layer of interconnecting tissue. The soft tissue of stony corals harbor mutualistic intracellular symbiotic dinoflagellates called zooxanthellae, which are photosynthetic. The zooxanthellae allow scleractinian corals to gain most of their food through photosynthesis during the day, switching to more capture of microscopic prey with nematocysts on their tentacles at night. Corals also absorb significant amounts of microorganic compounds and free nutrients (Bythell, 1990; Grover et al. 2008). However, the dominant feeding mode varies among species and some species can shift among them as needed Grottoli et al. 2006).

T. stellulata is typically an encrusting coral, found attached to hard substrate, but sometimes forms massive dome-shaped colonies. Its depth range is unknown, but it is generally found in clear (low turbidity) water. The reproductive characteristics of *T. stellulata* are unknown, but three of its congeners are gonochoric (separate sexes) spawners; releasing gametes of one sex or the other that become fertilized in the water (Brainard *et al.* 2011).

4.15.3 Threats to the Species

Current threats include: thermal stress, acidification, disease, predation, pollution, and exploitation. Increased exposure to thermal stress is occurring as part of the rising ocean temperatures being caused by anthropogenic climate change. Susceptibility of *Turbinaria spp.* to thermal stress induced bleaching (where the coral expels its zooxanthellae) varies regionally, and among species, but ranges between low to moderate. The physiological stress and reduced nutrition from bleaching may have synergistic effects of lowered fecundity and increased susceptibility to disease. Bleaching can also result in mortality of the affected colony (Brainard *et al.* 2011). The susceptibility of *Turbinaria spp.* to acidification appears to be lower than that of other genera of scleractinian corals tested. However, in most corals studied, acidification impaired growth, as well as impaired fertilization, larval settlement, and zooxanthellae acquisition rates in juveniles for some species, and can induce bleaching more so than thermal stress (Anthony *et al.* 2008). Susceptibility and impacts of disease on *T. stellulata* are not known, but both white syndrome disease and black lesions have affected other members of this genus. *Turbinaria spp.* are rarely eaten by the crown of thorns seastar (*Acanthaster planci*), but the gastropod nudibranch (*Phestilla sibogae*) both feeds upon, and infects *Turbinaria spp.* with disease. *T. stellulata* appears to tolerate low-salinity events, but it is also intolerant of high-turbidity, and land-based toxins and nutrients may have deleterious effects on a regional scale, depending on the substance, concentration, and duration of exposure. Although the genus *Turbinaria* has been heavily involved in international trade, *T. stellulata* is likely less impacted by this trade due to its relatively unattractive morphology (Brainard *et al.* 2011). As described above, *T. stellulata* may be susceptible to some effects attributed to anthropogenic climate change, and as such could be currently adversely affected by those effects across its range.

4.15.4 Conservation of the Species

T. stellulata is listed in CITES Appendix II, and has been retained as a consultation species under the UES, by the RMI Government.

4.16 *Tectus niloticus* (Top Shell Snail)

The top shell snail is also sometime referred to as *Trochus niloticus*. It is a broadly distributed marine gastropod, and is a consultation species under UES section 3-4.5.1 (a).

4.16.1 Distribution and Abundance

The top shell snail is distributed in sub-tropical to tropical waters of the Indo-Pacific region. They are indigenous to Yap, Palau, and Helen Reef in Micronesia, but have been introduced to nearly every island group across the Indo-Pacific region (Smith 1987). Larvae recruit to shallow intertidal zones, typically along exposed (seaward) shores. Individuals migrate into deeper water as they grow (Heslinga *et al.* 1984) with maximum reported depth being 24 m (Smith 1987). Data are insufficient to determine current population levels and trends across its range, including in the RMI. Within the area potentially impacted at Illeginni, the top shell snail is estimated to be scattered across submerged hard pavement reef areas, including intertidal and/or inshore rocky areas, at a density of up to 0.09 individuals/m^2. It has been observed at Illeginni, at all of the other USAKA islands, and at 12 of 35 sites within the MAC (NMFS 2014).

4.16.2 Life History Characteristics Affecting Vulnerability to Proposed Action

The top shell is a nocturnal, herbivorous, marine gastropod mollusk. It is normally found on the reef surface in the intertidal and subtidal zones. The life span is between 15 and 20 years, with sexual maturity occurring at about 2 years. It is a hardy species that is commonly relocated between island groups with high success. Dobson (2001), reports that top shell snails can survive out of the water for up to 36 hours when kept cool and damp. After being relocated on a new reef area and left undisturbed for a brief period, top shell snails typically resume normal behaviors with no measurable effects assuming the relocation site supports adequate forage and shelter.

4.16.3 Threats to the Species

The top shell is highly susceptible to over-exploitation. It is an edible species whose shells are also commercially important in the mother of pearl button industry (Heslinga *et al.* 1984). They are slow moving and are easily spotted by reef-walkers and snorkelers. Unregulated or poorly regulated harvesting has led to their depletion across their range. Although top shell snails are probably beginning to be affected by impacts associated with anthropogenic climate change (described in more detail in the Environmental Baseline section below), no significant climate change-related impacts to its populations have been observed to date.

4.16.4 Conservation of the Species

The top shell is afforded protection at USAKA as a consultation species under the UES (USAKA 2014).

5 Environmental Baseline

The UES does not specifically describe the environmental baseline for a biological opinion. However, under the ESA, the environmental baseline includes: past and present impacts of all State, Federal, or private actions and activities in the action area; the anticipated impacts of all proposed Federal projects in the action area that have already undergone Section 7 consultation; and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The Consultation Handbook further clarifies that the environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area (USFWS & NMFS 1998). The purpose of describing the environmental baseline in this manner within a biological opinion is to provide the context for the effects of the proposed action on the listed species. Although the ESA does not apply for actions in USAKA, the basis for analysis remains consistent with the intent of this consultation, so the ESA description will be used for this Opinion. As described in Sections 2 and 3 above, the action area where the proposed action may adversely affect consultation species consists of the marine waters adjacent to Illeginni Islet at Kwajalein Atoll, RMI (Figure 5).

Figure 5. Illeginni Islet.

The Marshall Islands consist of 29 atolls and 5 islands aligned in two roughly parallel northwest-southeast chains: the northeastern Ratak Chain and the southwestern Ralik Chain. The total land area is about 70 square miles, and the total lagoon area is about 4,500 square miles. Kwajalein Atoll is located near the center of the island group, about 8 degrees above the equator, and is considered the largest coral reef atoll in the world. The past and present impacts of human and natural factors leading to the status of UES-protected species within the action area include coastal development, armed conflict, direct take, fishing interactions, vessel strikes and groundings, marine debris, and climate change.

Kwajalein Atoll was the site of heavy fighting during World War II (1940s), when the US took it from the Japanese. Many of the islets have been heavily modified by dredge and fill construction operations by both the Japanese and US forces. More recently, the RMI has provided eleven islets around the rim of Kwajalein Atoll for the use of the US Government as part of the Ronald Reagan Ballistic Missile Defense Test Site (RTS). Hundreds of US personnel live on some of the islets, and Marshallese workers commute daily between the US occupied islets and the ones the Marshallese live on. Vessel traffic occurs regularly between the islets, and to and from the atoll. This includes fishing boats, personnel ferries, military service craft, visiting military ships, and cargo vessels that supply the peoples of Kwajalein Atoll. For more than 18 years, the USAG-KA has participated in testing hypersonic vehicles from ICBM and other flight tests launched from Vandenberg AFB and other locations. Vehicle impacts from such tests have occurred and continue to occur on and in the vicinity of Illeginni Islet and in adjacent ocean waters (Figures 4 & 5).

Direct take through harvest continues in the RMI for several of the UES consultation species. For example, sea turtles, black lip pearl oysters, and top shell snails (all of which are UES consultation species) are considered a food source or of economic value by many RMI nationals. The harvest of these and other UES-protected marine species is believed to continue on most of the inhabited islands and islets of the RMI, with the possible exception of the USAKA-controlled islets, where access is limited and the UES prohibits those activities. However, the level of exploitation is unknown, and no concerted research or management effort has been made to conserve these species in the RMI. No information is currently available to quantify the level of impact direct take is having on consultation species in the Marshall Islands.

Despite the development, wartime impacts, and human utilization of marine resources mentioned above, the atoll's position at the center of the Pacific Ocean is far from highly industrialized

areas, and its human population remains relatively low. Consequently, the water quality of the lagoon and the surrounding ocean is very high, and the health of the reef communities, along with the overall marine environment of Kwajalein Atoll, borders on pristine.

Climate change may be affecting marine ecosystems at Kwajalein Atoll. Climate refers to average weather conditions within a certain range of variability. The term climate change refers to distinct long-term changes in measures of climate, such as temperature, rainfall, snow, or wind patterns lasting for decades or longer. Climate change may result from: natural factors, such as changes in the Sun's energy or slow changes in the Earth's orbit around the Sun; natural processes within the climate system (e.g., changes in ocean circulation); and human activities that change the atmosphere's makeup (e.g., burning fossil fuels) and the land surface (e.g., cutting down forests, planting trees, building developments in cities and suburbs, etc.), also known as anthropogenic climate change (U.S. Environmental Protection Agency). The global mean temperature has risen 0.76°C over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (Solomon *et al.* 2007). Sea level rose approximately 17 cm during the 20th century (Solomon *et al.* 2007) and further increases are expected. Climate change is a global phenomenon so resultant impacts have likely been occurring in the action area. However, scientific data describing impacts in the action area are lacking, and no climate change-related impacts on UES-protected species within the action area have been reported to date.

Climate change-induced elevated water temperatures, altered oceanic chemistry, and rising sea level may be contributing to changes to coral reef ecosystems, and is likely beginning to affect corals and mollusks found in the action area. Globally, climate change is adversely affecting many species of corals. Increasing thermal stress due to rising water temperatures has already had significant effects on most coral reefs around the world. It has been linked to widespread and accelerated bleaching and mass mortalities of corals around the world over the past 25 years (Brainard *et al.* 2011). As the atmospheric concentration of CO_2 has increased, there has been a corresponding reduction in the pH of ocean waters (acidification). As ocean acidity increases, the calcium carbonate saturation state of the water decreases. Increased ocean acidity has the potential to lower the calcium carbonate saturation state enough to slow calcification in most corals and may increase bioerosion of coral reefs. It is thought to adversely affect fertilization, larval settlement, and zooxanthellae acquisition rates for corals, and can induce bleaching more so than thermal stress, and tends to decrease growth and calcification rates (Brainard *et al.* 2011). By the middle of this century, ocean acidity could lower calcium carbonate saturation to the point where the reefs may begin to dissolve (Brainard *et al.* 2011).

Changes in ocean temperature and chemistry, and rising sea level may be affecting the black-lip pearl oyster in the action area, but no specific information is currently available to assess the impacts. Because this species depends on an exoskeleton that is comprised primarily of calcium carbonate, we expect that minimally, increased acidity could have effects that parallel those described for corals above, with the exception of impacts related to zooxanthellae.

Attempting to determine whether recent biological trends are causally related to anthropogenic climate change is complicated because non-climatic influences dominate local, short-term biological changes. However, the meta-analyses of 334 species and the global analyses of 1,570

species show highly significant, nonrandom patterns of change in accord with observed climate warming in the twentieth century. In other words, it appears that these trends are being influenced by climate change-related phenomena, rather than being explained by natural variability or other factors (Parmesan and Yohe 2003). However, the implications of these changes are not clear in terms of population level impacts, and data specific to the action area are lacking. Over the long-term, climate change-related impacts could influence the biological trajectories of UES-protected species on a century scale (Parmesan and Yohe 2003). However, due to a lack of scientific data, the specific effects climate change could have on these species in the future are not predictable or quantifiable to any degree that would allow for more detailed analysis in this consultation (Hawkes *et al.* 2009).

6 Effects of the Action

In this section of a biological opinion, we assess the probable effects of the proposed action on UES-protected species. Effects of the Action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that would be added to the environmental baseline. Direct effects are caused by exposure to the action related stressors that occur at the time of the action. Indirect effects are those that are likely to occur later in time (50 CFR 402.02). The effects of the action are considered within the context of the Status of the Species, together with the Environmental Baseline and Cumulative Effects sections of this Opinion to determine if the proposed action can be expected to have direct or indirect effects on UES-protected species that appreciably reduce their likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (50 CFR 402.02), otherwise known as the jeopardy determination. Since no critical habitat has been designated in the RMI, impacts on critical habitat are not considered in this Opinion.

Approach. WE determine the effects of the action using a sequence of steps. The first step identifies potential stressors associated with the proposed action with regard to listed species. We may determine that some potential stressors result in insignificant, discountable, or beneficial effects to listed species, in which case these potential stressors are considered not likely to adversely affect protected species, and subsequently are considered no further in this Opinion. Those stressors that are expected to result in significant negative (i.e., adverse) effects to listed species are analyzed via the second, third, and fourth steps described below.

The second step identifies the magnitude of the stressors (e.g., how many individuals of a particular species would be exposed to the stressors; *exposure analysis*). In this step of our analysis, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to a proposed action's effects, and the populations or subpopulations those individuals represent.

The third step describes how the exposed individuals are likely to respond to the stressors (*response analysis*). In this step, we determine if the stressors are likely to result in any adverse effects on exposed individuals.

The final step in determining the effects of the action is to establish the risks those responses pose to listed resources (*risk analysis*). The risk analysis is different for listed species and

designated critical habitat. However, as mentioned above, the action area includes no designated critical habitat, thus it is not considered in this Opinion. Our jeopardy determinations must be based on an action's effects on the continued existence of UES-protected species within USAKA. Because the continued existence of listed species depends on the fate of the populations that comprise them, the viability (probability of extinction or probability of persistence) of listed species depends on the viability of their populations.

6.1 Stressors

As described above in Section 3, we believe that the proposed action would cause 5 stressors that may affect the consultation species considered in this consultation: exposure to elevated noise levels; impact by falling missile components; exposure to hazardous materials; disturbance from human activity and equipment operation; and collision with vessels. Of those stressors, impact by falling missile components, specifically for the single event that would target Illeginni Islet, is the only stressor that is likely to adversely affect consultation species. The remaining stressors are expected to have insignificant effects and/or exposure is discountable (extremely unlikely to occur), and those stressors are discussed no further in this Opinion. Similarly, Section 3 described why all of the species identified in Table 2, and the humphead wrasse from Table 1, are unlikely to be adversely affected, and therefore considered no further in this Opinion. In summary, the 15 coral species and top shell snail identified in Table 1 may be hit by the falling RV or by ejecta, or be significantly affected by concussive forces during the single planned RV strike on Illeginni Islet.

Note: Within the 15 coral species that may be adversely affected by the proposed action, the effects are expected to be practically identical. Addressing the species individually would significantly increase the length of this Opinion with no discernible improvement in the evaluation. Therefore, all 15 corals are referred to together as "corals", unless an individual species needs to be identified due to some unique sensitivity or response.

6.2 Exposure to Impact by Falling Missile Components

This section analyzes the proposed action's potential for exposing UES-consultation corals and top shell snails to being hit by a RV and/or ejecta, or to concussive forces from the single planned RV strike on Illeginni Islet. This analysis is based on the distribution and density report completed for the proposed action and on personal communication with the survey team (NMFS 2014b, Kolinski Pers. Comm. 2015), and on the description of the effects of a RV land impact (USA/USAF 2015). We believe that the distribution and density report likely over-estimates the number of coral and mollusk species that may be within the action area at Illeginni, but that it represents the best available information to make those estimates.

The quantitative estimates of species distribution and abundance within the potentially affected areas at Illeginni are based on surveys of 136 sites around the 11 USAKA islets, including 4 sites around Illeginni (NMFS 2014b). Species observed to occur on reef flat, crest, and gently sloping substrates around USAKA islets at depths less than or equal to 35 feet water depth were considered as potentially being present within the MMIII impact area. Because the available survey information also includes the observed distribution and abundance of the affected consultation species in numerous habitat types around the 11 USAKA islets and at 35 survey sites throughout the mid-atoll corridor (MAC), we believe that the existing information also

serves as a reasonable foundation to estimate the distribution and abundance of these organisms throughout USAKA.

As described above in Sections 2 and 3, there is a 20% chance that the RV could strike the water's edge along the lagoon or ocean shore at Illeginni. Based on previous land impacts, impact ejecta could fall anywhere within a 120° arc centered on the RV's track, out to 300 ft (91 m) from the impact site. Based on a 180° arc, the USA/USAF estimates that an area equal to 15,557 yd^2 (13,008 m^2) could be affected by ejecta impact along either shore (Figure 6).

Figure 6. Potential area of effect for ejecta (yellow) and shockwave (red) along the shore of the lagoon (left) and ocean (right) at Illeginni (USA/USAF 2015).

Habitat suitability is lowest along the water's edge and with the exception of sandy patches, typically increases with distance from shore. Based on the professional judgement of the NMFS survey divers, up to 80% of the area potentially affected by ejecta, 12,445 yd^2 (10,406 m^2), is suitable habitat for the consultation species (Kolinski 2014 in USA/USAF 2015). The ground borne shock wave could affect consultation species within 123 ft (37.5 m) of the impact. An in-water area equal to 2,642 yd^2 (2,209 m^2) could be subject to shockwave effects. USA/USAF estimates that up to 60% of that area, 1,585 yd^2 (1,325 m^2), is suitable habitat for the consultation species (Kolinski 2014 in USA/USAF 2015).

The effects of ejecta impact would not occur evenly across the affected area. Chunks of ejecta would be scattered across the area; impacting a small proportion of the suitable habitat. Due to variances in substrate density and structure, the shockwave effect would also occur unevenly, and it too would affect only a proportion of the suitable habitat within its range of effect. Also, the area within the shockwave range of effect would be completely contained within the area at risk for ejecta impacts. To account for the unevenness of impact across the area, and to avoid double counting potential exposures, the USA/USAF estimates that 50% of the 12,445 yd^2 (10,406 m^2) potentially affected suitable habitat would be affected by the combination of ejecta and/or shock waves 6,223 yd^2 (5,203 m^2). The 99% upper confidence level of the bootstrap mean densities for the potentially affected consultation species in the area was multiplied by the areal extent of potentially affected suitable habitat to estimate the number of coral colonies and top shell snails that may be adversely affected by ejecta and/or shockwave effects by a RV land impact at Illeginni Islet (Table 3).

Table 3. Marine UES consultation species likely to be adversely affected by ejecta and/or shockwaves per RV strike		
Scientific Name	**Species**	**Colonies or Individuals Affected**
	Corals	
Acanthastrea brevis	No Common Name	416
Acropora aculeus	No Common Name	416
A. aspera	No Common Name	203
A. dendrum	No Common Name	416
A. listeri	No Common Name	416
A. microclados	No Common Name	416
A. palystoma	No Common Name	416
Alveopora verriliiiana	No Common Name	832
Cyphastrea agassizi	No Common Name	416
Heliopora coerulea	No Common Name	2,758
Leptoseris incrustons	No Common Name	416
Montipora caliculata	No Common Name	728
Pavona venosa	No Common Name	416
Turbinaria reniformis	No Common Name	832
T. stellulata	No Common Name	832
	Mollusks	
Tectus niloticus	Top Shell Snail	468

6.3 Response to Falling Missile Components

This section analyzes the responses of UES-consultation corals and top shell snails that may be exposed to being hit by a RV and/or ejecta, or to concussive forces from the single planned RV strike on Illeginni Islet.

The RV would be traveling at hypersonic velocity when it impacts the islet. The kinetic energy released into the substrate would be similar to the detonation of high explosives. The RV will effectively "explode", with some of its mass reduced to very fine particles ("aerosolized") and the remainder reduced to an undescribed range of fragment sizes. The substrate at the impact site would be blasted into a range of fragment sizes ranging from powder to larger rocks toward the outer edges of the crater. Some RV debris and substrate rubble would remain in the crater. The remainder would be thrown from the crater (ejecta). Initially, some of the ejecta would be moving at high velocity (bullet speeds). Some ejecta would move laterally, some would travel upward then fall back down close to the impact area. The resulting crater would be up to 30 ft (9 m) across and 10 ft (3 m) deep. The substrate immediately around the crater would be covered by larger chunks of ejecta from the outer edges of the crater as well as finer material that was thrown more vertically before falling back down. The movement of ejecta away from the crater would act to spread it out (scatter) over an increasing area, with decreasing available material being scattered over an increasing area. The velocity of the ejecta would also diminish with distance.

The intensity of the RV impact, and the uniformity of exposure to ejecta and the shockwave would decrease with distance from the point of impact. Any corals and top shell snails directly beneath the RV, or within the crater radius are expected to be instantly killed, with very little left of the organisms that would be recognizable. Beyond the crater, corals and top shell snails

would be exposed to ejecta and the ground borne shockwave. Corals and top shell snails immediately beyond the crater would likely experience mortality from impact by high-velocity ejecta, from burial under mobilized crater material, or from exposure to the ground borne shockwave.

The response of corals to ejecta and the ground borne shockwave would depend largely on the scale and intensity of the exposure. Impact by high-velocity dense ejecta (rock or metal), could fracture the hard structure of corals and would likely injure or destroy soft tissues. Fracturing would depend largely on the size and intensity of the impact and on morphology of the impacted coral. Plate-forming and branching corals are more easily broken than large massive or encrusting forms. Fractures due to a RV impact are expected to range from pulverization of colonies in and close to the crater, to cracks and/or loss of branches in colonies toward the outer edge of effect. Additionally, exposure to the ground based shockwave could also fracture or dislodge coral colonies out to about 123 ft from the RV impact. Because the coral skeletons are hard rock-like structures that are rigidly fixed to the hard substrate through which the shock wave would travel, much of the available energy in the substrate can be transferred directly into the coral's skeletal structure. If the shockwave is intense enough, the coral's structure may crack or fracture and/or it may become unattached from the substrate. At close ranges, impact by lower velocity and/or lower density ejecta could affect the soft tissues of corals, ranging from burial to scouring away all or most of the living polyps and interconnecting soft tissues from a colony. At greater ranges, localized damage of a small part of a colony is possible.

Pulverization of a colony's structure, deep burial, or loss of a large proportion of a colony's soft tissue would likely result in the mortality of the colony. Partial fracturing of a coral skeleton and/or dislodgement of a coral from the substrate due to ejecta impact or from exposure to the ground based shock wave would injure the soft tissues at and around the break. Re-growth of soft tissues has energetic costs that could slow other growth and reproduction. Exposed areas of coral skeleton are prone to bioerosion and overgrowth by algae and certain sponges. Large areas of damaged or dead tissue could result in the introduction of algae that may prevent the regeneration of healthy coral tissue, or that may overcome the whole colony. Damaged and stressed tissues may also be more susceptible to infection by coral diseases that may hinder or prevent healing to the point that the colony dies.

Fragmentation is a form of asexual reproduction in some branching corals, resulting in the development of new, but genetically identical colonies. Bothwell (1981) reports that several *Acropora* species successfully colonize through fragmentation and translocation of fragments by storm-driven waves. However, not all coral fragments, or dislodged colonies would be expected to survive. Survival would depend largely on where a fragment falls and how it is oriented after it settles to substrate. A fragment or colony is likely to die if the living tissue is on the underside of the fragment or if the fragment settles into fine sediments. Additionally, in areas that experience regular high surf, such as the ocean side reef at Illeginni, loose coral fragments and colonies could repeatedly become mobilized by the waves. This reduces the likelihood of their survival, and potentially injures additional coral colonies should the fragments be cast against them.

Based on the available information, we believe that the numbers of coral colonies, identified above in Table 3, represent a conservative yet reasonable estimate of the corals that may be adversely affected by the proposed action. Further, this Opinion conservatively assumes that mortality would result for all exposed coral colonies. This approach is being taken to ensure a precautionary assessment is made of the jeopardy risk for the affected species.

In the case of the top shell snail, the effects of exposure to ejecta and shockwave is expected to quickly diminish to insignificance with distance from the RV impact site. Impact by high-velocity dense ejecta (rock or metal) immediately around the crater could penetrate or fracture an exposed snail's shell, either killing the animal directly, or leaving it vulnerable to predation. Conversely, with movement away from the RV impact site, ejecta would become slower, and the ejecta would have to penetrate increasing water depth to impact the snails. Considering the conical shape and thickness of a top shell snail's shell, most ejecta that may strike one that is under water and at any distance from the RV impact site is likely to be deflected without imparting a significant proportion of its kinetic energy to the shell or the animal within.

Top shell snails immediately around the RV crater may also be buried by ejecta. The potential for burial, and the depth of the material under which a snail may be buried would likely decrease quickly with distance from the RV impact site. Mortality could result if the snail is crushed, smothered, or permanently pinned beneath rubble. Non-lethal effects could include energetic costs and/or foraging impacts.

Exposure to intense ground borne shockwaves could injure the soft tissues of top shell snails. Mortality of the snail is possible if the injury is significant enough. The range to the onset of significant injuries for top shell snails exposed to a ground based RV impact shockwave is unknown, but it is likely much less than that estimated for corals (123 ft). Top shell snails are not rigidly attached to the substrate as are corals. Instead, they adhere to the reef using a muscular foot. Whereas rigidly attached corals would be directly linked to the substrate such that the energy could readily travel into and along its skeletal structure, the muscular foot of the snail acts to isolate the snail's shell from the vibration, and to reduce the transfer of the energy to other soft tissues and organs. Non-lethal effects could include bruising of the foot and other tissues, which may have energetic costs and/or may have reproductive impacts.

As stated above at 6.2, habitat suitability for the consultation species is lowest along the water's edge and typically increases with distance from shore. Therefore, top shell snail density would be lowest in the area immediately adjacent to the RV impact site, where ejecta effects and shockwave would be greatest. Conversely, in the areas where top shell snail density would be highest, ejecta would be slower, and it would have to penetrate several feet of water to impact the snails. Based on this, on the robust nature of snail (see Section 3), and the characteristics of its shell, most ejecta that may strike top shell snails is likely to be deflected without imparting any significant proportion of its kinetic energy to the shell or the animal within. In this situation, ejecta impact would result in little more than inducing the affected snail to briefly adhere more tightly to the substrate before resuming normal behaviors. The range to adverse effects from burial and shockwaves would likely be similarly restricted to the area along the water's edge. Therefore, we expect that fewer than 117 (25%) of the 468 top shell snails that may be exposed

to the combined effects of an RV land strike (Table 3, above), would be adversely affected by the exposure.

6.4 Risk

This section analyzes the risk posed by the proposed action for populations of UES-protected marine species at USAKA due to exposure to direct impact and removal from the water as described above. Because this Opinion assumes mortality for all exposed individuals, regardless of the stressor, the risk assessment below focuses on the species vice the stressors.

6.4.1 Risk for coral populations due to expected levels of action-related mortality

As described in the exposure analyses above, up to 9,929 colonies of 15 UES-consultation coral species (Table 3) could experience mortality per RV strike on Illeginni Islet. This would be due to the combined exposure to direct RV impact, ejecta, and ground based shockwave. The USAF plans a total of five RV strikes on Illeginni Islet over the duration of this project. A worst case scenario would occur if all five RV strikes are misstrikes (between 0.1 and 0.2 probability) and hit the shallow waters or reef flats, and all misstrikes land in different areas of the reef impacting new areas of the each time. Under this scenario, a total of 49,645 colonies would be injured or killed over the 15 year period. This is highly unlikely due to the relatively low probability of misstrike, and the probability that each misstrike would hit new areas each time, and is likely a high overestimate. It is also unlikely that already damaged coral colonies would not completely regenerate within 5 to 15 year periods in time to be re-exposed at the original estimated amount.

Based on the best information available, we believe that these corals are all widely distributed around the atoll, and that the potentially impacted area represents a very small fraction (not currently quantifiable) of coral-occupied habitat at Illeginni, and likely below 1% of coral-occupied habitat at USAKA. As described above at 6.2, we further believe that the distribution and abundance of these coral species in similar habitat areas outside of the potentially impacted zones would be similar to their estimated distribution and abundance within the impacted zones, and as such, these 49,645 colonies likely represent a tiny fraction of their species found at Illeginni and across USAKA. Therefore, based on the best available information, we consider the risk negligible that project-related effects from direct RV impact, ejecta, and ground based shockwave would eliminate any of these species at USAKA, or appreciably reduce the likelihood of their survival and recovery at USAKA and across their global range.

6.4.2 Risk for top shell snails due to expected levels of action-related mortality

As described in the exposure and response analyses above, we expect up to 117 top shell snails could experience mortality as the result of a single direct RV impact, ejecta, and ground based shockwave. In a worst case scenario like one described in the previous section or if 117 top shell snails repopulate a damaged area between strikes and are exposed, 585 top shell snails would be injured or kill over the duration of the project. This total is highly unlikely due to a combination of low probability events. We believe that top shell snails are widely distributed at all of the USAKA islets around the atoll, and that the potentially impacted area represents a very small fraction (not currently quantifiable) of top shell snail-occupied habitat at Illeginni, and likely below 1% of top shell snail-occupied habitat at USAKA. As described above at 6.2, we further believe that the distribution and abundance of these mollusks in similar habitat areas outside of

the potentially impacted zones would be similar to their estimated distribution and abundance within the impacted zones, and as such, these 585 top shell snails likely represent a tiny fraction of their species found at Illeginni and across USAKA, and their loss would be virtually indistinguishable from natural mortality levels in the region. Therefore, based on the best available information, we consider the risk negligible that the effects of direct RV impact, ejecta, and ground based shockwave would eliminate this species at USAKA, or appreciably reduce the likelihood of its survival and recovery at USAKA and across their global range.

7 Cumulative Effects

The UES does not specifically describe "cumulative effects" for a biological opinion. However, Section 161of the Compact provides that for U.S. Government activities requiring the preparation of an environmental impact statement (EIS) under NEPA, the U.S. Government shall comply with environmental standards that protect public health and safety and the environment that are comparable to the U.S. environmental statutes, including the Endangered Species Act. Although not all USAKA actions that require formal consultation also require the preparation of an EIS, such as this action, we analyze cumulative effects in all USAKA consultations as that term is defined in the ESA implementing regulations. Cumulative effects are limited to the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion (50 CFR 402.02). Cumulative effects, as defined in the ESA, do not include the continuation of actions described under the Environmental Baseline, and future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

The impacts of RMI coastal development, fisheries interactions, vessel groundings, direct take, marine debris, and global climate change (as described in the Environmental Baseline section) are not only expected to continue, they are likely to intensify over time. The intensification of those impacts is expected to cause cumulative effects on UES-protected marine species at USAKA. Continued growth of the human population at Kwajalein Atoll would likely result in increased coastal development, fishing pressure, vessel traffic, and pollution of the marine environment.

Anthropogenic release of CO^2 and other greenhouse gases is considered the largest contributor to global climate change, and it is expected that the release of those gases is not only likely to continue, but the rate of their release is expected to increase during the next century (Brainard *et al.* 2011). Therefore, global climate change is expected to continue to impact UES-protected marine species and their habitats, especially on those species that are dependent on shallow coastal reefs and shorelines, such corals and marine mollusks.

There is uncertainty associated with the analysis of potential impacts of climate change on species and ecosystems (Barnett 2001). Effects of climate change will not be globally uniform (Walther *et al.* 2002) and information regarding the magnitude of future climate change is speculative and fraught with uncertainties (Nicholls and Mimura 1988). In particular, there is no comprehensive assessment of the potential impacts of climate change within the action area or specific to UES-protected marine species. In addition to the uncertainty of the rate, magnitude, and distribution of future climate change and its associated impacts on temporal and spatial scales, the adaptability of species and ecosystems are also unknown. Impact assessment models

that include adaptation often base assumptions (about when, how, and to what conditions adaptations might occur) on theoretical principles, inference from observed observations, and arbitrary selection, speculation, or hypothesis (see review in Smit *et al.* 2000). Impacts of climate change and hence its 'seriousness' can be modified by adaptations of various kinds (Tol *et al.* 1998). Ecological systems evolve in an ongoing fashion in response to stimuli of all kinds, including climatic stimuli (Smit *et al.* 2000).

The effects of global climate change, the most significant of which for corals are the combined direct and indirect effects of rising sea surface temperatures and ocean acidification, are currently affecting corals on a global scale, particularly in parts of the Caribbean. The return frequency of thermal stress-induced bleaching events has exceeded the ability of many reefs and coral species to recover there. Brainard *et al.* (2011) report that those effects likely represent the greatest risk of extinction to ESA-candidate corals over the next century. Field observation and models both predict increasing frequency and severity of bleaching events, causing greater coral mortality and allowing less time to recover between events. However, predicting how global climate change may impact particular species remains poorly understood, especially in understudied areas such as USAKA.

The effects of global climate change could act synergistically on corals affected by the proposed action. The ability of impacted corals to respond to the effects of the proposed action could be reduced due to the effects of elevated temperatures and increased ocean acidity, and the longer it takes for impacted corals to recover from the effects of the proposed action, the more likely it becomes that the effects of climate change would synergistically impact those corals. However, the degree to which those synergistic impacts may affect corals over the time required for them to recover from project impacts is unknown.

The effects of global climate change could also act synergistically on top shell snails affected by the proposed action. However, no specific information is currently available to assess the impacts. Changes in ocean temperature and chemistry, and rising sea level may be affecting this species because it depends on an exoskeleton that is comprised primarily of calcium carbonate. We expect that minimally, increased acidity could have effects that parallel those describe for corals above, with the exception of impacts related to zooxanthellae.

Given the small area and low numbers of individuals expected to be adversely affected by the proposed action, the possible synergistic impacts of climate change combined with the effects of the proposed action are not expected to be significant for the corals and mollusk considered in this Opinion.

8 Integration and Synthesis of Effects

The purpose of this Opinion is to determine if the proposed action is likely to jeopardize the continued existence of UES-protected marine species at USAKA (USAKA 2014). "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a UES-protected marine species at USAKA by reducing the reproduction, numbers, or distribution of that species. This Opinion considers the Effects of the Action within the context of the Status of the Species, the Environmental Baseline, and Cumulative Effects as described in Section 6

under "Approach".

We determine if reduction in fitness to individuals of marine consultation species that may result from the proposed action are sufficient to reduce the viability of the populations those individuals represent (measured using changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, or variance in these measures to make inferences about the risk of reducing the likelihood of survival and recovery of UES-protected species). In order to make that determination, we use the population's base condition (established in the Status of Listed Species and Environmental Baseline sections of this Opinion), considered together with Cumulative Effects, as the context for the overall effects of the action on the affected populations at USAKA. The following discussion summarizes the probable risks the proposed action poses to the corals and top shell snails identified in Section 4.

8.1 Corals

As described in the Effects of the Action section, a total of up to 49,645 colonies of UES-consultation corals (15 species) could be killed through some combination of exposure to direct RV impact, ejecta, and ground based shock wave.

As discussed in the Status of Listed Species, abundance and trend data are lacking for these corals at USAKA. However, they are all widely distributed around the atoll, with 3 of the 15 corals being known to occur at all USAKA islets. Seven others are known to occur on at least half of the USAKA islets. Of the remaining 5, 1 has been found on 5 of the islets, and 3 are known on 4 islets, and 1 is known from 2 islets that are on opposite ends of the atoll. All 15 species have also been observed at survey sites in the mid-atoll corridor (MAC), with 3 found at over 30 of the 35 sites, 8 have been observed at 4 to 25 sites, and 4 at 3 or less sites. It is important to recognize that survey data for USAKA is far from complete. Only a small portion of the total reef area around the USAKA islets and MAC has been surveyed, and surveys to specifically identify and quantify these species are yet to be done. As such, it is possible that the distribution and abundance of these corals at USAKA is higher than the current information can confirm.

As discussed more fully in the Environmental Baseline and Cumulative Effects sections, the effects of fisheries interactions, direct take, and climate change are expected to continue and likely worsen in the future for these corals. However, the impact and time scale of these effects on the trajectory of the affected coral populations at USAKA, and across Oceania is currently uncertain, and those impacts are expected to occur on a time scale against which the impacts of the proposed action would be indistinguishable.

The proposed action is anticipated to result in the mortality of up to 49,645 coral colonies at Illeginni Islet. These coral colonies represent a small fraction of the total number of their species found at Illeginni, and even less around USAKA. The potential loss of these coral colonies is not expected to significantly impact reproduction or to impede the recovery of their species across USAKA and the MAC. Therefore, when taken in context with the status of the species, the environmental baseline, cumulative impacts and effects, the proposed action is not likely to eliminate any of the 15 UES consultation corals considered in this Opinion from Illeginni, or

appreciably reduce the likelihood of their survival and recovery across USAKA including the MAC.

8.2 Top Shell Snail

As described in the Effects of the Action section, a total of up to 585 top shell snails could be killed through some combination of exposure to direct RV impact, ejecta, and ground based shock wave.

As discussed in the Status of Listed Species, top shell snails have been reported at all of the 11 USAKA islets as well as at 12 of 35 survey sites in the mid-atoll corridor (MAC). It is important to recognize that survey data for USAKA is far from complete. Only a small portion of the total reef area around the USAKA islets has been surveyed, and surveys to specifically identify and quantify this species are yet to be done. As such, it is possible that the distribution and abundance of top shell snails at USAKA is higher than the current information can confirm. As discussed more fully in the Environmental Baseline and Cumulative Effects sections, the effects of coastal development, direct take, and climate change are expected to continue and likely worsen in the future for this species. However, the impact and time scale of these effects on the trajectory of the affected top shell snail populations at USAKA is currently uncertain, and those impacts are expected to occur on a time scale, against which the impacts of the proposed action would be indistinguishable.

The proposed action is anticipated to result in death of up to 585 top shell snails at Illeginni. The affected snails would represent a small fraction of the total number of top shell snails found at Illeginni, and an even smaller proportion of the population across USAKA. The potential loss of 585 top shell snails across the area is not expected to significantly impact reproduction or to impede the recovery of this species across USAKA and the MAC. Therefore, when taken in context with the status of the species, the environmental baseline, cumulative impacts and effects, the proposed action is not likely to eliminate top shell snails at Illeginni, or appreciably reduce the likelihood of their survival and recovery across USAKA including the MAC.

9 Conclusion

After reviewing the current status of UES-protected marine species, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our Opinion that the USA/USAF's continued implementation of the Minuteman III ICBM testing program at the Reagan Test Site, USAKA, RMI during fiscal years 2016 through 2030 is not likely to jeopardize the continued existence of any of the UES-protected corals considered in this Opinion or the top shell snail. As described above in Section 3, no critical habitat has been designated or proposed for designation for any UES-protected marine species in the action area or elsewhere in the RMI. Therefore, the proposed action would have no effect on designated or proposed critical habitat.

10 Incidental Take Statement

The UES does not specifically describe "take" for a biological opinion. However, under the ESA "take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of

Section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the reasonable and prudent measures and terms and conditions of the Incidental Take Statement (ITS). Although the ESA does not specifically apply to actions taken at USAKA, under section 161 of the Compact and the UES, the ESA provides the basis for determining the level of incidental take, so the ESA definitions will be used for this Opinion.

10.1 Anticipated Amount or Extent of Incidental Take

Based on the analysis in the accompanying Opinion we conclude that the continued implementation of the Minuteman III ICBM testing program at the USAKA RTS, through fiscal year 2030 would result in the take of 15 species of UES consultation corals and top shell snails. As described above in the exposure and response analyses, we expect that up to 49,645 colonies of UES consultation corals (as quantified in Table 4) could experience complete mortality, and that up to 117 top shell snails may be killed by the proposed action.

Table 4. Expected Take of Marine UES consultation species due to continuation of MMIII through FY 2030

Scientific Name	Species	Colonies or Individuals Taken
	Corals	
Acanthastrea brevis	No Common Name	2,080
Acropora aculeus	No Common Name	2,080
A. aspera	No Common Name	1,015
A. dendrum	No Common Name	2,080
A. listeri	No Common Name	2,080
A. microclados	No Common Name	2,080
A. polystoma	No Common Name	2,080
Alveopora verriliiiana	No Common Name	4,160
Cyphastrea agassizi	No Common Name	2,080
Heliopora coerulea	No Common Name	13,790
Leptaseris incrustans	No Common Name	2,080
Montipora caliculata	No Common Name	3,640
Pavona venosa	No Common Name	2,080
Turbinaria reniformis	No Common Name	4,160
T. stellulata	No Common Name	4,160
	Mollusks	
Tectus niloticus	Top Shell Snail	585

10.2 Effect or Impact of the Take

In the accompanying Opinion, we determined that this level of anticipated take is not likely to result in the jeopardy of any of the UES consultation species expected to be taken by the proposed action.

10.3 Reasonable and Prudent Measures

We believe the following reasonable and prudent measures (RPM), as implemented by the terms and conditions, are necessary and appropriate to minimize impacts of the proposed action and monitor levels of incidental take. The measures described below are non-discretionary and must be undertaken in order for the ITS to apply.

1. The USA/USAF shall reduce impacts on UES-protected corals and top shell snails and their habitats through the employment of BMP and conservation measures.
2. The USA/USAF shall record and report all action-related take of UES-consultation species.

10.4 Terms and Conditions

The USA/USAF must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. To meet reasonable and prudent measure 1 above, the USA/USAF shall ensure that their personnel comply fully with the BMP and conservation measures identified in the BA and below.
    a. The USA/USAF shall ensure that all relevant personnel associated with this project are fully briefed on the BMP and the requirement to adhere to them for the duration of this project.
    b. In the event of a RV land impact that affects the reef at Illeginni, the USA/USAF shall require its personnel to secure or remove from the water any substrate or coral rubble from the ejecta impact zone that may become mobilized by wave action.
        i. Ejecta greater than 6 inches in any dimension shall be removed from the water or positioned such that it would not become mobilized by expected wave action, including replacement in the RV crater.
        ii. If possible, coral fragments greater than 6 inches in any dimension shall he positioned on the reef such that they would not become mobilized by expected wave action, and in a manner that would enhance its survival; away from fine sediments with the majority of the living tissue (polyps) facing up.
        iii. UES consultation coral fragments that cannot be secured in-place should be relocated to suitable habitat where it is not likely to become mobilized.
    c. In the event of a RV land impact that affects the reef at Illeginni, the USA/USAF shall require its personnel to reduce impacts on top shell snails.
        i. Rescue and reposition any living top shell snails that are buried or trapped by rubble.
        ii. Relocate to suitable habitat, any living top shell snails that are in the path of any heavy equipment that must be used in the marine environment.

2. To meet reasonable and prudent measure 2 above:
    a. The USA/USAF shall assign appropriately qualified personnel to record all suspected incidences of take of any UES-consultation species.
    b. The USA/USAF shall utilize digital photography to record any UES-consultation species that is found injured or killed in or near the ocean target areas and/or at Illeginni. As practicable: 1) Photograph all damaged corals and/or other UES-consultation species that may be observed injured or dead; 2) Include a scaling

device (such as a ruler) in photographs to aid in the determination of size; and 3) Record the location of the photograph.

c. In the event of a RV land impact that affects the reef at Illeginni, the USA/USAF shall require its personnel to survey the ejecta field for impacted corals and top shell snails. Also be mindful for any other UES-consultation species that may have been affected.
d. Within 60 days of completing post-test clean-up and restoration, provide photographs and records to the USAG-KA environmental office. USAG-KA and our biologists will review the photographs and records to identify the organisms to the lowest taxonomic level accurately possible to assess impacts on consultation species.
e. Within 6 months of completion of each fiscal year, USAG-KA will provide an annual report to us. The report shall identify: 1) The flight test and date; 2) The target area; 3) The results of the pre- and post-flight surveys; 4) The identity and quantity of affected resources (include photographs and videos as applicable); and 5) The disposition of any relocation efforts.

11 Conservation Recommendations

The following conservation recommendations are discretionary agency activities provided to minimize or avoid adverse effects of a proposed action on UES-protected marine species or critical habitat, to help implement recovery plans, or develop information.

1. We recommend that the USA/USAF continue to work with NMFS staff to conduct additional marine surveys around Illeginni Islet to develop a comprehensive understanding of the distribution and abundance of species that are there.
2. We recommend that the USA/USAF continue to work with NMFS staff to conduct marine surveys at additional sites around all of the USAKA islets and in the mid-atoll corridor to develop a more comprehensive understanding of the distribution and abundance of species and habitats at USAKA.
3. We recommend that the USA/USAF conduct regular (monthly or quarterly if possible) surveys of the KMISS, the ocean target area off Illeginni, and the RMI broad ocean area to develop a better understanding of the distribution and abundance of marine mammals and other species in the area.
4. We recommend that the USA/USAF adapt the KMISS to support acoustic monitoring for marine mammals in the target area, and to install hydrophones off the ocean side of Illegini for similar marine mammal monitoring.
5. We recommend that the USAG-KA develop capacity and procedures for responding to marine mammal and turtle strandings.
    a. Acquire required permits and training to perform necropsies and/or to take and transport tissue samples.
    b. Develop professional relations with qualified federal agencies and universities to capitalize on samples and information gained at USAKA.
    c. Develop mechanisms to collect and disseminate the information.

Reinitiation Notice

This concludes formal consultation on the continued implementation of the Minuteman III ICBM testing program at the USAKA RTS, RMI through fiscal year 2030. Reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law, and if:

1. The amount or extent of anticipated incidental take is exceeded;
2. New information reveals that the action may affect UES-protected marine species or critical habitat in a manner or to an extent not considered in this Opinion;
3. The action is subsequently modified in a manner that may affect UES-protected marine species or critical habitat to an extent, or in a manner not considered in this Opinion; or
4. A new species is listed or critical habitat designated that may be affected by the action.

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APPENDIX D

Citations From the Final Ground-Based Strategic Deterrent (GBSD) Environmental Assessment/Overseas Environmental Assessment (EA/OEA)

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3.4.1.2.3 Affected Environment

Illeginni Soil

Because of previous reentry vehicle tests on Illeginni Islet, residual concentrations of beryllium and DU remain in the soil near the helipad on the west side of the islet. In 2005, LLNL analyzed over 100 soil samples collected around the helipad to determine concentrations of beryllium and DU in the soil. Soil samples were collected again following subsequent flight tests and results were reported in 2010 and 2013 (Robison et al. 2013). The observed soil concentrations of beryllium and uranium (as a surrogate for DU) on Illeginni Islet are within compliance with USEPA Region 9 Preliminary Remediation Goals as outlined in the UES. Results from the soil sampling conducted in September 2018 indicated possible beryllium and uranium above the screening levels. Beryllium was not detected in any of the 20 parent soil samples collected from the Illeginni Islet borings; however, it was detected in one of the duplicate samples with a concentration of 1.9 mg/kg, which exceeded the 1.1 mg/kg screening level for beryllium (U.S. Navy 2019b). This sample was a field duplicate of a sample in which beryllium was not detected above 0.089 mg/kg (U.S. Navy 2019b). This large discrepancy may be due to the heterogeneous nature of the soil matrix (described as gravelly sand). A previous test program post-test survey and sampling report described pre-test and post-test soil sampling results for uranium, beryllium, and tungsten at 34 sites (RGNext 2020). The pre-and post-test sampling revealed beryllium and tungsten were undetected, and uranium detected, but well below the USEPA composite worker regional screening level (ingestion and inhalation) (RGNext 2020, USEPA 2020d). Residual concentrations of tungsten remaining in the soil following the flight tests from other programs were below the EPA Regional Screening Level (RSL) for residential areas (63 mg/kg) and commercial areas (930 mg/kg).

Illeginni Groundwater

In September 2018, groundwater samples collected from the groundwater monitoring wells were analyzed for tungsten, beryllium, and uranium. Beryllium was not detected in any of the nine

groundwater samples. Uranium was detected in three of the groundwater samples, but concentrations did not exceed the 30 ug/L USEPA Maximum Contaminant Level (MCL) screening level. Tungsten was detected in seven of the nine groundwater samples collected from the Illeginni Islet wells (U.S. Navy 2019b). Detected concentrations ranged from 0.055 milligrams per liter (mg/L) to 1.2 mg/L, and all detected concentrations exceeded the USEPA residential tap water screening level (0.016 mg/L) (U.S. Navy 2019b). However, because the groundwater at Illeginni Islet is currently deemed to be too saline and not available year-round, it is not considered a viable source of potable water and the USEPA residential screening level would not apply. Groundwater samples collected from monitoring wells following a program flight test were analyzed for tungsten, beryllium, and uranium. Water samples collected in the impact crater shortly after the flight test had tungsten concentrations of 0.65 mg/L (range of 0.64 to 0.67 mg/L) (U.S. Navy 2019b).

A 2018 post-test survey and sampling report from a previous program flight test described pre-test and post-test groundwater results for uranium, beryllium, and tungsten at seven wells (RGNext 2020). The pre-and post-test sampling showed little variation in values, with beryllium remaining undetected, tungsten exceeding residential tap water screening levels, and uranium well below the USEPA MCL for drinking water. The sampling report following the flight test showed lower levels of tungsten than the 2018 sample results—with detected concentrations ranging from 0.0023 mg/L to 0.99 mg/L (RGNext 2020) compared to previously detected concentrations ranging from 0.055 mg/L to 1.2 mg/L (U.S. Navy 2019b). Tungsten was detected in 8 of the 12 groundwater samples collected from the Illeginni wells. The 2020 sampling report described that monitoring wells MW-03, MW-04, and MW-05 were located within the flight test impact zone and could not be sampled. The DEP for the flight test explains that the wells on Illeginni were to be sampled every 3 to 6 months for metals, including tungsten.

4.2.4 Downrange Test and Support Locations

4.2.4.1 United States Army Garrison–Kwajalein Atoll (USAG-KA)

4.2.4.1.1 Biological Resources – USAG-KA

Under the Proposed Action, both Minuteman III and GBSD testing would occur at USAG-KA. Minuteman III testing would continue with RV impacts in the KMISS area as described (**Section 2.4**) for the No Action Alternative and analyzed in the Minuteman III Modification Supplemental EA (pages 70 to 74 in USAF 2020e). GBSD testing would be similar to Minuteman III testing in many respects, but RV impacts may occur either in the deep waters of the KMISS area, on Illeginni Islet, or in the vicinity of Illeginni Islet (i.e., the waters southwest of Illeginni Islet). GBSD testing would involve approximately six tests per year between FY 2024 and FY 2029, which would impact in ocean waters of KMISS or in the vicinity of Illeginni Islet for the majority of flights. Only up to three total tests over the entire test program would impact on land at Illeginni Islet. Each test could involve up to three RVs which may, in some cases, impact in more than one area. Up to three total land RV impacts on Illeginni Islet are planned for GBSD through 2029. The majority of flights would not have an air burst but up to two per year may occur.

This section evaluates the environmental consequences of Proposed Action activities involved with RV impacts in both the KMISS area and in the vicinity of Illeginni Islet in the context of the regulatory setting discussed in **Section 3.4.1.1**.

Flight Test Mitigation Measures at USAG-KA

Over time and through consultation with NMFS and USFWS for Minuteman III activities and for proposed GBSD activities, DAF has developed several avoidance, minimization, and mitigation measures to minimize the impacts of flight testing on protected species and their habitats. These measures, which would be implemented as part of GBSD Test Program activities at Kwajalein Atoll, are very similar to those implemented for Minuteman III (USAF 2015, USAF 2020e) and other recent test programs with payload impacts at Illeginni Islet (U.S. Navy 2019, U.S. Navy 2017). The measures listed in this section would be implemented as part of the Proposed Action GBSD Test Program activities at Kwajalein Atoll.

Consequences of Activities in Deep Offshore Waters

Under the Proposed Action, potential impacts on biological resources in the offshore waters of Kwajalein Atoll may include exposure to elevated noise levels, direct contact from RV components, disturbance from human activity and vessel operation, and exposure to hazardous chemicals. The potential impacts from the GBSD tests are expected to be of the same types and magnitude as for Minuteman III tests under the No Action Alternative. The addition of GBSD tests to this area may lead to additional accumulation of marine debris in the KMISS area and would slightly increase the risk to marine wildlife due to the increased number of tests per year. However, the impacts of the Proposed Action on wildlife species in the offshore waters ROI would still be less than significant.

As under the No Action Alternative, pre-test preparation and post-test activities in deep-water impact zones would include aircraft overflights and potential vessel traffic for placement of sensor rafts. The same avoidance and minimization measures implemented for Minuteman III testing would also be implemented for GBSD testing. With implementation of avoidance and mitigation measures, pre-test and post-test activities are not likely to impact marine wildlife.

During test activities, stressors to marine wildlife would be the same as under the No Action Alternative: sonic boom overpressures, direct contact and shock/sound waves from RV impact, and exposure to contaminants.

Elevated noise levels from sonic booms, air bursts, and RV impact would be the same for GBSD testing as for Minuteman III tests. Physical injury caused by elevated noise levels is extremely unlikely. Even given the increased testing frequency (assuming a total of 10 RV impact events in the KMISS area per year), the estimated number of animal exposures would be substantially less than one per year for marine mammal and sea turtle species (USAF 2019d) These expected sound pressure levels may cause some startle and temporary flush responses in birds, marine mammals, sea turtles, and fish (USAF 2020e); however, no long-term or population-level effects are expected.

Marine wildlife would have the potential to be impacted by direct contact and hazardous chemicals from RV impact in deep water impact zones. While there is a chance that marine

mammals and sea turtles near the surface might be struck by RV debris, the chances are very low. The area of potential direct contact would be less than the area with elevated noise levels; therefore, the potential for wildlife exposures to direct contact would be less than those discussed for elevated noise levels and impacts would be less than significant.

Effects from exposure to hazardous chemicals are not expected in deep water impact zones. Most RV components would sink to the ocean floor where they would not be a risk to wildlife. Small quantities of hazardous chemicals such as battery acids and residual fuels may enter the water but would be rapidly diluted by the large volume of ocean water. Materials released during RV impact are not expected to be present in sufficient quantities or concentrations to adversely affect any sensitive or special-status wildlife.

DAF prepared a Biological Assessment (USAF 2020d) to evaluate the effects of the Proposed Action on UES-consultation species at Kwajalein Atoll and to support consultation with NMFS and USFWS under the UES. DAF concluded that proposed GBSD Test Program activities in the deep ocean waters of KMISS and the vicinity of Illeginni Islet were not likely to adversely affect UES-consultation species and that impacts would be less than significant. In their Biological Opinion on the effects of GBSD Test Program activities, the NMFS concurred that species in deep offshore waters were not likely to be adversely affected (**Appendix A**).

Consequences of Activities at Illeginni Islet and in Nearshore Waters

Land RV impacts have been discontinued for the Minuteman III program; therefore, future Minuteman III activities would not contribute to consequences at Illeginni Islet. Proposed GBSD testing would include up to three total tests with RV impact on land at Illeginni Islet through 2029. The Proposed Action has the potential to impact biological resources through elevated sound pressure levels, direct contact and shock waves, exposure to hazardous materials, disturbance due to human activity or equipment operation, and vessel strike. The potential impacts from GBSD testing on Illeginni Islet are expected to be similar in types and magnitude as for previously evaluated Minuteman III land impacts (USAFGSC and USASMDC/ARSTRAT 2015) and other recent flight tests with payload impact at Illeginni Islet (U.S. Navy 2019, U.S. Navy 2017). The potential consequences of testing activity at USAG-KA are explained in detail in these documents which are incorporated by reference and summarized below as relevant to GBSD test activities.

Terrestrial Vegetation. Under the Proposed Action, RV impacts on Illeginni Islet would result in crater formation as well as debris and natural substrate being ejected outward from the point of impact. No sensitive vegetation species occur on Illeginni Islet, and the RV impact zone is on a previously disturbed, mostly cleared area on the western end of Illeginni Islet. Any impacts to terrestrial vegetation would be minor and short term.

Terrestrial Wildlife. Under the Proposed Action, GBSD activities would include human activity, equipment operation, elevated noise levels, and RV impact resulting in crater formation and

debris. A number of avoidance and minimization measures would be in place for activities at Illeginni Islet to avoid impacts on birds and sea turtles. Despite the presence of suitable habitat, no sea turtle nesting activity has been observed on Illeginni Islet in over 20 years. With implementation of pre-test monitoring, it is not likely that sea turtles would be impacted by the Proposed Action. DAF has prepared a Biological Assessment (USAF 2020d) to evaluate the effects of the Proposed Action on sea turtles at Illeginni Islet. DAF has initiated informal consultation with the USFWS on potential effects of the Proposed Action on sea turtles in terrestrial habitats and requested their concurrence with the DAF determination that the Proposed Action may affect but is not likely to adversely affect sea turtles on Illeginni Islet.

Birds in and near the payload impact zone also have the potential to be impacted by elevated noise levels, direct contact, and human disturbance. The impact zone is composed primarily of previously disturbed habitat, but some black-naped terns have the potential to nest in the impact zone (U.S. Navy 2019). For previous testing, USFWS estimated that no more than 12 black-naped terns (4 adults and 8 eggs or chicks) would be expected to be in the impact area during daylight hours (Appendix A of U.S. Navy 2019). A maximum of 16 black-naped terns could be in the area when both adults are roosting at or near the nests (U.S. Navy 2019). Several avoidance and minimization measures would be implemented as part of the Proposed Action based on recommendations from the USFWS for past tests (U.S. Navy 2019) as detailed earlier in this section. With these mitigation measures in place, no adverse effects to black-naped terns are expected. The impacts to black-naped terns and other birds from direct contact, elevated noise levels, and human activity on Illeginni Islet would be less than significant.

Marine Vegetation. Marine vegetation, including seagrass, is not expected to be impacted by the Proposed Action at Illeginni Islet. Most macroalgae species found at Illeginni Islet are common and likely to be found throughout Kwajalein Atoll (U.S. Navy 2019). Seagrass beds are known to occur in Illeginni Harbor as well as down the slopes in and near the harbor entrance (U.S. Navy 2019). However, vessel traffic as a result of the Proposed Action is not expected to alter benthic habitats or impact seagrass beds.

Marine Wildlife. Under the Proposed Action, marine wildlife in nearshore habitats have the potential to be impacted by direct contact from RV debris and ejecta, elevated noise levels, vessel strike, exposure to hazardous materials, and human activity and equipment operation.

Elevated noise levels due to sonic booms, RV impact, and equipment operation have the potential to affect the behavior and hearing sensitivity in birds, sea turtles, and fish. Loud sounds might cause these organisms to quickly react, altering their normal behavior either briefly or more long term or may even cause physical injury. The extent of these effects depends on the frequency, intensity, and duration of the sound pressures as well as on the hearing ability and physiology of the organism. Additional information about the potential effects of elevated noise levels and effect thresholds can be found in the GBSD USAG-KA Biological Assessment (USAF 2020d). As discussed for deep ocean waters of Kwajalein Atoll, the

expected sound pressure levels may cause some startle and temporary flush responses in birds, sea turtles, and fish near Illeginni Islet (USAF 2020d). However, animals are expected to return to normal behaviors within moments of exposure and impacts would be minor and short-term.

At Illeginni Islet, impact of the RV on land would result in ejecta and/or shock waves radiating out from the point of impact. For Minuteman III, ejecta resulting from crater formations was estimated to extend no more than 200 to 300 feet from the impact location (USAF 2015, U.S. Navy 2019). Based on observations from Minuteman III and other payload testing at Illeginni Islet, most of the RV materials and substrate ejecta would remain close to the edge of the crater and the density of ejecta would be expected to decrease with distance from the impact point (USAF 2015). Since a nearshore or shoreline strike is not expected, most of this ejecta would fall on land. However, since the exact impact location and distribution of ejecta is unknown, these analyses assume a worst-case scenario of a shoreline strike where ejected debris could enter the nearshore marine environment. UES-listed consultation and coordination corals, mollusks, fish, and sea turtles within 300 feet of an RV impact have the potential to be harmed by debris.

For Minuteman III tests, shock waves resulting from payload impact were estimated to be strong enough to damage corals out as far as 123 feet from the point of impact (USAF 2015). If impact occurred on the shoreline, shock waves would propagate into the submerged seafloor (USAF 2015). No shoreline impact is planned for GBSD testing; however, is assumed that shock waves strong enough to damage corals might propagate up to 123 feet into the marine environment. These shock waves may damage corals but are not likely to impact mollusks, sea turtles, or fish near Illeginni Islet.

DAF and NMFS calculated the number of UES-consultation species which are likely to be exposed to debris and shock waves based for the worst-case scenario of a shoreline RV impact (details in USAF 2020d and **Appendix A**). The NMFS concluded that up to 31,224 UES-consultation coral colonies and 228 individual UES-consultation mollusks might be exposed to direct contact and shock waves (see **Table 4-29**) for all proposed land impacts combined. A number of other non-consultation invertebrates might also be exposed to debris and shock waves. Not all corals and mollusks exposed to debris or shock waves would be damaged, as the extent of damage would depend on the structure of the coral (i.e., plate-forming corals are more easily broken), but the most likely realized effects would be broken branches or plates or damaged soft tissue. Coral also have the potential to regrow after damage, but regrowth and stress could still have a negative impact on growth rate, reproduction, and disease susceptibility (NMFS 2019). In the event of a shoreline nearshore land RV impact, some consultation invertebrates would likely be harmed. However, based on the known populations and distribution of invertebrate species and the expected effects, the Proposed Action is not likely to change the distribution, relative abundance, or recovery ability of any species at Kwajalein Atoll.

Therefore, the impacts of direct contact and shock waves would be less than significant to invertebrates in the ROI.

Humphead wrasses have the potential to be injured if exposed to direct contact from debris. However, humphead wrasses are generally not found at the surface where they would be most vulnerable to effects from direct contact. These fish are most commonly found in waters a few feet to 197 feet deep (USAF 2020d). The NMFS has concluded that up to 324 humphead wrasse could be harassed, injured, or killed through exposure to direct contact and shock waves (**Appendix A**). Some other, more common species of fish might be harmed. However, no change in the population or distribution of any species at Kwajalein Atoll would be expected and impacts would be less than significant.

Exposure to hazardous materials as a result of the Proposed Action would have minor to no impact on marine wildlife. Several avoidance and minimization measures would be in place as part of the Proposed Action to minimize the potential for hazardous material to affect biological resources. The Proposed Action may result in introduction of potentially hazardous materials (i.e., DU, beryllium, cadmium, chromium, and lead) into terrestrial and marine habitats. Heavy metals may accumulate in sediments and benthic invertebrates and even fish have the potential to accumulate heavy metals (França et al. 2005, Eisler et al. 1978). The potential for accumulation is metal specific and species specific, dependent on the trophic level of the wildlife and in some cases on metal concentrations (Chen et al. 2016). There is some evidence that uranium concentrations in some freshwater invertebrates is related to uranium concentrations in water and sediments; however, uranium is not known to biomagnify in food webs (Bergmann and Graça 2019). There is also evidence that beryllium does not bioconcentrate in aquatic organisms or food webs (U.S. Department of Health and Human Services 2002). As described in **Section 3.4.1.2**, soil and groundwater testing at Illeginni Islet indicate that beryllium and uranium in samples remain below the USEPA screening levels. Since DoD test activities primarily occur on land at Illeginni Islet, it is unlikely that marine waters or sediments would have higher concentrations of these hazardous materials than samples from Illeginni Islet. It is not expected that proposed testing would result in hazardous material concentrations in the marine environment that would result in accumulation of these chemicals in wildlife, such as mollusks or fish, or that would significantly impact marine wildlife. Considering the planned cleanup of man-made materials, the very small quantities of hazardous materials expected to be introduced into terrestrial and marine habitats, and the dilution and mixing capabilities of the ocean and lagoon waters, materials released during RV impact would not be present in sufficient quantities or concentrations to adversely affect marine wildlife.

Planned human activity and equipment operation in marine areas would only involve vessel traffic to and from Illeginni Islet and use of sensor rafts. No debris recovery or other cleanup activities are expected to be required in shallow nearshore waters. In the event that debris entered the nearshore marine environment, several measures would be in place to protect reef habitats and UES-consultation species. During planned test activities, nearshore reef-

associated species including corals and mollusks would not be impacted by human activity and equipment operation.

Table 4-29. Estimated Total Number of Consultation Coral Colonies and Individual Mollusks Potentially Adversely Affected by Proposed GBSD Activities.

Species	Estimated Total Number of Colonies or Individuals That May be Adversely Affected[1]
Corals	
Acropora microclados	51
Acropora polystoma	51
Cyphastrea agassizi	42
Heliopora coerulea	14,049
Pavona venosa	42
Pocillopora meandrina	16,947
Turbinaria reniformis	42
Coral Subtotal	31,224
Mollusks	
Hippopus hippopus	186
Tectus niloticus	9
Tridacna squamosa	33
Mollusk Subtotal	128
Fish	
Cheilinus undulatus	324

Notes:
[1] The estimated total number of colonies or individuals that may be adversely affected for all three tests with land impact was based on conclusions in the NMFS Biological Opinion for Test activities at USAG-KA (Appendix A).

DAF prepared a Biological Assessment (USAF 2020d) to address the effects of the Proposed Action on UES-consultation species at Illeginni Islet and to support consultation with NMFS and USFWS under requirements of the UES. DAF has concluded that the Proposed Action may adversely affect seven coral species, three mollusk species, and one fish species (**Table 4-29**) but is not likely to adversely affect consultation sea turtles, or other consultation corals, mollusks, and fish at Illeginni Islet. DAF has consulted with NMFS and USFWS under the requirements of the UES on the effects of the proposed GBSD test activities at Kwajalein Atoll. The USFWS has concurred with the DAF determination that the Proposed Action is not likely to adversely affect sea turtles on Illeginni Islet or elsewhere on land on Kwajalein Atoll islets (letter of concurrence dated January 7, 2021 in **Appendix A**). The NMFS concurred with the DAF determination that the Proposed Action is not likely to adversely affect 25 marine consultation

species but may result in incidental take of up to 31,224 UES consultation coral colonies, 128 UES consultation mollusks, and 324 UES consultation fish (Biological Opinion dated March 15, 2021 in **Appendix A**). The NMFS has concluded that this level of incidental take is not likely to jeopardize the continued existence of any of the UES-protected species considered in their Biological Opinion.

Flight Test Mitigation Measures – USAG-KA

The following measures would be implemented as part of the Proposed Action and would be included in the DEP for GBSD Test Program activities at Kwajalein Atoll.

Marine Mammal and Sea Turtle Protection Measures

- During travel to and from impact zones, including Illeginni Islet, ship personnel would monitor for marine mammals and sea turtles to avoid potential ship strikes. Vessel operators would adjust speed or raft deployment based on expected animal locations, densities, and/or lighting and turbidity conditions.
- USAG-KA personnel would conduct a helicopter or fixed-wing aircraft overflight of the impact area three times over the week preceding a flight test and as close to launch as safely practical to survey for marine mammals and sea turtles. The final overflight would be within 1 day of the proposed launch. If personnel observe marine mammals or sea turtles in the vicinity, they would report such findings to the USAG-KA Environmental Office.
- Any observations of marine mammals or sea turtles during ship travel or overflights would be reported (including location, date, time, species or taxa, and number of individuals) to the USAG-KA Environmental Engineer who would maintain records of these observations and report sightings to that National Marine Fisheries Service (NMFS) and USFWS.
- Pre-flight monitoring by qualified personnel will be conducted on Illeginni Islet for sea turtles or sea turtle nests. For at least 8 weeks preceding the launch, Illeginni Islet would be surveyed by pre-test personnel for sea turtles, sea turtle nesting activity, and sea turtle nests. If possible, personnel will inspect the area within days of the launch. If sea turtles or sea turtle nests are observed near the impact area, observations would be reported to appropriate test and USAG-KA personnel for consideration in approval of the launch, and to USFWS and NMFS.
- Personnel will report any observations (including location, date, time, species, and number of individuals) of sea turtles or sea turtle nests on Illeginni Islet to the USAG-KA Environmental Engineer who would maintain records of these observations and report sightings to USFWS.
- Although unexpected, any dead or injured marine mammals or sea turtles sighted by post-flight personnel would be reported to the USAG-KA Environmental Office and

USASMDC, who would then inform NMFS, USFWS, and the RMI Environmental Protection Authority. USAG-KA aircraft pilots otherwise flying in the vicinity of the impact and test support areas would also similarly report any opportunistic sightings of dead or injured marine mammals or sea turtles.

- Human activity and equipment operation would avoid use or modification of the beach/dune environment during peak sea turtle nesting or hatching season (October through March).
- No native dune vegetation would be removed.
- If a basking sea turtle is found within the project area, all human activity and equipment operation within 100 feet of the animal or between the animal and the ocean would cease until the animal voluntarily leaves the area.

Hazardous Materials and Waste Measures

- Vessel and equipment operations would not involve any intentional discharges of fuel, toxic wastes, or plastics and other solid wastes that could harm terrestrial or marine life.
- Any accidental spills from support equipment operations would be contained and cleaned up and all waste materials would be transported to Kwajalein Islet for proper disposal.
- Hazardous materials would be handled in adherence to the hazardous materials and waste management systems of USAG-KA. Hazardous waste incidents would comply with the emergency procedures set out in the Kwajalein Environmental Emergency Management Plan and the UES.
- Vessel and heavy equipment operators would inspect and clean equipment for fuel or fluid leaks prior to use or transport and would not intentionally discharge fuels or waste materials into terrestrial or marine environments.
- All equipment and packages shipped to Kwajalein Atoll will undergo inspection prior to shipment to prevent the introduction of alien species into Kwajalein Atoll.
- Following a land-impact test, DAF and USAG-KA would collect soil and groundwater samples at various locations around the impact site and test the samples for beryllium, depleted uranium, and other metals. Testing results that exceed UES criteria would require a soil investigation as detailed in the UES and may require subsequent soil removal or other remediation.
- All project related debris, trash, and equipment would be removed from the beach and dunes if not actively being used.
- No project-related materials or equipment would be stockpiled or stored in the intertidal zone, reef flats, sandy beach and adjacent vegetated areas, or stream channels.

Reef Protection Measures

- To avoid impacts on coral heads in waters near Illeginni Islet, sensor rafts would not be located in waters less than 10 feet deep.
- When feasible, within 1 day after the land impact test at Illeginni Islet, USAG-KA environmental staff would survey the islet and the near-shore waters for any injured wildlife, damaged coral, or damage to sensitive habitats (i.e., reef habitat). Any impacts to biological resources would be reported to the Appropriate Agencies, with USFWS and NMFS offered the opportunity to inspect the impact area to provide guidance on mitigations.
- If an inadvertent impact occurs on the reef, reef flat, or in shallow waters less than 10 feet deep, an inspection by project personnel would occur within 24 hours. Representatives from NMFS and USFWS would also be invited to inspect the site as soon as practical after the test. The inspectors would assess any damage to coral and other natural and biological resources and, in coordination with DAF, USAG-KA, and RTS representatives, decide on any response measures that may be required.
- If any man-made debris were to enter the marine environment and divers were required to search for payload debris on the adjacent reef flat, they would be briefed prior to operations about coral fragility and provided guidance on how to carefully retrieve the very small pieces of payload debris that they would be looking for.
- In the event a payload land impact affects the reef at Illeginni Islet, DAF will require its personnel to secure or remove from the water any substrate or coral rubble from the ejecta impact zone that may become mobilized by wave action as soon as possible.
    - Ejecta greater than 6 inches in any dimension will be removed from the water or positioned such that it would not become mobilized by expected wave action, including replacement in the payload crater.
    - If possible, coral fragments greater than 6 inches in any dimension will be positioned on the reef such that they would not become mobilized by expected wave action, and in a manner that would enhance its survival; away from fine sediments with the majority of the living tissue (polyps) facing up.
    - UES consultation coral fragments that cannot be secured in-place would be relocated to suitable habitat where they are not likely to become mobilized.
- In the event the payload land impact affects the reef at Illeginni, DAF will require its personnel to reduce impacts on top shell snails and clams.
    - Rescue and reposition any living top shell snails and giant clams that are buried or trapped by rubble.
    - Relocate to suitable habitat, any living top shell snails and giant clams that are in the path of any heavy equipment that must be used in the marine environment.

- DAF will assign appropriately qualified personnel to record all suspected incidences of take of any UES-consultation species.
- DAF will utilize digital photography to record any UES consultation species found injured or killed in or near the ocean target areas and/or at Illeginni Islet. As practicable, DAF will: (1) photograph all damaged corals and/or other UES-consultation species that are observed injured or dead; (2) include a scaling device (such as a ruler) in photographs to aid in the determination of size; and (3) record the location of the photograph.
- In the event the payload impact affects the reef at Illeginni Islet, DAF will survey the ejecta field for impacted corals, top shell snails, and clams while also recording any other UES consultation species that may have been affected.
- Within 60 days of completing post-test clean-up and restoration, DAF will provide photographs and records to the USAG-KA environmental office to be reviewed by the USAG-KA environmental personnel and NMFS biologists.
- Within 6 months of completion of the action, DAF and/or USAG-KA will provide a report to the NMFS. The report shall identify: 1) The flight test and date; 2) The target area; 3) The results of the pre- and post-flight surveys; 4) The identity and quantity of affected resources (include photographs and videos as applicable); and 5) The disposition of any relocation efforts.

Protective Measures for Birds

- Payload impact would be in the non-forested area.
- The impact zone would be searched for black-naped tern nests and chicks prior to any pre-flight equipment mobilization. Any discovered nests would be covered with an A-frame structure per current USFWS guidance. The area would be monitored to ensure no black-naped tern nests were disturbed during heavy equipment use.
- To prevent birds from nesting on the support equipment after initial setup, the equipment would be appropriately covered with tarps or other materials and “scare” techniques (e.g., scarecrows, mylar ribbons, and/or flags) would be used on or near the equipment.

General Measures at Illeginni Islet

- All relevant project personnel associated with project activities at Kwajalein Atoll will be fully briefed on the BMPs and the requirement to adhere to them for the duration of the GBSD Test Program.
- At Illeginni Islet, should any missile components or debris impact areas of sensitive biological resources (i.e., sea turtle nesting habitat or coral reef), a USFWS or NMFS biologist would be allowed to provide guidance and/or assistance in recovery operations to minimize impacts on such resources. To the greatest extent practicable, protected marine species including invertebrates will be avoided or effects to them will be

minimized. This may include movement of these organisms out of the area likely to be affected.

- Debris recovery and site cleanup would be performed for the land impact. To minimize long-term risks to marine life, all visible project-related man-made debris would be recovered during post-flight operations. In all cases, recovery and cleanup would be conducted in a manner to minimize further impacts on biological resources.
- For recovery and rehabilitation of any injured migratory birds or sea turtles found at Illeginni Islet, USFWS and NMFS would be notified to advise on best care practices and qualified biologists would be allowed to assist in recovering and rehabilitating any injured sea turtles found.
- During post-test recovery and cleanup, should personnel observe endangered, threatened, or other species requiring consultation moving into the area, work would be delayed until such species were out of harm's way or leave the area.
- Project activities would incorporate the applicable USFWS "Recommended Standard Best Management Practices" regarding work in aquatic environments including:
    - Authorized dredging and filling-related activities that may result in the temporary or permanent loss of aquatic habitats should be designed to avoid indirect, negative impacts to aquatic habitats beyond the planned project area.
    - Dredging/filling in the marine environment should be scheduled to avoid coral spawning and recruitment periods, and sea turtle nesting and hatching periods.
    - Turbidity and siltation from project-related work should be minimized and contained within the project area by silt containment devices and curtailing work during flooding or adverse tidal and weather conditions. BMPs should be maintained for the life of the construction period until turbidity and siltation within the project area is stabilized. All project construction-related debris and sediment containment devices should be removed and disposed of at an approved site.
    - All project-related materials and equipment (dredges, vessels, backhoes, silt curtains, etc.) to be placed in an aquatic environment should be inspected for pollutants including, but not limited to; marine fouling organisms, grease, oil, etc., and cleaned to remove pollutants prior to use. Project related activities should not result in any debris disposal, non-native species introductions, or attraction of non-native pests to the affected or adjacent aquatic or terrestrial habitats. Implementing both a litter-control plan and a Hazard Analysis and Critical Control Point plan (HACCP – see https://www.fws.gov/policy/A1750fw1.html) can help to prevent attraction and introduction of non-native species.
    - Project-related materials (fill, revetment rock, pipe, etc.) should not be stockpiled in, or in close proximity to aquatic habitats and should be protected from erosion

(e.g., with filter fabric, etc.), to prevent materials from being carried into waters by wind, rain, or high surf.

- Fueling of project-related vehicles and equipment should take place away from the aquatic environment and a contingency plan to control petroleum products accidentally spilled during the project should be developed. The plan should be retained on site with the person responsible for compliance with the plan. Absorbent pads and containment booms should be stored on-site to facilitate the clean-up of accidental petroleum releases.
- All deliberately exposed soil or under-layer materials used in the project near water should be protected from erosion and stabilized as soon as possible with geotextile, filter fabric or native or non-invasive vegetation matting, hydro-seeding, etc.

4.2.4.1.2 Hazardous Material and Waste

Site Preparation Activities

Other than the use of fuels and lubricants for operating transportation and related support equipment, there would be limited use of hazardous materials at USAG-KA in support of Minuteman III and GBSD site preparation activities. Site preparation activities that would have the potential to develop hazardous material or waste include deployment of radar and heavy equipment to Illeginni Islet.

Any releases of hazardous or non-hazardous waste during site preparation activity at Illeginni Islet would be cleaned up per current UES and KEEP regulations. Impacts on hazardous material and waste at USAG-KA would be considered environmentally significant if the following were to occur:

- If an increase of hazardous material and waste as a result of the Proposed Action exceeded USAG-KA's capacity to manage, store, or dispose of them in accordance with federal, state, or local laws.
- If the hazardous material and waste as a result of the Proposed Action increased the risk of soil or groundwater contamination; or created new human and environmental health risks.
- Minuteman III testing would continue with RV impacts in the KMISS area as applied to the No Action Alternative and analyzed in the Minuteman III Modification SEA (USAF 2020e). GBSD testing would involve approximately six tests per year between FY 2024 and FY 2029 which would impact in ocean waters of KMISS or in the vicinity of Illeginni Islet. Each test could involve up to three RVs which may, in some cases, impact in more than one area. Up to three total land RV impacts on Illeginni Islet are planned for GBSD

through 2029. Most flight tests would not have an air burst, but up to two per year may occur.

The Minuteman III RS employs either the Mark 12A or Mark 21 operational RV. A Mark 21A RV is currently under development, which is anticipated to include similar materials utilized in the legacy hardware design of the Mark 21. For the Minuteman III flight tests conducted from VSFB, the operational RVs are replaced with one to three test RVs (one Mark 21 or up to three Mark 12A RVs) (**Figure 2-2**). The test RVs do not contain any fissile materials; however, they do contain batteries, high explosives, asbestos, DU, and other heavy metals. The individual Mark 12A RVs contain one silver zinc battery (approximately 1.6 pounds), while the Mark 21 RV contains one silver zinc and one thermal battery (total battery weight of approximately 2.4 pounds). All test RVs typically include 0.29 to 22 ounces of asbestos; approximately 0.035 to 0.353 ounces each of beryllium, cadmium, and chromium; approximately 4.8 ounces of lead; and less than 187 pounds of DU. Only two test RVs per year contain high explosives (USAF 2004, 2013a, 2020e). As described in **Section 2.2.1**, the design of the GBSD Weapon System would be similar to the Minuteman III system described above. The GBSD flight test missile PBACM includes a PBPS with liquid hypergolic propellants and a PRS. For electrical power, the GBSD weapon system also would contain multiple batteries like those described above for Minuteman III. Although the PRS may be of a new design, the test RVs used for flight testing would be the same or similar to those used for Minuteman III flight testing.

Flight Test Activities

Launch Activities

Illeginni Soil: Up to three total land RV impacts on Illeginni Islet are planned for GBSD. Since existing speed, altitude, and size data are not available for a GBSD payload impact, estimates of reentry vehicle cratering from Minuteman III test flights (USAFGSC and USASMDC/ARSTRAT 2015) were used as a bounding case for potential impacts. Minuteman III RV data was used as an analog for GBSD to understand the potential environmental consequences of the Proposed Action. No Minuteman III RVs are anticipated to impact Illeginni as a result of this Proposed Action. The Minuteman III RV ejecta field from crater formation at impact was expected to cover a semicircular area (approximately 120º) extending 200 to 300 feet from the impact, and the density of ejecta was expected to decrease with distance from the point of impact (USAFGSC and USASMDC/ARSTRAT 2015). Craters from Minuteman III RVs have been documented to be 20 to 30 feet in diameter and 7 to 10 feet deep. During impact, the GBSD payload particles could partially disintegrate into fugitive dust around the impact site and a short distance downwind. Based on the composition of existing Minuteman III RVs, if all the payload particles deposited into the top 1 inch of soil on Illeginni Islet then the expected concentration of toxic heavy metals would be very low. The maximum potential concentrations on Illeginni Islet would be far below toxic concentrations for humans. Illeginni Islet is an active range it not considered a residential area (USASMDC 2021a). Therefore, the Regional Screening Levels in Soil for Composite Workers shall be used as the basis of understanding risk (USEPA 2020d). The most stringent criteria shall be utilized where the UES (USASMDC 2021a)

does not specify an RSL. For beryllium, the RSL is 160 mg/kg (USASMDC 2021a). For cadmium, the RSL is 1,200 mg/kg (USEPA 2020d). For chromium (Cr-III), the RSL is 1,800,000 mg/kg, and for Cr-VI the RSL is 6.3 mg/kg (USEPA 2020d). For lead, the RSL is 800 mg/kg (USEPA 2020d) (HQ=1). For DU, the RSL is 47 mg/kg (USASMDC 2021a).

Soil samples taken at Illeginni Islet for a previous program flight test post-test survey and sampling report described pre-test and post-test soil sampling results for uranium, beryllium, and tungsten at 34 sites (RGNext 2020). The pre-and post-test sampling revealed beryllium and tungsten were undetected, and uranium detected in 9 out of 34 soil samples (results ranging from 1.8 mg/kg to 4.3 mg/kg), but well below the USEPA composite worker regional screening level (ingestion and inhalation) (RGNext 2020, USEPA 2020d). Observed soil concentrations of beryllium and DU on Illeginni Islet from prior RV tests do not exceed the USEPA RSLs for assessing the need for soil cleanup under the UES (USAF 2020e). Comprehensive soil analyses have shown that the concentrations of beryllium and uranium on Illeginni Islet are at the natural background concentrations found in soils on other coral atolls in the northern Marshall Islands and at other global locations, and additional missile tests would not cause redistribution of the pre-existing contaminants on the islet (RGNext 2020; Robison 2005, 2006, 2010, 2013).

Illeginni Groundwater: Illeginni Islet is an active range and is not considered a residential area (USASMDC 2021a). Illeginni Islet has no surface water; groundwater is very limited in quantity with no pathways to public or private consumption, is saline, and non-potable. Freshwater used to minimize fugitive dust following impacts would not be allowed to flow to the lagoon or ocean and would evaporate in place. In the unlikely event of an accidental release of a hazardous material or petroleum product at the impact site, emergency response personnel would comply with the UES KEEP. The most stringent groundwater quality criteria shall be utilized where the UES does not specify an MCL for hazardous pollutants in non-residential groundwater. For beryllium, the Primary Standard MCL is 0.004 mg/L (USASMDC 2021a). For cadmium, the Primary Standard MCL is 0.005 mg/L (USASMDC 2021a). For chromium, the Primary Standard MCL is 0.1 mg/L (USASMDC 2021a). For lead, the Primary Standard MCL is 0.015 mg/L (action level) (USASMDC 2021a). For DU, the Primary Standard MCL is 0.030 mg/L (USASMDC 2021a). Minuteman III RV data was used as an analog for GBSD to understand the potential environmental consequences of the Proposed Action. No Minuteman III RVs are anticipated to impact Illeginni as a result of this Proposed Action. Based on the composition of existing Minuteman III RVs, the maximum potential concentrations would be far below toxic concentrations for humans and based on similar past actions at Illeginni Islet such as Minuteman III, AHW, FE-1, FE-2, and ARRW, this Proposed Activity would not be expected to reach the above screening criteria (Robison, 2005, 2006, 2010, 2013; RGNext, 2020).

A post-test survey and sampling report from a previous program flight test described pre-test and post-test groundwater results for uranium, beryllium, and tungsten at seven wells on Illeginni Islet (RGNext 2020). The pre-and post-test sampling showed little variation in values,

with beryllium remaining undetected, tungsten exceeding residential tap water screening levels in 6 of the 12 samples (detected concentrations ranged from 2.3 micrograms per liter [µg/L] to 990 µg/L), and uranium was detected in all 12 samples well below the USEPA MCL for drinking water (detected concentrations ranged from 0.57 µg/L to 5.4 µg/L). Although the groundwater at Illeginni Islet shows tungsten levels above the MCL, the groundwater is not potable under the UES standards. Tungsten is not included in the Minuteman III or GBSD weapon system and are not analyzed further for environmental consequences in this EA/OEA. With the reasonably foreseeable land use at Illeginni Islet as an active range and with the groundwater being not potable, further risk-based analysis and remediation planning is not required at this time. If in the future the land use designation changes, Illeginni Islet would be evaluated under the UES Restoration requirements to determine if the new land use requires institutional controls or remediation.

Post-launch Activities

The GBSD payload would descend onto Illeginni Islet or into the KMISS northeast of Gagan Islet. Post-launch activities include any necessary debris recovery and disposal per the UES for land or water impact, and impact crater remediation for a land-impact. Explosive Ordnance Disposal would be tasked with scanning the impact crater for explosive hazards and properly recovering them if found.

Any floating debris would be recovered and disposed of according to federal and UES standards. NASA conducted a thorough study of the seawater quality effects of missile components deposited in ocean waters (U.S. Navy 2017). NASA concluded that the release of hazardous materials from missiles into seawater would not be significant. The materials would be rapidly diluted and, except in the immediate vicinity of the debris, would not be found at concentrations that produce adverse effects. The payload materials are insoluble and the depth of the Pacific Ocean at the KMISS impact site is thousands of feet where light does not penetrate, levels of oxygen that might interact with materials at the surface are too low for that to occur, and water temperature differences from the upper water layers hamper any mixing between them. Any area on the ocean bottom affected by the slow dissolution of the payload debris would be relatively small, due to the size of the payload debris pieces as compared relative to the volume of surrounding seawater. Therefore, adverse water quality effects from the payload are expected to be minimal to insignificant. There are no plans to monitor deep water impacts in the BOA, where no mixing with upper layers of water occurs.

Mitigation Measures listed in this section apply to all aspect of flight test and would be included in the DEP for GBSD Test Program activities at Kwajalein Atoll.

Operations and Maintenance

All hazardous and non-hazardous waste would be properly disposed of in accordance with the UES. Hazardous material and waste-handling capacities would not be exceeded, and

management programs do not have to change. As a result, no significant impacts from hazardous material and waste management are expected. No hazardous material and waste from the Proposed Action would increase the risk of soil or groundwater contamination or create new human and environmental health risks. If exceedances of UES regulations occur, soil excavation will be conducted to clean up contaminated soil in accordance with the KEEP. No groundwater remediation planning is necessary despite existing tungsten exceedances from past test events because Illeginni Islet groundwater is not potable under the UES, and the land use is designated as an active range. Tungsten is not a contaminant of concern in the Minuteman III or GBSD weapon system. GBSD spent booster motors, PBACM components, and test RVs would be expected to impact primarily in ocean waters at the KMISS away from populations and land areas. Although unlikely, if there were any floating debris it would be recovered and brought onboard a vessel for appropriate handling and disposal from USAG-KA to the United States per the hazardous waste management plan. Considering the small quantities of hazardous materials expected in the payload RVs; the capacity of the USAG-KA hazardous waste management to accept and properly dispose of potential debris per UES standards; and the dilution and mixing capabilities of the ocean waters, the potential for hazardous materials released during the GBSD tests to adversely affect human health or the environment should be deemed insignificant.

Mitigation Measures

Flight Test Mitigation Measures – USAG-KA

The following measures would be implemented as part of the Proposed Action and would be included in the DEP for GBSD Test Program activities at Kwajalein Atoll.

Hazardous Materials and Waste Measures

- Vessel and equipment operations would not involve any intentional discharges of fuel, toxic wastes, or plastics and other solid wastes that could harm terrestrial or marine life.
- Any accidental spills from support equipment operations would be contained and cleaned up and all waste materials would be transported to Kwajalein Islet for proper disposal.
- Hazardous materials would be handled in adherence to the hazardous materials and waste management systems of USAG-KA. Hazardous waste incidents would comply with the emergency procedures set out in the Kwajalein Environmental Emergency Management Plan and the UES.
- Vessel and heavy equipment operators would inspect and clean equipment for fuel or fluid leaks prior to use or transport and would not intentionally discharge fuels or waste materials into terrestrial or marine environments.
- All equipment and packages shipped to Kwajalein Atoll will undergo inspection prior to shipment to prevent the introduction of alien species into Kwajalein Atoll.

- Following a land-impact test, DAF and USAG-KA would collect soil and groundwater samples at various locations around the impact site and test the samples for beryllium, depleted uranium, and other metals. Testing results that exceed UES criteria would require a soil investigation as detailed in the UES and may require subsequent soil removal or other remediation.
- All project related debris, trash, and equipment would be removed from the beach and dunes if not actively being used.
- No project-related materials or equipment would be stockpiled or stored in the intertidal zone, reef flats, sandy beach and adjacent vegetated areas, or stream channels.

4.2.4.1.3 Noise – USAG-KA

The implementation of the Proposed Action would not require site grading, ground disturbance associated with site preparation, and no construction requirements. Therefore, the implementation of the Proposed Action within the downrange area would have no significant impact to ambient noise levels from site preparation and construction.

Pre-test preparation activities, which may include operations of rafts/sensors, vessel and aircraft operations, are not expected to have any noise impacts downrange. Personnel would comply with all applicable DoD noise management program and noise management requirements as well as with any established international requirements. Therefore, no significant impacts to ambient noise levels are anticipated from pre-test preparation and support of the Proposed Action.

There would be an increase in the number of flight tests between FY 2024 and FY 2029 (see **Table 2-4**). Each flight will be an individual separate flight test. As each descending test flight approaches its designated termination point, sonic booms may initially generate over a very broad area of the open ocean. At the ocean surface, the sound pressure levels for the sonic booms would vary close to the point of impact. The sonic boom footprint would occur almost entirely over open ocean. The duration for sonic boom overpressures produced by the test could range from 40 milliseconds where the boom is strongest to 124 milliseconds where it is weakest (Moody 2004).

Within the majority of the sonic boom footprint, sound levels are below the 120 dB produced by a thunderclap (Vavrek et al. 2008) and well within the DoD standard of 140 dB (peak sound pressure level) for impulse noise. However, close to the point of impact, maximum sound levels of 150 dB could break windows or crack plaster in structures and cause hearing loss in people. Because the sonic boom footprints normally do not overlap any communities and because of range evacuation procedures during such flight tests, no residents or personnel are expected to be subjected to significant noise-related impacts.

Therefore, no significant impacts to ambient noise levels are anticipated from the flight test segment of the Proposed Action.

In general, noise levels associated with post-test operations would be similar to those generated during pre-test preparation. Thus, no significant impacts to ambient noise levels are expected.

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