Biological Assessment for Hypersonic Flight Test-3 Activities

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ACRONYMS AND ABBREVIATIONS

µPa	micropascal
ARSTRAT	Army Forces Strategic Command
BA	Biological Assessment
BOA	broad ocean area
CFR	Code of Federal Regulations
cm	centimeter(s)
cm^3	cubic centimeters
dB	decibels
DPS	distinct population segment
EEZ	Exclusive Economic Zone
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FR	Federal Register
FE-2	Flight Experiment-2
ft	foot/feet
ft^3	cubic feet
GOA	Gulf of Alaska
Hz	hertz
KEEP	Kwajalein Environmental Emergency Management Plan
kg	kilogram(s)
kHz	kilohertz
km	kilometer(s)
km^2	square kilometer(s)
lb	pound(s)
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
mi	mile(s)
MMPA	Marine Mammal Protection Act
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration

PIRO	Pacific Islands Regional Office (National Marine Fisheries Service)
PSCA	Pacific Spaceport Complex Alaska
PTS	permanent threshold shift
RCCTO	United States Army Rapid Capabilities and Critical Technologies Office
re	referenced to
RMI	Republic of the Marshall Islands
RTS	Ronald Reagan Ballistic Missile Defense Test Site
SEL	Sound Exposure Level
SPL	sound pressure level
TTS	temporary threshold shift
U.S.	United States
UES	United States Army Kwajalein Atoll Environmental Standards
USAF	United States Air Force
USAG-KA	United States Army Garrison – Kwajalein Atoll
USAKA	United States Army Kwajalein Atoll
USASMDC	United States Army Space and Missile Defense Command
USC	United States Code
USFWS	United States Fish and Wildlife Service
yd^2	square yard(s)

1.0 INTRODUCTION

1.1 Purpose and Objectives

The purpose of this Biological Assessment (BA) is to evaluate the potential effects of the proposed Hypersonic Flight Test-3 (FT-3) on species listed as endangered or threatened under the Endangered Species Act (ESA), on marine species listed under the United States Army Kwajalein Atoll Environmental Standards (UES), and on designated critical habitat. FT-3 is sponsored by the United States Department of the Army (U.S. Army), which has designated the U.S. Army Rapid Capabilities and Critical Technologies Office (RCCTO) as the lead agency for the Proposed Action. The U.S. Army RCCTO, along with the U.S. Army Space and Missile Defense Command (USASMDC) as a Participating Agency, prepared this BA in accordance with the requirements of Section 7 of the ESA and Section 3-4 of the UES.

The Proposed Action involves a single developmental flight test from the Pacific Spaceport Complex Alaska (PSCA) to Kwajalein Atoll, Republic of the Marshall Islands (RMI). The Proposed Acton includes launch of the FT-3 vehicle from PSCA, flight across a broad ocean area (BOA) of the Pacific Ocean, and payload impact at Ronald Reagan Ballistic Missile Defense Test Site (RTS) at Illeginni Islet, RMI.

The proposed FT-3 is designed to test a long-range, global strike capable technology. The purpose of the Proposed Action is to develop, integrate, and flight test this longer-range payload system to demonstrate the maturity of key technologies. The Proposed Action would include observation of the FT-3 launch vehicle and payload system from launch to impact. Data collected would be utilized to improve the models that predict the performance of the system. The Proposed Action, FT-3, is needed to gain progress in testing, modeling, and simulating developmental payload systems and to advance technologies necessary to ultimately establish operational strike capabilities.

1.2 Regulatory Setting

This BA addresses the potential effects of Proposed Action activities on marine ESA-listed species and critical habitats in compliance with Section 7 of the ESA for the portions of the Proposed Action that would take place in and over U.S. territory and international waters. This BA also addresses the potential effects of Proposed Action activities in and over RMI territory, including territorial waters, on UES consultation species in compliance with Section 3-4 of the UES. This BA addresses only species under the jurisdiction of the National Marine Fisheries Service (NMFS).

Endangered Species Act (ESA). The purpose of the ESA is to conserve the ecosystems upon which threatened and endangered species depend and to conserve and recover listed species.

Under Section 9 of the ESA it is unlawful for any person subject to the jurisdiction of the United States to take ESA-listed species within the United States or territorial sea of the United States. As defined in the ESA, the term "take" means to harass, harm, pursue, hunt, wound, kill, trap, capture, or collect an ESA-listed species (16 United States Code [USC] §§ 1532, 1538). For all ESA-listed species, the ESA defines "harm" as an act which kills or injures wildlife including significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering (16 USC §§ 1531-1544). The ESA defines harassment as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to breeding, feeding, or sheltering.

Section 7(a)(2) of the ESA requires federal agency cooperation and consultation with the United States Fish and Wildlife Service (USFWS) and/or NMFS to ensure that any federal action, including federal permits or funding, is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of their critical habitat (16 USC §§ 1536).

Destruction or adverse modification of designated critical habitat means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species (81 Federal Register [FR] 7214 [February 11, 2016]). Alterations of critical habitat may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features (81 FR 7214 [February 11, 2016]). Destruction or adverse modification of critical habitat is determined on the basis of whether implementation of the proposed federal action would result in alteration of the quantity or quality of the essential physical or biological features of designated critical habitat, or would preclude or significantly delay the capacity of that habitat to develop those features over time, and if the effect of the alteration was to appreciably diminish the value of critical habitat for the conservation of the species (81 FR 7214 [February 11, 2016]).

United States Army Kwajalein Atoll Environmental Standards (UES). The Compact of Free Association between the RMI and the United States (48 USC Section [§] 1921) requires all U.S. Government activities at the United States Army Garrison – Kwajalein Atoll (USAG-KA) and all Department of Defense and RTS activities in the RMI to conform to specific compliance requirements, coordination procedures, and environmental standards identified in the UES (USASMDC/ARSTRAT 2018). As specified in Section 2-2 of the UES, these standards also apply to all activities occurring in the territorial waters of the RMI. The Proposed Action, which could affect Illeginni Islet, the deep-water region southwest of Illeginni Islet, or the deep ocean waters northeast of Kwajalein Atoll, must comply with the UES (USASMDC/ARSTRAT 2018).

Section 3-4 of the UES contains the standards for managing endangered species and wildlife resources. The standards in this section were derived primarily from 50 Code of Federal Regulations (CFR), Sections (§§) 17, 23, 402, 424, and 450-452, which include provisions of the ESA (16 USC §§ 1531-1544) and other regulations applicable to biological resources. Other U.S. statutes embodied in these standards are the Fish and Wildlife Coordination Act (16 USC

§§ 661-666), the Migratory Bird Treaty Act (16 USC §§ 703-712), and the Marine Mammal Protection Act (MMPA) (16 USC §§ 1361-1389, 1401-1407, 1538, and 4107). The UES also requires consultation for potential effects on certain species protected by laws of the RMI. The Marshall Islands Marine Resources Authority manages marine resources in the RMI.

The UES contains a requirement that a BA must be prepared when a proposed activity may affect a species requiring consultation. For the purposes of this BA, a species requiring consultation under the UES is defined as any species listed in the UES Appendix 3-4A (USASMDC/ARSTRAT 2018), which also includes any candidate or proposed ESA species. The BA must contain an analysis that is sufficient to allow the appropriate regulatory agency to prepare a biological opinion (BO). According to Section 3-4.5.3(g) of the UES, if NMFS or USFWS prepares an adverse opinion or a no adverse opinion with an incidental take statement, an approved Document of Environmental Protection (DEP) must be prepared before proceeding with the proposed activity.

1.3 Consultation History

Early coordination and pre-consultation with NMFS for the Proposed Action was conducted during a series of meetings, phone conversations, and email communications including:

- July 23, 2020 – USASMDC and KFS, LLC personnel met with Steve Kolinski, Ron Dean, Josh Rudolph, and Bonnie Shorin of NMFS Pacific Islands Regional Office (PIRO) to provide NMFS with general information about the FT-3 project and to discuss a consultation plan for the Proposed Action. During this meeting, NMFS PIRO personnel requested that the PIRO conduct consultation for all portions of the Proposed Action and that PIRO would be responsible for coordination with the Alaska Regional Office where necessary. During this coordination meeting, parties discussed using the Flight Experiment–2 (FE-2) Biological Assessment (U.S. Navy 2019) for baseline conditions in the Kwajalein Atoll portion of the Action Area.

Launch Activities at PSCA. The PSCA was developed and is operated by the Alaska Aerospace Corporation (AAC) on Kodiak Island, Alaska. It supports the launch of rockets and satellites for commercial and Government aerospace interests. PSCA is located on State of Alaska land and is under an operating permit issued by the Federal Aviation Administration (FAA). The U.S. Army RCCTO and USASMDC have concluded that all Proposed Action launch activities at PSCA are covered under existing programmatic consultations for ongoing space and missile launch activities at PSCA and that no further consultation is needed for Proposed Action launch activities. A brief Section 7 consultation history for ongoing programmatic launch activities at PSCA is provided below for ESA-listed species and designated critical habitats under the jurisdiction of both the NMFS.

Consultation history with the NMFS for PSCA launch activities included:

- In 2011, the NMFS issued a programmatic Biological Opinion for space vehicle and missile launch operations at PSCA for the 5-year period from 2011-2016 (NMFS 2011). In this biological opinion, the NMFS concluded that launch operations at PSCA were not likely to adversely affect ESA-listed whales (i.e., fin whale, humpback whale, and North Pacific right whale) (NMFS 2011). The NMFS also concluded that launch operations would not destroy or adversely modify Steller sea lion (*Eumetopias jubatus*) critical habitat (NMFS 2011). The NMFS concluded that launch noise from the loudest launch vehicles may affect and would likely adversely affect Steller sea lions through non-lethal incidental take. The biological opinion concluded that this take was not likely to jeopardize the continued existence of the species and required monitoring of pinnipeds quarterly and during launches.
- In 2017, the AAC applied for a new 5-year programmatic permit for small takes of marine mammals incidental to launching of space launch vehicles and missiles at the PSCA (AAC 2016). In their application, AAC concluded that ongoing space and missile launch activities at the PSCA would not affect ESA-listed marine species in the action area (i.e., Steller sea lions, gray whales, and humpback whales) (AAC 2016). When NMFS issued regulations (valid May 2017 through April 2022) allowing for the issuance of Letters of Authorization for the incidental take of harbor seals during launch operations at the PSCA (82 FR 14996 [24 March 2017]), NMFS determined that proposed activities would not affect Steller sea lions (or any other ESA-listed species) and that no consultation was required under the ESA.

Consultation History for Similar Actions at Kwajalein Atoll. Many aspects of the proposed FT-3 Action are very similar to other recent flight tests with terminal impacts at Illeginni Islet. The Proposed Action is most notably similar to the recent FE-2 test conducted by the U.S. Navy (U.S. Navy 2019). The U.S. Navy prepared a BA for FE-2 to evaluate the effects of the action on ESA and UES consultation species and designated critical habitats (U.S. Navy 2019). Given the similarity of the two tests and the fact that the best available information on species occurrence and baseline conditions have not changed, portions of the FE-2 BA will be used to support consultation on the current Proposed Action and are referenced in the text where relevant. The U.S. Navy consulted with the NMFS on the effects of the FE-2 Action. A brief summary of the consultation history for FE-2 is included below.

Consultation history with the NMFS for FE-2 activities included:

- On 27 September 2019, the NMFS, Pacific Islands Region issued a Biological Opinion for FE-2 activities (NMFS File Number: PIRO-2019-02607) (NMFS 2019). In this biological opinion, the NMFS concluded that the FE-2 action was not likely to adversely affect 54 consultation species and would have no effect on critical habitats designated under the ESA and/or the UES at Kwajalein Atoll. The NMFS determined that exposure to FE-2 payload debris or impact ejecta was likely to adversely affect 11 UES consultation species in reef habitats near Illeginni Islet. Furthermore, NMFS determined

that the FE-2 test was not likely to jeopardize the continued existence of any of these species. NMFS issued an incidental take statement with the conclusion that the FE-2 test could result in mortality of up to 10,404 colonies of UES consultation corals, 4 top shell snails (*Tectus niloticus*), 108 humphead wrasse (*Cheilinus undulatus*), and 75 clams.

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2.0 DESCRIPTION OF THE ACTION AREA AND PROPOSED ACTION

The Proposed Action involves a single developmental flight test launched from PSCA with flight across a BOA of the Pacific Ocean and payload impact at RTS on Illeginni Islet in the RMI (**Figure 2-1**). As discussed in the *Regulatory Setting* (**Section 1.2**) section, the effects of launch activities at PSCA and in nearby habitats on ESA-listed species and critical habitats are covered under programmatic consultations and are not addressed in this BA. The following section describes the FT-3 Action Area beginning with the stage 1 booster drop zone and continuing to flight termination at Kwajalein Atoll. This section describes the Action Area, the Proposed Action, environmental stressors associated with the Proposed Action at Kwajalein Atoll, and avoidance and minimization measures which would be implemented as part of the Proposed Action.

2.1 Description of the Action Area

The Action Area for this BA includes:

- the stage 1 booster drop zone in U.S. territorial waters near Kodiak Island, Alaska and nearshore flight corridor (**Figure 2-2**);
- the over-ocean flight corridor and stage 2 and 3 booster drop zones in the North and Central Pacific Ocean (**Figure 2-1**), referred to as the BOA; and
- the terminal end of payload flight within RMI territory, including the payload impact site at Illeginni Islet (**Figure 2-3**).

The FT-3 launch vehicle consists of a three-stage booster system and an experimental payload. The FT-3 vehicle would launch from PSCA on Kodiak Island, Alaska. After launch the vehicle would fly over the Pacific Ocean towards Kwajalein Atoll. The three booster stages would separate after motor burn-out and fall into the north Pacific Ocean while the payload would continue flight towards Kwajalein Atoll (**Figure 2-1**).

The stage 1 booster drop zone is within U.S. territorial waters near Kodiak Island, Alaska (**Figure 2-2**) and the over-ocean flight corridor extends from PSCA, over nearshore waters, to the BOA. The coastal and pelagic waters offshore of Kodiak Island provide a diversity of highly productive habitats for marine organisms. The relatively deep and broad continental shelf offshore of Kodiak Island has gravel, sand, silt, mud, and rocky substrates (Fautin et al. 2010).

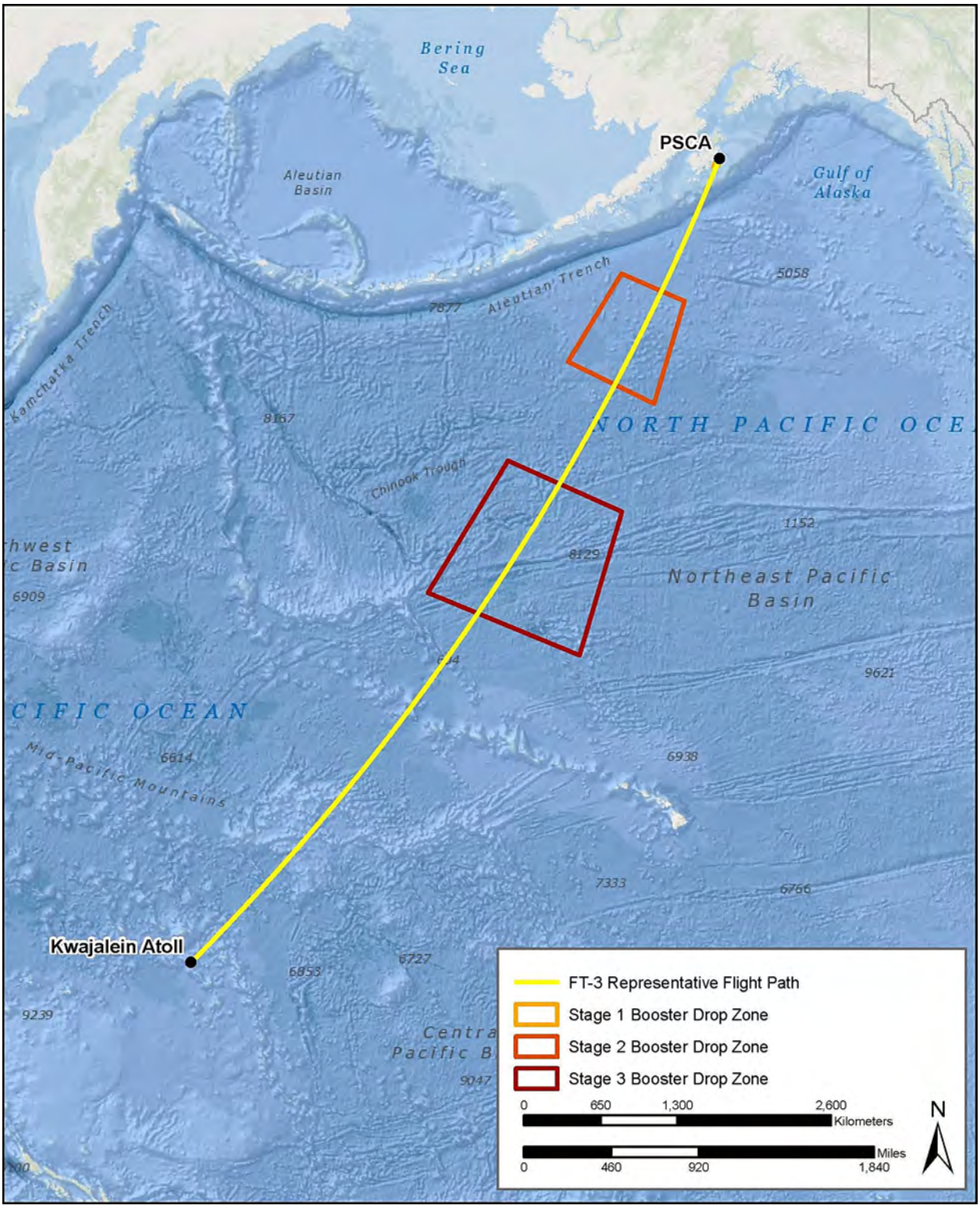


Figure 2-1. Flight Test-3 (FT-3) Representative Flight Path and Stage Drop Zones.

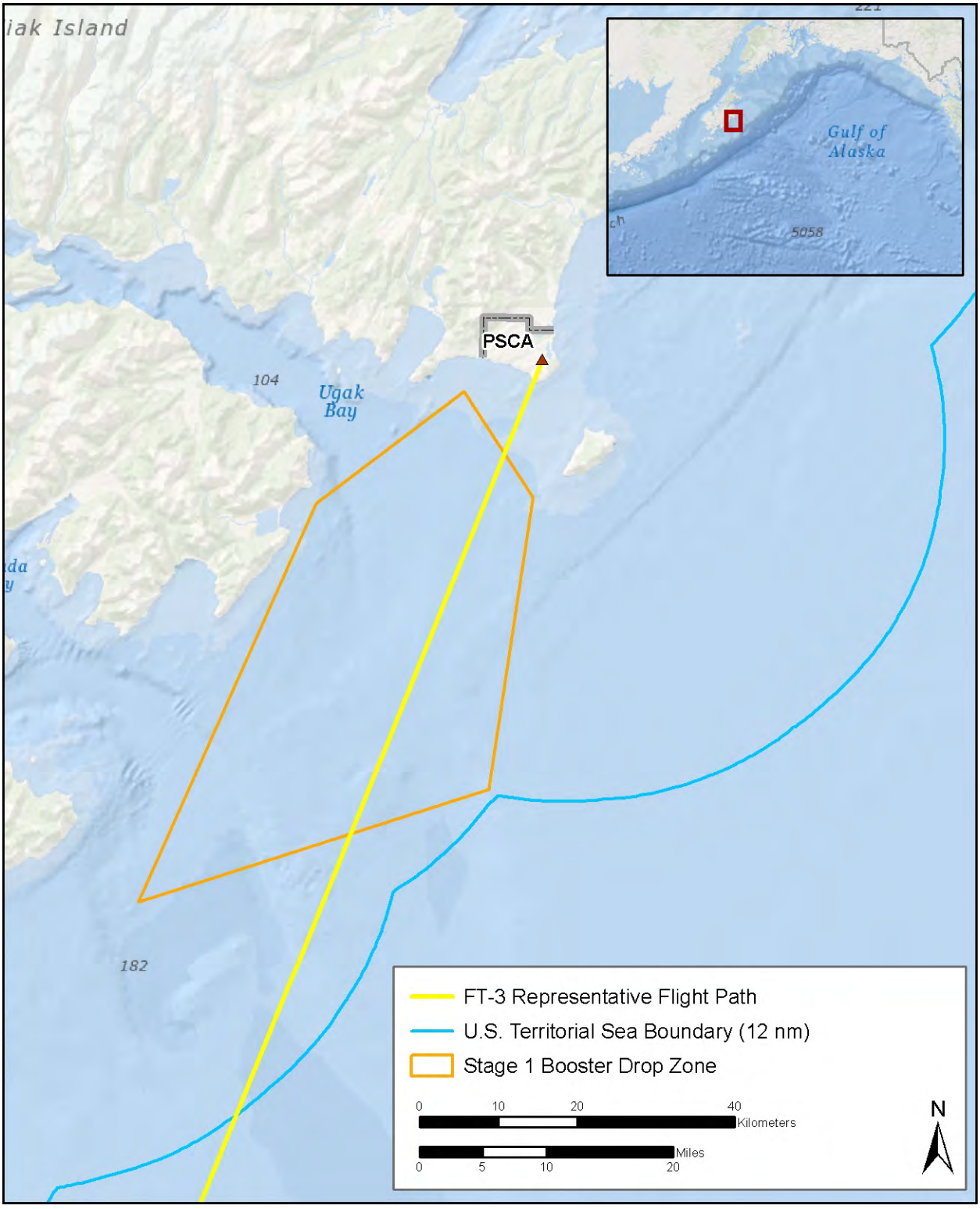


Figure 2-2. Flight Test-3 (FT-3) Representative Flight Path and Stage 1 Booster Drop Zone.

The over-ocean flight path in the BOA includes a wide range of ocean regions extending from temperate waters of the Gulf of Alaska (GOA), through subtropical and tropical waters of the North Central Pacific, to equatorial waters of the RMI. The flight path includes flight over the Northwest Hawaiian Islands including the waters of the U.S. exclusive economic zone (EEZ) there (**Figure 2-1**). However, FT-3 flight would occur at a high altitude over the BOA and no debris would enter U.S. territory or EEZ waters near the Hawaiian Islands.

The terminal end of the payload flight would be at Kwajalein Atoll in the RMI with payload impact at Illeginni Islet (**Figure 2-3**). The payload impact zone on Illeginni Islet is an area approximately 137 meters (m) (450 feet [ft]) by 290 m (950 ft) on the non-forested, northwest end of the islet. A reef or shallow water impact is not part of the Proposed Action, would be unintentional, and is considered very unlikely to occur.

Figure 2-3. Representative Flight Path and Payload Impact Location, Illeginni Islet, Kwajalein Atoll, Republic of the Marshall Islands.

2.2 Description of the Proposed Action

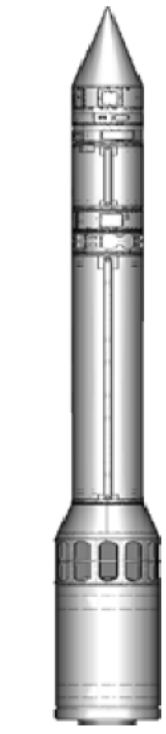
The proposed FT-3 flight test activities analyzed in this BA consist of pre-flight preparation activities, the FT-3 flight test activities including payload impact at Illeginni Islet, and post-flight operations. The Proposed Action flight test would occur sometime in the second half of fiscal year 2021 (April through September 2021).

2.2.1 Launch Vehicle Description

The FT-3 launch vehicle would consist of a three-stage booster system and a payload (**Table 2-1**). The FT-3 launch vehicle and payload characteristics and/or assumptions are detailed in **Table 2-1** and **Table 2-2**.

The FT-3 payload would be similar to the recently tested FE-2 payload (U.S. Navy 2019) except that the payload would contain approximately 10 percent of the tungsten contained on the FE-2 payload. The FT-3 payload would weigh approximately 350 kilograms (kg) (750 pounds [lb]).

Table 2-1. FT-3 Vehicle Characteristics.

Component	Representative Launch Vehicle (not to scale)	Type	Diameter	Approximate Length	Propellant Type and Mass
Payload		Sandia National Laboratories	Unknown	Unknown	N/A
Stage 3 Booster		Orion 50 XLT	130 cm (50 inches)	3.1 m (10 ft)	Solid 3,915 kg (8,632 lb)
Stage 2 Booster		Orion 50S XLT	130 cm (50 inches)	9.2 m (30 ft)	Solid 15,037 kg (33,152 lb)
Stage 1 Booster		C4	188 cm (74 inches)	4.7 m (15.5 ft)	Solid 17,543 kg (38,677 lb)

Sources: MDA 2007, MDA 2019a, MDA 2019b

Abbreviations: cm = centimeters, ft = feet, kg = kilograms, lb = pounds, m = meters

Table 2-2. FT-3 Launch Vehicle and Payload Characteristics.

	Launch Vehicle	Payload [a]
Major Components and Structure	Rocket motors, propellant, magnesium thorium (booster interstage), nitrogen gas, halon, asbestos, battery electrolytes (lithium-ion, silver zinc)	Aluminum, titanium, steel, tantalum, tungsten, carbon, silica, Teflon®, and alloys containing chromium, magnesium, and nickel
Communications	Various 5- to 20-watt radio frequency transmitters; one maximum 400-watt radio frequency pulse	Various 5- to 20-watt (radio frequency) transmitters
Power	Rechargeable lithium batteries	Lithium-ion batteries
Other	Small Class C (1.4) electro-explosive devices	Mechanical and flight termination Systems: initiators and explosive charges

Sources: USASMDC/ARSTRAT 2014, U.S. Army 2020.

2.2.2 Pre-Flight Preparations

PSCA, USAG-KA, RTS, and various other support facilities would participate in routine pre-flight support operations related to the Proposed Action. Support operations for the FT-3 Proposed Action would include base support, range safety, flight test support, and test instrumentation, at a minimum. Pre-flight activities at these additional locations are covered under existing NEPA documentation and/or consultations for their ongoing activities. As such, analysis of these support operations is not included in this BA.

Kwajalein Atoll. The Proposed Action would include pre-flight preparation activities on land at Illeginni Islet as well as in Kwajalein Atoll waters. Pre-flight activities would include several vessel round-trips and helicopter trips to Illeginni Islet for personnel and equipment transport. It is anticipated that, similar to other flight tests with payload impact at Illeginni Islet, there would be increased human activity on Illeginni Islet over a 3-month period (U.S. Army 2020). Heavy equipment, such as a backhoe or loader, may be used for placement of test equipment on Illeginni Islet and would be transported to the islet by barge or landing craft.

Several self-stationing raft-borne sensors may be deployed and recovered on both the ocean and lagoon sides of Illeginni Islet to collect data on payload descent and impact. These rafts would be equipped with battery-powered electric motors for propulsion to maintain position in the water. Two types of rafts would be used, hydrophone rafts and camera/radar rafts. Hydrophone rafts are equipped with hydrophones that are deployed off the back of the raft and hang in the water at a depth of approximately 3.7 m (12 ft). Camera rafts are equipped with stabilized cameras and/or radar as well as hydrophones as described above. Before the flight test, one or two landing craft utility vessels would be used to deploy the rafts. Rafts would be deployed in waters at least 4 m (13 ft) deep to avoid contact with the substrate and/or coral colonies.

2.2.3 Flight Test

After launch from PSCA, the FT-3 vehicle would fly out over the BOA of the Pacific Ocean and on to Illeginni Islet in Kwajalein Atoll, RMI (**Figure 2-1**). A series of ground, sea, and/or air based sensors would monitor the FT-3 vehicle during flight and collect data on vehicle flight and system performance. All of these sensors are used for existing programs and would be scheduled for use based on availability. Following motor ignition and liftoff from the launch location, the vehicle booster stages would burn out sequentially and splash down in the North Pacific Ocean (**Figure 2-1**). The first-stage motor would burn out, separate from the second stage, and splash down in U.S. territorial waters off Kodiak Island (**Figure 2-2**). Farther into flight, the second-stage would burn out, separate, and splash down in the North Pacific Ocean (**Figure 2-1**). The shroud assembly would also be jettisoned prior to third stage ignition and would splash down. After stage 3 motor burn-out and separation, the payload would continue flight over the Pacific Ocean toward Kwajalein Atoll while the stage 3 booster would splash down in the North Pacific Ocean (**Figure 2-1**).

If the launch vehicle were to deviate from its course or should other problems occur during flight that might jeopardize public safety, the onboard flight termination system would be activated. This action would initiate a predetermined safe mode for the vehicle, causing it to terminate flight and fall into the ocean. Computer-monitored destruct lines are pre-programmed into the flight safety software to avoid any debris falling on inhabited areas, and no termination debris would be expected to fall on land. Similarly, if data from the payload onboard sensors indicated that there was not sufficient energy to reach the target area, payload flight would be terminated, and the payload would fall along a ballistic trajectory into the BOA. The need for flight termination is unplanned and would be an unexpected and unlikely event.

At the terminal end of the flight, the payload would impact on land on the non-forested western end of Illeginni Islet (**Figure 2-3**). A crater would form as a result of payload impact and natural substrate (coral rubble) would be ejected around the rim of the crater. Information concerning the vehicle's energy release on impact is unknown. However, it is expected that cratering as a result of FT-3 payload impact would be less than observations of cratering for previous test program impacts on Illeginni Islet. The Proposed Action has the potential to result in elevated noise levels near Illeginni Islet due to sonic booms from payload approach and due to impact of the payload.

2.2.4 Post-Flight Operations

With the exception of normal operations at the PSCA, the effects of which are covered under opinions on programmatic launch activities, all post-flight operations would take place at Kwajalein Atoll. The expended rocket motors and other vehicle components would not be recovered from the ocean following flight.

Kwajalein Atoll. Following the test, personnel would recover FT-3 debris from land either manually or with heavy equipment similar to that used during site preparation. While debris is not expected to reach the ocean, if any FT-3 debris is present in the shallow waters (less than

55 m [180 ft] deep) near Illeginni Islet, it would be removed where reasonably possible without impacting listed species or sensitive habitats (i.e., reef habitats). The impact crater would be excavated using a backhoe or front-end loader, and the excavated material would be screened to recover debris. Following debris removal, the crater would be backfilled with the excavated material and substrate which was ejected during crater formation. United States Army Garrison-Kwajalein Atoll (USAG-KA) and RTS personnel would be involved in these post-test operations. In preparation for the test, USASMDC would prepare a post-test recovery/cleanup plan detailing specific actions which would be taken, including the measures listed in **Section 2.4**, to avoid impacts to listed species. Accidental spills from support equipment operations would be contained and cleaned up according to the UES Kwajalein Environmental Emergency Plan (KEEP). All waste materials would be appropriately stored and returned to Kwajalein Islet for proper disposal.

If an inadvertent impact occurs on the reef, reef flat, or in shallow waters less than 3 m (10 ft) deep, an inspection by project personnel would occur within 24 hours. Representatives from NMFS and the 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 USASMDC, USAG-KA, and RTS representatives, decide on any response measures that may be required. Payload recovery/cleanup operations and removal of surface floating debris in the lagoon and ocean reef flats, within 152 to 300 m (500 to 1,000 ft) of the shoreline, would be conducted similarly to land operations when tide conditions and water depth permit. In the event of an unintentional shallow water impact, visible debris would be removed as feasible and while protecting sensitive shallow-water resources.

2.3 Stressors Associated with the Proposed Action

The Proposed Action has the potential to directly or indirectly affect ESA and UES listed species and their habitats due to elevated sound pressure levels (SPLs), direct contact, vessel strike, exposure to hazardous chemical, and disturbance due to human activity or equipment operation. As stated in the *Introduction* (**Section 1.0**), proposed FT-3 activities are very similar to those of the recent FE-2 action. To simplify analyses and consultation, a comparison of stressors resulting from the two actions is presented in **Table 2-3** for Alaska nearshore waters and the BOA, and in **Table 2-4** for activities at Kwajalein Atoll.

The Proposed Action stressors are described on pages 15-18 of the FE-2 BA (U.S. Navy 2019) where they are the same as FE-2 stressors or are described in more detail in **Section 4.0** where the stressors are substantially or meaningfully different than for FE-2.

Table 2-3. Comparison of FE-2 Activity Stressors with Proposed FT-3 Activities near Kodiak Island and in the BOA.

Stressor	FE-2 Action	Proposed FT-3 Action
Elevated Sound Pressure Levels		
Sonic Booms	Maximum sound pressure less than 145 dB in water (re 1 µPa) at the surface near launch at PSCA. Maximum sound pressures less than 135 dB re 1 µPa in the BOA. Duration 0.27 second for sounds below 140 dB.	Same as FE-2.
Vehicle Component Splashdown	Estimated maximum of 218 dB in-water.	Same as FE-2. No splashdown pressure modeling conducted for FT-3. FE-2 maximum estimates used.
Direct Contact		
Vehicle Components	Three booster stage sections and payload shroud would splash down into the Pacific Ocean. Approximate dimensions were: Stage 1= 4.6 m long x 1.4 m diameter Stage 2= 2.3 m long x 1.4 m diameter Stage 3= 1.3 m long x 1.4 m diameter Nose fairing/Shroud = 3.1 m long x 1.4 m diameter	Three booster stage sections and payload shroud would splash down into the Pacific Ocean. Approximate dimensions: Stage 1= 4.7 m long x 1.9 m diameter Stage 2= 9.2 m long x 1.3 m diameter Stage 3= 3.1 m long x 1.3 m diameter Shroud = 4.1 m long x 1.3 m diameter
Exposure to Hazardous Materials		
	Introduction of launch vehicle materials into deep ocean waters, including rocket motors, unused propellant, battery electrolytes, and heavy metals. Components and materials expected to sink to the bottom or rapidly dilute.	Same materials as FE-2 (see Table 2-1) with the exception of larger quantities of propellant before launch. Same as FE-2.

Table 2-4. Comparison of FE-2 Activity Stressors with Proposed FT-3 Activities at Kwajalein Atoll.

Stressor	FE-2 Action	Proposed FT-3 Action
Elevated Sound Pressure Levels		
Sonic Booms	Maximum sound pressure less than 175 dB in water (re 1 µPa) at the surface, 149 dB in-air (re 20 µPa). Duration 0.075 second for loudest sounds and 0.27 second for sounds below 140 dB.	Same as FE-2.
Payload Impact	Estimated maximum of 140 dB in-air at 18 m (59 ft) from impact. Estimated maximum of 191 dB in-water.	FE-2 estimates used as a bounding case. Sound pressures expected to be less than 140 dB in-air at 18 m (59 ft) from impact. In-water sound pressures expected to be less than 166 dB.
Direct Contact and Shock Waves		
Cratering	Target area on land on the non-forested Western end of Illeginni Islet. Shoreline impact not planned or expected. Cratering estimated to be 6 to 9 m (20 to 30 ft) in diameter and 2.1 to 4.5 m (7 to 15 ft) deep.	Same target area as FE-2. FE-2 cratering estimates used as maximum bounding case.
Ejecta/Debris	Ejecta estimated to extend 60 to 91 m (200 to 300 ft) from the impact location. Worst case of shoreline impact evaluated.	Based on modeling, less than one percent of debris that might reach water's edge. Probability of any man made or natural debris reaching the water is less than 0.000001. If any debris entering the water would be relatively small fragments of natural debris (i.e., coral rubble from crater formation), generally less than 2.3 kg (5 lb). Shoreline impact not planned or expected.
Shock Waves	Propagation of shock waves up to 37.5 m (123 ft) from the point of impact if on the shoreline.	Same as FE-2. Shoreline impact not planned or expected.

Stressor	FE-2 Action	Proposed FT-3 Action
Exposure to Hazardous Materials		
	Potential introduction of payload materials into terrestrial and marine environments. All visible test debris would be cleaned up where possible. Introduction of up to 454 kg (1,000 lb) of tungsten into terrestrial habitats. Potential for accidental spills or leaks from support equipment. Avoidance measures would be implemented.	Same as FE-2. Introduction of up to 45 kg (100 lb) of tungsten into terrestrial habitats. Same as FE-2.
Human Activity and Equipment Operation		
Human Activity	Increased human activity on Illeginni Islet for up to 3 months	Same as FE-2.
Equipment Operation	Several helicopter trips for personnel and equipment transport. Heavy equipment such as a backhoe or loader for equipment placement and post-test cleanup.	Same as FE-2.
Vessel Strike	Several vessel round trips for personnel and equipment transport pre- and post-test. Several self-stationing rafts (combination of camera/radar rafts and hydrophone rafts) place in waters at least 4 m (13 ft) deep.	Same as FE-2.

2.4 Avoidance, Minimization, and Mitigation Measures

Similar to other flight tests which have been conducted with impacts at Illeginni Islet, several avoidance, minimization, and reporting measures shall be implemented as part of the Proposed Action to reduce the potential effects of the Proposed Action on consultation species. The measures which would be implemented as part of the Proposed FT-3 Action are the same measures proposed and implemented for the FE-2 flight test. These measures can be found on pages 18-19 of the FE-2 BA (U.S. Navy 2019) and are incorporated by reference except that U.S. Navy would be replace by U.S. Army RCCTO.

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3.0 LISTED SPECIES AND CRITICAL HABITAT IN THE ACTION AREA

This section describes the marine species requiring consultation and designated critical habitats that occur or have the potential to occur in the Action Area and may be affected by the Proposed Action. This section also describes the baseline conditions in the Action Area. This BA only addresses species under the jurisdiction of the NMFS that are listed or proposed for listing under the ESA or are listed as consultation species under Section 3-4 of the UES. Terrestrial species and those marine species under the jurisdiction of the USFWS are addressed in a separate evaluation. To determine whether the Proposed Action may affect these species or the habitats on which they depend, each species or habitat was evaluated based on the potential for exposure and response to Proposed Action stressors. No critical habitat has been designated in the RMI.

Because the FT-3 Action is very similar to the recent FE-2 action, because the Action Area at Kwajalein Atoll is the same as the action area for the FE-2 test, and because the best available information on species occurrence and baseline conditions has not changed since the FE-2 BA was prepared, the species descriptions in this FE-2 BA (U.S. Navy 2019) are incorporated by reference where appropriate as indicated in the text. The FE-2 BA was prepared by the same preparers as this BA.. For each listed species, the listing status, a general description, the known distribution, threats to the species, and population of each species in the Action Area are or were presented as they pertain to and proportional to the potential effects of the Proposed Action.

The portion of the Action Area in nearshore waters off PSCA includes the over ocean flight corridor and stage 1 booster drop zone within the U.S. EEZ (200 nautical miles [nm] from shore) in the GOA. The coastal and pelagic waters offshore of Kodiak Island provide a diversity of highly productive habitats for marine organisms. The relatively deep and broad continental shelf offshore of Kodiak Island has gravel, sand, silt, mud and rocky substrates (Fautin et al. 2010). Biodiversity studies in GOA waters have documented plankton assemblages consisting of hundreds of species and hundreds of species of pelagic and benthic invertebrates (Fautin et al. 2010). Marine vertebrate diversity and abundance are also high in Alaska waters. Over half of the commercial fish landings from U.S. waters come from Alaskan fisheries and GOA waters support large feeding congregations of many marine mammals (Fautin et al. 2010). The ESA-listed species with the potential to occur in the GOA nearshore portion of the Action Area are listed in **Table 3-1**.

Table 3-1. ESA-listed Species with the Potential to Occur in the FT-3 Booster Drop Zones.

Scientific Name	Common Name	ESA Listing Status	Occurrence in Stage 1 Drop Zone	Occurrence in Stage 2 and 3 Drop Zones
Cetaceans				
Balaenoptera borealis	Sei whale	E	-	Likely
Balaenoptera musculus	Blue whale	E	Potential	Likely
Balaenoptera physalus	Fin whale	E	Likely	Likely
Eschrichtius robustus(1)	Gray whale			
Western North Pacific DPS(1)		E	Potential	Unlikely
Eubalaena japonica	North Pacific right whale	E	Potential	Unlikely
Megaptera novaeangliae(2)	Humpback whale			
Mexico DPS(2)		T	Potential	Potential
Western North Pacific DPS(2)		E	Potential	Potential
Physeter macrocephalus	Sperm whale	E	Likely	Likely
Pinnipeds				
Eumetopias jubatus	Steller sea lion			
Western DPS		E	Likely	-
Sea Turtles				
Caretta caretta	Loggerhead turtle			
North Pacific Ocean DPS		E	-	Likely
Chelonia mydas	Green turtle			
North Pacific DPS		T	-	Unlikely
Dermochelys coriacea	Leatherback turtle	E	Potential	Likely
Eretmochelys imbricata	Hawksbill turtle	E	-	Unlikely
Lepidochelys olivacea	Olive ridley turtle	T(3)	-	Unlikely
Fishes				
Manta birostris	Oceanic giant manta ray	T	-	Potential
Oncorhynchus keta(4)	Chum Salmon			
Hood Canal Summer-run ESU/DPS		T	Potential	Potential
Oncorhynchus kisutch(4)	Coho Salmon			
Lower Columbia River ESU/ DPS		T	Potential	Potential
Oncorhynchus mykiss(4)	Steelhead			
Lower Columbia River ESU/DPS		T	Potential	Likely
Middle Columbia River ESU/DPS		T	Potential	Likely
Snake River Basin ESU/DPS		T	Potential	Likely
Upper Columbia River ESU/DPS		T	Potential	Likely
Upper Willamette River ESU/DPS		T	Potential	Likely
Oncorhynchus nerka(4)	Sockeye Salmon			
Snake River ESU/DPS		E	Potential	Potential

Scientific Name	Common Name	ESA Listing Status	Occurrence in Stage 1 Drop Zone	Occurrence in Stage 2 and 3 Drop Zones
Oncorhynchus tshawytscha(4)	Chinook Salmon			
Lower Columbia River ESU/DPS		T	Likely	Potential
Puget Sound ESU/DPS		T	Potential	Potential
Snake River Fall ESU/DPS		T	Potential	Potential
Snake River Spring/Summer ESU/DPS		T	Likely	Potential
Upper Columbia River Spring ESU/DPS		E	Likely	Potential
Upper Willamette River ESU/DPS		T	Likely	Potential

Sources: FAA 2016, NMFS 2019, AAC 2016, FAA 1996, Rone et al. 2017, U.S. Navy 2016, Hanser et al. 2017

Note: Species for which the Action Area is considered extralimital (i.e., very few confirmed sightings and the area is outside the normal range for the species) are not included in this table.

Abbreviations and Definitions: DPS = Distinct Population Segment, ESA = Endangered Species Act, ESU = Evolutionarily Significant Unit; E = Endangered, T = Threatened; Likely = regularly observed, Potential = rare, with few or no confirmed observations, "-" = does not occur in this portion of the Action Area.

(1) Gray whales in the Action Area are likely from the Eastern Population which is not listed under the ESA. It is possible that a small (but unknown) number of gray whales in the Action Area would be from the ESA-endangered Western DPS.

(2) Humpback whales in the Action Area may include whales from three DPSs (Barlow et al. 2011, Bettridge et al. 2015, Calambokidis et al. 2001). Humpback whales feeding in the GOA may be from the Hawai`i DPS (89%), the Mexico DPS (10.5%), and the Western North Pacific DPS (0.5%) (Wade et al. 2016) and it is assumed the same DPSs may be represented in the Action Area.

(3) The olive ridley turtle is listed as threatened throughout its range except for the Mexican Pacific Coast nesting population which is listed as endangered. Olive ridley turtles in the Action Area likely do not belong to the endangered east Pacific Coast nesting population (NMFS and USFWS 2014).

(4) These fish species spawn elsewhere but may occur in the GOA during the marine phase of their life cycles (NMFS 2019). Occurrence for these species is based on general patterns of migration for these species; no specific occurrence data for ESA-listed ESUs in the Action Area are known.

The BOA portion of the Action Area includes the ocean area along the FT-3 flight path that is outside the U.S. EEZ (200 nm from the coastline) as well as the stage 2 and 3 booster drop zones. The flight path does include flight over the U.S. EEZ near the Northwest Hawaiian Islands (**Figure 2-1**). The BOA portion of the Action Area consists of deep North Pacific Ocean waters with a diversity of pelagic and benthic habitats. This area includes a wide range of ocean regions extending from temperate waters of the GOA, through subtropical and tropical waters of the North Central Pacific, to equatorial waters of the RMI. Since no effects to listed species are expected for overflight of the FT-3 vehicle in the BOA, this section focuses on species in the stage 2 and 3 booster drop zone (**Figure 2-1**). The stage 2 and 3 booster drop zone would be in deep oceanic waters of the North Pacific Current, subarctic current, and the subpolar and subtropical gyres. The North Pacific transition zone (between the subtropical and subarctic gyres) varies in location from year to year but is known to be a productive area that provides important habitat and feeding grounds for many pelagic organisms in the North Pacific (Polovina et al. 2017). The ESA-listed species with the potential to occur in the BOA portion of the Action Area are listed in **Table 3-1**.

Illeginni Islet has served as a flight test termination site for numerous Department of Defense ballistic and target test flights in the past several decades. All U.S. Government activities that occur on USAG-KA and RTS controlled islands, the Kwajalein Mid Atoll Corridor, or elsewhere in the RMI have been subject to regulations in the UES since December 1995 (USASMDC/ARSTRAT 2018). The FT-3 flight test activities are consistent with the ongoing RTS mission and are well within the limits of current operations of RTS and USAG-KA. The UES listed species with the potential to occur in the Kwajalein Atoll portion of the Action Area are listed in **Table 3-2**.

Table 3-2. Species Requiring Consultation under the UES Known to or with the Potential to Occur in the Kwajalein Atoll Portion of the Action Area.

Scientific Name	Common Name	UES Consultation Species Listing Status[1]			
		ESA	MMPA	RMI Statue	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 Statue	UES 3-4.5.1(a)
Corals					
Acanthastrea brevis					x
Acropora aculeus					x
A. aspera					x
A. dendrum					x
A. listeri					x
A. microclados					x
A. polystoma					x
A. speciosa		T			
Acropora tenella		T			
A. vaughani					x
Alveopora verrilliana					x
Cyphastrea agassizi	Agassiz's coral				x
Heliopora coerulea	Blue coral				x
Leptoseris incrustans					x
Montipora caliculata					x
Pavona cactus					x
P. decussata					x
P. venosa					x
Pocillopora meandrina		C			
Turbinaria mesenterina					x
T. reniformis					x
T. stellulata					x
Mollusks					
Hippopus hippopus	Giant clam	C			
Pinctada margaritifera	Black-lipped pearl oyster			3	
Tectus niloticus[3]	Top shell snail			3	
Tridacna gigas	Giant clam	C			
T. squamosa	Giant clam	C			

Sources: USASMDC/ARSTRAT 2018, NOAA 2020, U.S. Navy 2019

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).

(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 Section 4.1.14).

(3) 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*.

3.1 Marine Mammals

Twenty marine mammal species protected under the ESA and UES have the potential to occur in the Action Area and be affected by the Proposed Action (**Table 3-1, Table 3-2**). All marine mammals discussed in this section are also protected under the MMPA (16 USC § 1361 et seq.). Only marine mammals with the potential to occur in the spent booster drop zones of the BOA are included in this section. The U.S. Army has determined that vehicle overflight activities outside the booster drop zones in the BOA would not result in stressors that would affect marine mammals. The vehicle would be flying at a very high altitude over the BOA and no components would splash down outside the designated drop zones.

A summary of threats to marine mammals in the Action Area and a summary of noise exposure are available in the FE-2 BA (U.S. Navy 2019 p. 22) and are incorporated by reference.

Summary of Marine Mammals Near Kodiak Island. Seven ESA-listed cetacean species and one ESA-listed pinniped may occur in the stage 1 drop zone and nearby waters (**Table 3-1**). Baseline conditions for marine mammal density and distribution in this portion of the Action Area are derived primarily from studies of marine mammals in the GOA conducted by Rone et al. (2017) and by the U.S. Navy for the Temporary Maritime Activities Area (2016) as well as from several agency reports and peer reviewed studies. Designated critical habitat for the Steller sea lion occurs within the stage 1 booster drop zone and the vehicle flight path crosses over critical habitat for the North Pacific right whale (*Eubalaena japonica*) as discussed in **Section 3.6**.

Summary of Marine Mammals in the BOA. Six ESA-listed cetacean species may occur in the stage 2 and 3 drop zones (**Table 3-1**). Baseline conditions for marine mammal density and distribution in this portion of the Action Area are derived primarily from studies of cetaceans in the GOA (Rone et al. 2017, U.S. Navy 2016), studies of the U.S. Navy's Hawaii-Southern California Training and Testing Area (Hanser et al. 2017), as well as from various other agency reports and peer reviewed studies. No designated critical habitat occurs within the stage 2 and 3 booster drop zones. The flight path crosses over designated critical habitat for the Hawaiian monk seal (*Neomonachus schauinslandi*) and is discussed in **Section 3.6**.

Summary of Marine Mammals at Kwajalein Atoll. Most of the 16 cetacean species listed as consultation species under the UES (**Table 3-2**) have been observed in the RMI (Miller 2007, Reeves et al. 1999). For other species such as pygmy killer whale (*Feresa attenuata*), Risso's dolphin (*Grampus griseus*), pygmy sperm whale (*Kogia breviceps*), and Blainville's beaked whale (*Mesoplodon densirostris*), potential presence in the Action Area is based on information regarding life history, including feeding patterns, known distribution, and migration patterns, as well as range distribution form the literature sources (NOAA 2020, Reeves et al. 2002, Perrin et al. 2002). There is no designated critical habitat in the Action Area for marine mammals.

3.1.1 Sei whale (*Balaenoptera borealis*)

Descriptions of sei whales, their distribution, threats, and populations near the Hawaiian Islands are available on pages 25-26 of the FE-2 BA (U.S. Navy 2019).

Populations in the Booster Drop Zones. Sei whales are known to occur in the GOA and near the Hawaiian Islands. No known density estimates are available for sei whales in the GOA, but the North Pacific stock has been estimated to have a minimum of 3,168 individuals (Muto et al. 2020). Since sei whales are often found in deeper waters, these whales are considered unlikely in the stage 1 booster drop zone near Kodiak Island. Sei whales may occur in the deeper waters of the stage 2 and 3 drop zones; however, these whales are still considered rare in this portion of the Action Area.

3.1.2 Blue Whale (*Balaenoptera musculus*)

Descriptions of blue whales, their distribution, threats, and populations near the Hawaiian Islands and at Kwajalein Atoll are available on pages 27-28 of the FE-2 BA (U.S. Navy 2019).

Populations in the Booster Drop Zones. Blue whales are known to occur in the GOA during summer months. During recent ship-board visual surveys in the GOA, most blue whales were sighted in pelagic waters with one sighting along the shelf break (Rone et al. 2017). These surveys resulted in density estimates for blue whales of 0.0001 individuals/square kilometer (km^2) in inshore waters and as high as 0.0014 individuals/km^2 in offshore waters of the BOA (Rone et al. 2017). Blue whales are found seasonally near Hawai`i; however, sighting frequency is low. Whales feeding in the north-central Pacific likely migrate to offshore waters north and west of Hawai`i in winter (Carretta et al. 2020) and are likely to occur in the stage 2 and 3 drop zones seasonally.

3.1.3 Fin Whale (*Balaenoptera physalus*)

Descriptions of fin whales, their distribution, threats, and populations near the Hawaiian Islands and at Kwajalein Atoll are available on pages 28-29 of the FE-2 BA (U.S. Navy 2019).

Populations in the Booster Drop Zones. Fin whales were one of the most frequently sighted large whales during ship-board line-transect surveys conducted in the GOA in the summer of 2009 (56 individuals), 2013 (317 individuals), and 2015 (60 individuals) (Rone et al. 2017). These surveys included the nearshore waters off Kodiak Island and resulted in a density estimates between 0.0070 and 0.0680 individuals/km^2 for “inshore” waters (Rone et al. 2017). Offshore density estimates in the GOA were as high as 0.0160 individuals/km^2 (Rone et al. 2017). Fin whales are considered rare in Hawaiian waters but are likely to occur in the stage 2 and 3 drop zones.

3.1.4 Short-beaked Common Dolphin (*Delphinus delphis*)

Descriptions of short-beaked common dolphins, their distribution, threats, and populations at Kwajalein Atoll are available on pages 29-30 of the FE-2 BA (U.S. Navy 2019). This species is likely to occur in the booster drop zones; however, this species is not listed under the ESA. Short-beaked common dolphins are listed as consultation species under the UES and are known to occur at Kwajalein Atoll.

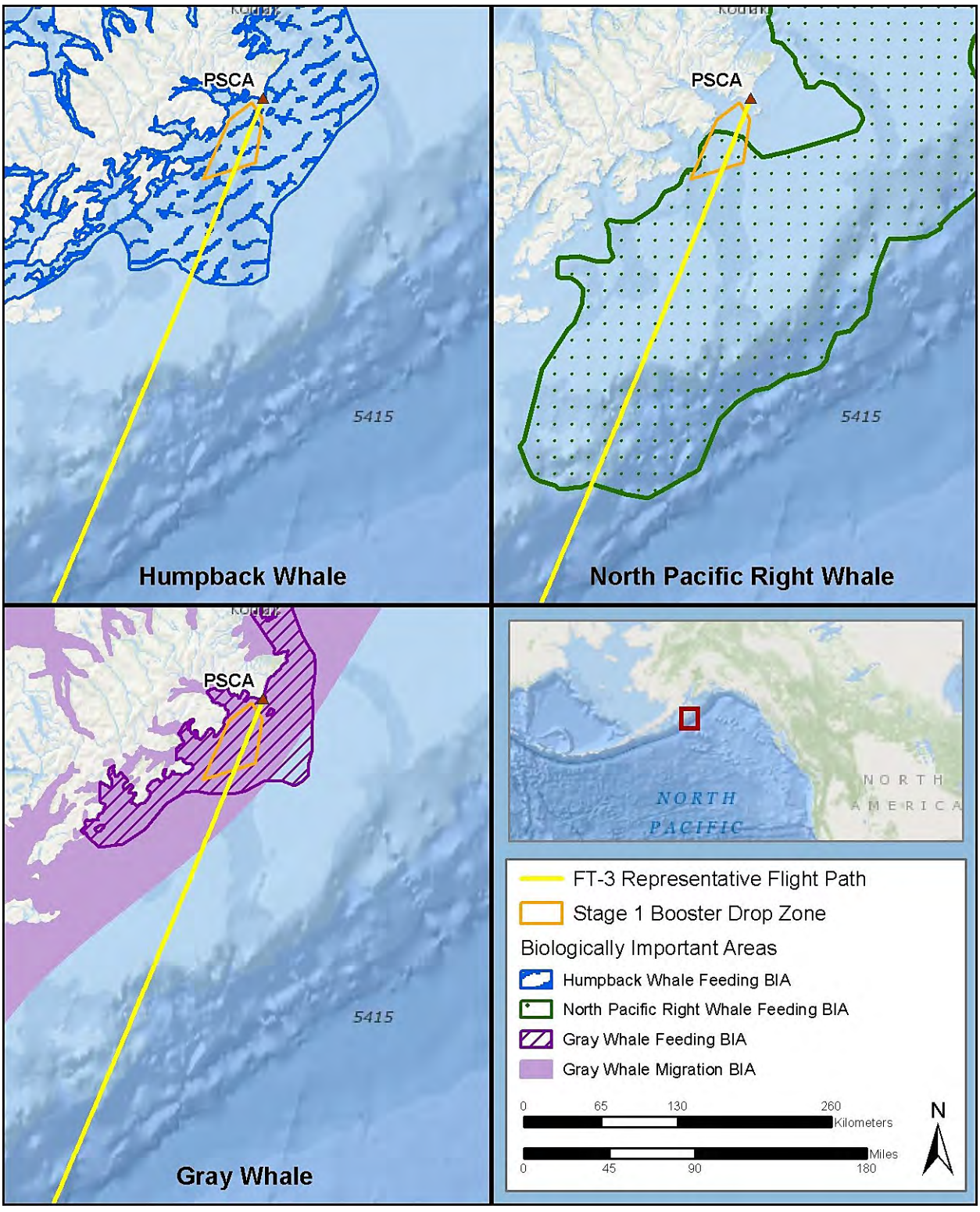
3.1.5 Gray Whale (*Eschrichtius robustus*)

Species Description and Distribution. Originally listed as endangered under the ESA throughout its range (35 FR 8491 [June 2, 1970]), the Eastern Pacific Population was delisted in 1994 (59 FR 31094 [June 16, 1994]) while the Western North Pacific Distinct Population Segment (DPS) remains listed as endangered. The Western North Pacific DPS feeds primarily in nearshore waters off Sakhalin Island in the Okhotsk Sea and off the southeastern Kamchatka Peninsula in the southwest Bering Sea (Weller et al. 2012, NMFS 1991). Based on samples of whales in Western DPS (Sakhalin area) and Eastern DPS feeding areas (including the Bering Sea north of the Aleutians), there is significant genetic differentiation between the Western and Eastern North Pacific populations (Lang 2010). These whales are believed to use coastal waters of eastern Russia, the Korean Peninsula, and Japan for migration to winter in waters of the South China Sea (Weller et al. 2012). Recent evidence indicates that Western DPS gray whales also migrate to wintering grounds in the Eastern North Pacific (Mate et al. 2015, Weller et al. 2012). Gray whales have been observed year-round near Ugak Bay since 2009 (Moore et al. 2007, Rone et al. 2017) and likely feed on abundant benthic organisms such as amphipods and cumaceans (Moore et al. 2007, NMFS 1991). Gray whales are in the low-frequency cetacean functional hearing group with an estimated auditory bandwidth of 7 hertz (Hz) to 35 kilohertz (kHz) (NOAA 2018).

The National Oceanic and Atmospheric Administration (NOAA) Cetacean Density and Distribution Mapping Working Group has identified a biologically important summer feeding area for gray whales in the Albatross Bank region off Kodiak Island as well as a gray whale migration corridor through the GOA (used November through January and March through May) which includes the waters east of Kodiak Island (Ferguson et al. 2015) (**Figure 3-1**).

Populations in the Action Area.
Booster Drop Zones. Gray whales are known to occur in the Action Area near Kodiak Island (Moore et al. 2007, Rone et al. 2017) and may occur seasonally in the northernmost portions of the stage 2 booster drop zone. The best available density estimates for gray whales in the Action Area are those found in the 2011 GOA EIS (U.S. Navy 2011) as extrapolated from Moore et al. 2007. The U.S. Navy estimated a density of 0.0125 whales/km^2 for high-density inshore areas and 0.0003 whales/km^2 for other offshore areas (U.S. Navy 2011). The GOA is considered to be within the range of the Eastern population of gray whales, and it is assumed that the majority of gray whales in the Action Area belong to this population. However, due to recent evidence of movement of Western DPS whales into the Eastern Pacific, it is considered a possibility that a small (but unknown) number of gray whales in the Action Area may be from the endangered Western DPS of gray whales. The most recent stock assessment report included a minimum population estimate for the Western North Pacific population of gray whales of 271 animals and 25,849 individuals for the Eastern North Pacific population (Carretta et al. 2020).

Kwajalein Atoll. This species does not occur in this portion of the Action Area.



Data source: Ferguson et al. 2015

Figure 3-1. Biologically Important Areas for Cetaceans in the Action Area.

3.1.6 North Pacific Right Whale (*Eubalaena japonica*)

Species Description and Distribution. The northern right whale (*Eubalaena* spp.) was originally listed under the Endangered Species Conservation Act of 1969, the precursor to the ESA (NMFS 2017). In 2008, the northern right whale was listed as endangered as two separate species, the North Pacific right whale and the North Atlantic right whale (*Eubalaena glacialis*) (73 FR 12024 [March 6, 2008]). North Pacific right whales likely number less than 1,000 individuals between both the eastern and western populations and remain one of the most critically endangered marine mammals (NMFS 2017). The eastern population of this species is known to use the waters of the Bering Sea and GOA as summer feeding grounds (NMFS 2017). Little is known about their migration routes or winter distribution; however, modeling indicates that potential calving locations include the waters off southern California and the Northwest Hawaiian Islands (NMFS 2017).

North Pacific right whales are large baleen whales that are skim feeders, continuously filtering through their baleen as they move through patches of zooplankton (NMFS 2017). Right whales feed primarily on copepods in the GOA (NMFS 2017) but also consume euphausiids and cyprids and require high densities of these zooplankton for efficient feeding. The diving frequency and duration for right whales varies, likely with season, time of day, prey availability, and prey location (Watkins and Schevill 1982, Winn et al. 1995). While little data is available for North Pacific right whales, observations of North Atlantic right whales included dive durations from 1 to 7 minutes with occasional dives of up to 20 minutes (Watkins and Schevill 1982) and a mean dive time of approximately 2 minutes (Winn et al. 1995). During some seasons, whales were rarely observed at the surface, while in other seasons, right whales were frequently observed feeding near the surface or in leisurely activities at the surface (Watkins and Schevill 1982). Winn et al. (1995) found that tagged whales spent nearly all of their time in the near-surface waters with 45 percent of depth records less than 5 m (16 ft) deep, 97 percent less than 20 m (66 ft) deep, and the deepest dive depth recorded was 85 m (279 ft). In addition to skim feeding, right whales exhibit a variety of behaviors at the surface including breaching, fluking, nursing, and resting. In terms of functional hearing capability, North Pacific right whales belong to the low-frequency group, with hearing ranging from 7 Hz to 35 kHz (NOAA 2018).

Populations in the Action Area.
Booster Drop Zones. North Pacific right whales observations in the GOA are rare but the few sightings and acoustic detection of right whales in the GOA have been in shelf waters adjacent to Kodiak Island (Muto et al. 2020, NMFS 2017). The area around the North Pacific right whale designated critical habitat in the vicinity of Albatross Bank (see **Figure 3-3**) is the only location in the GOA where this species has been consistently identified in recent decades (NMFS 2017, Wade et al. 2011). North Pacific right whales are known to feed near Kodiak Island in the summer months when zooplankton densities are high (Wade et al. 2011). These waters are considered biologically important feeding grounds for this species (**Figure 3-1**), with highest whale densities between June and September (Ferguson et al. 2015). Analysis of data from acoustic recorders in the southeastern Bering Sea indicate that North Pacific right whales remain in this area from May through December, with peak call detection in July through October (Munger et al. 2008). This study included acoustic monitoring off Kodiak Island from

April to August 2003, which resulted in no detections (Munger et al. 2008). However, right whales have been visually and acoustically detected in waters off Kodiak Island at other times (Munger et al. 2008, Muto et al. 2020). In a 2015 study, North Pacific right whale vocalizations were detected in August in the Barnabas Trough region within the North Pacific right whale designated critical habitat (Rone et al. 2015). The estimated locations for North Pacific right whales detected in the 2015 acoustic study were just south of the stage 1 booster drop zone near Kodiak Island.

The latest data indicate that abundance of the eastern stock of the North Pacific right whale is estimated at 31 individuals (Wade et al. 2011, Muto et al. 2020) and the effective population size (the number of individuals in the population that contribute offspring to the next generation) is only 11.6 whales (NMFS 2017).

Kwajalein Atoll. This species does not occur in this portion of the Action Area.

3.1.7 Pygmy Killer Whale (*Feresa attenuata*)

Descriptions of pygmy killer whales, their distribution, threats, and populations at Kwajalein Atoll are available on page 30 of the FE-2 BA (U.S. Navy 2019). This species has the potential to occur in the stage 2 and 3 booster drop zones but is not listed under the ESA. Pygmy killer whales are listed as consultation species under the UES and have the potential to occur at Kwajalein Atoll.

3.1.8 Short-finned Pilot Whale (*Globicephala macrorhynchus*)

Descriptions of short-finned pilot whales, their distribution, threats, and populations at Kwajalein Atoll are available on page 31 of the FE-2 BA (U.S. Navy 2019). This species is likely to occur in the stage 2 and 3 booster drop zones but is not listed under the ESA. Short-finned pilot whales are listed as consultation species under the UES and are known to occur at Kwajalein Atoll.

3.1.9 Risso's Dolphin (*Grampus griseus*)

Descriptions of Risso's dolphins, their distribution, threats, and populations at Kwajalein Atoll are available on pages 31-32 of the FE-2 BA (U.S. Navy 2019). This species has the potential to occur in the stage 2 and 3 booster drop zones but is not listed under the ESA. Risso's dolphins are listed as consultation species under the UES and are known to occur at Kwajalein Atoll.

3.1.10 Pygmy Sperm Whale (*Kogia breviceps*)

Descriptions of pygmy sperm whales, their distribution, threats, and populations at Kwajalein Atoll are available on pages 33-34 of the FE-2 BA (U.S. Navy 2019). This species is likely to occur in the stage 2 and 3 booster drop zones but is not listed under the ESA. Pygmy sperm whales are listed as consultation species under the UES and have the potential to occur at Kwajalein Atoll.

3.1.11 Humpback Whale (*Megaptera novaeangliae*)

Descriptions of humpback whales, their distribution, threats, and populations near the Hawaiian Islands and at Kwajalein Atoll are available on pages 36-37 of the FE-2 BA (U.S. Navy 2019).

Populations in the Booster Drop Zones. Humpback whales are known to occur in the stage 1 booster drop zone during the summer months where they feed in relatively shallow continental shelf waters (Rone et al. 2017). Survey data suggest a relatively large concentration of humpback whales feed near Dangerous Cape (Rone et al. 2017). The waters near Kodiak are known to be a primary feeding ground for humpback whales (Barlow et al. 2011, Witteveen et al. 2011), and NOAA's Cetacean Density and Distribution Mapping Working Group has determined that the waters of Albatross Bank, including portions of the Action Area, are a biologically important feeding ground for humpback whales (**Figure 3-1**). These whales are most abundant in the GOA in the summer months (July to September); however, some whales are known to use the area year-round (Ferguson et al. 2015, U.S. Navy 2016). During ship-board line-transect surveys conducted in the GOA in the summers of 2009, 2013, and 2015, humpback whales were among the most abundant whales sighted (Rone et al. 2017). Theses surveys resulted in density estimate between 0.0050 and 0.0930 individuals/km^2 for "inshore" waters off Kodiak Island (Rone et al. 2017). Offshore density estimates based on these surveys were as high as 0.0010 individuals/km^2 (Rone et al. 2017).

Most humpback whales in the booster drop zones are likely from the Hawaii DPS but a small number may be from the ESA-listed Mexico or Western North Pacific DPSs. In a 2004-2006 study, Barlow et al. (2011) determined that the relative probability of humpback whales feeding in the GOA being sampled in a given winter breeding area was 0.47 for Hawaii, 0.22 for Mexico Islands, 0.26 for Baja, 0.03 for Mainland Mexico, and 0.02 for the Western Pacific. Wade et al. (2016) reported the probability of humpback whales feeding in the GOA being from a given DPS as 89 percent for the Hawaii DPS, 10.5 percent for the Mexico DPS, and 0.5 percent for the Western North Pacific DPS. Overall, there is some evidence that humpback whale populations are increasing in the North Pacific (Barlow et al. 2011) but some populations continue to have low abundance estimates. The Western North Pacific DPS is only estimated to have around 1,000 individuals and the Mexico DPS only 3,264 (NMFS 2016).

3.1.12 Blainville's Beaked Whale (*Mesoplodon densirostris*)

Descriptions of Blainville's beaked whales, their distribution, threats, and populations at Kwajalein Atoll are available on pages 37-38 of the FE-2 BA (U.S. Navy 2019). This species may occur in the stage 2 and 3 booster drop zones but is not listed under the ESA. Blainville's beaked whales are listed as consultation species under the UES and have the potential to occur at Kwajalein Atoll.

3.1.13 Killer Whale (*Orcinus orca)*

Descriptions of killer whales, their distribution, threats, and populations at Kwajalein Atoll are available on pages 38-39 of the FE-2 BA (U.S. Navy 2019). Killer whales occur throughout the

Pacific Ocean in a variety of habitats; however, no ESA-listed populations occur in the Action Area. Killer whales are listed as consultation species under the UES where they occur at Kwajalein Atoll.

3.1.14 Melon-headed Whale (*Peponocephala electra*)

Descriptions of Melon-headed whales, their distribution, threats, and populations at Kwajalein Atoll are available on pages 39-40 of the FE-2 BA (U.S. Navy 2019). This species has the potential to occur in the stage 3 booster drop zone but is not listed under the ESA. Melon-headed pilot whales are listed as consultation species under the UES and are known to occur in deep waters of the RMI.

3.1.15 Sperm Whale (*Physeter macrocephalus*)

Descriptions of sperm whales, their distribution, threats, and populations near the Hawaiian Islands and at Kwajalein Atoll are available on pages 40-42 of the FE-2 BA (U.S. Navy 2019).

Populations in the Booster Drop Zones. Sperm whales are known to occur in the GOA and have been observed regularly during recent visual and acoustic surveys (2009, 2013, and 2015). Sperm whales have been observed in both offshore and inshore waters (Rone et al. 2017) with most observation in continental shelf break and slope waters (Rone et al. 2017). Based on these studies, density estimates as high as 0.0030 individuals/km^2 for sperm whales in offshore waters and 0.0020 individuals/km^2 for inshore waters were calculated. The inshore estimate is likely an overestimate of density for continental shelf waters such as those of the debris zones near Kodiak Island, as the “inshore” stratum for the 2015 study included shelf break and slope waters where the majority of sperm whales detections were located in this stratum (Figure 4a of Rone et al. 2017). Another significant observation during these studies was of a group of 11 sperm whales composed of females, immature males, and calves in 2015 (Rone et al. 2017). This indicates that not only mature males are found in the high latitude waters of the GOA as previously thought. Sperm whales are known to be present in the GOA year-round but are more common in the summer months (peak July through September) than in the winter months by a factor of two (Mellinger et al. 2004). A reliable estimate of abundance for the North Pacific stock of sperm whales is not available at this time (Muto et al. 2020).

3.1.16 Pantropical Spotted Dolphin (*Stenella attenuata*)

Descriptions of pantropical spotted dolphins, their distribution, threats, and populations at Kwajalein Atoll are available on pages 43-44 of the FE-2 BA (U.S. Navy 2019). This species is not likely to occur in the booster drop zones and is not listed under the ESA. Pantropical spotted dolphins whales are listed as consultation species under the UES and are known to occur in the RMI.

3.1.17 Striped Dolphin (*Stenella coeruleoalba*)

Descriptions of stiped dolphins, their distribution, threats, and populations at Kwajalein Atoll are available on pages 44-45 of the FE-2 BA (U.S. Navy 2019). This species is likely to occur in the stage 2 and 3 booster drop zones but is not listed under the ESA. Striped dolphins are listed as consultation species under the UES and are known to occur in the RMI.

3.1.18 Spinner Dolphin (*Stenella longirostris*)

Descriptions of spinner dolphins, their distribution, threats, and populations at Kwajalein Atoll are available on pages 45-46 of the FE-2 BA (U.S. Navy 2019). This species is unlikely to occur in the stage 2 and 3 booster drop zones and is not listed under the ESA. Spinner dolphins are listed as consultation species under the UES and are known to occur at Kwajalein Atoll.

3.1.19 Bottlenose Dolphin (*Tursiops truncatus*)

Descriptions of bottlenose dolphins, their distribution, threats, and populations at Kwajalein Atoll are available on pages 47-48 of the FE-2 BA (U.S. Navy 2019). This species is likely to occur in the stage 1 booster drop zone and but is not listed under the ESA. Bottlenose dolphins are listed as consultation species under the UES and are known to occur in the RMI.

3.1.20 Steller sea lion (*Eumetopias jubatus*)

Species Description and Distribution. Steller sea lions were listed as a threatened species under the ESA throughout their range in 1990. In 1997, the NMFS reclassified Steller sea lions as two DPSs under the ESA (62 FR 24345 [May 5, 1997]). The eastern DPS maintained its threatened status until it was delisted in 2013. The western DPS is defined as Steller sea lions born at rookeries from Prince William Sound westward, including those located on and near Kodiak Island. The listing status of the western DPS was revised to endangered in 1997 (62 FR 24345).

Sea lions use terrestrial habitats throughout the year for haul-out sites where they rest and molt, and as rookery sites for mating and pupping (NMFS 2008). Steller sea lions are predators that forage and feed at sea on a variety of fish and cephalopods (NMFS 2008). These large pinnipeds primarily forage near shore and in pelagic waters and may dive several hundred feet to catch prey (NMFS 2008). Satellite telemetry studies of sea lions in the central GOA and Aleutian Islands indicate that adult females and juveniles make short trips to sea from rookeries in the summer averaging 17 kilometers (km) (maximum 49 km) from rookeries and generally stay on the continental shelf (NMFS 2008). In winter, adult females went farther out to sea with an average distance of 133 km (82.6 mi) from haul-out/rookery sites (maximum 543 km or 337 miles [mi]) (NMFS 2008). In the winter, most pups made relatively short trips to sea (average distance 30 km [19 mi] from rookeries) (NMFS 2008). Data also indicate that seasonal differences in foraging distribution are likely related to seasonal variations in prey distribution (NMFS 2008). Steller sea lions are in the otariid pinniped functional hearing group in water with

an estimated full range of functional hearing between approximately 60 Hz and 39 kHz (NOAA 2018).

Populations in the Action Area.

Booster Drop Zones.. Steller sea lions are likely to occur in the stage 1 booster drop zone and have critical habitat in this portion of the Action Area (see **Section 3.6**). As the at-sea distribution of Steller sea lions varies seasonally and with prey availability, the density of sea lions in the Action Area is largely unknown. Several known haul-out and rookery sites occur near the stage 1 booster drop zone near Kodiak Island (details in **Section 3.6**) and sea lions must regularly transit nearshore waters surrounding haul-out sites to reach their offshore feeding areas (NMFS 2008). While adult females with pups generally forage within 20 km (12 mi) of rookery sites, adult sea lions without pups forage at larger distances from haul-out sites and dive to greater depths (NMFS 2008, 58 FR 165). The best available density estimates for Steller sea lions at-sea are found in the 2011 Navy GOA EIS (U.S. Navy 2011) where year-round at-sea density was estimated at 0.0098 individuals/km^2.

Based on 2018 surveys of the Western DPS of Steller sea lion haul-out and rookery sites in Alaska, there were an estimated 41,782 non-pups (95% Confidence Interval (CI) = 37,370-46,822) and 11,842 pups (95% CI = 10,659-13,238) in the Alaska portion of this population (Sweeney et al. 2018). The modeled non-pup counts for the Western DPS in Alaska increased at a rate of 2.05% per year (95% CI = 1.46-2.66) between 2000 and 2018; with sites east of Samalga Pass exhibiting increasing count trends while sites in the Aleutians west of the pass exhibited decreasing count trends (Sweeney et al. 2018). The modeled pup count increased at a rate of 1.52% per year (95% CI = 0.94-2.08) between 2000 and 2018 and exhibited similar trends east and west of Samalga Pass.

Kwajalein Atoll. This species does not occur in this portion of the Action Area.

3.2 Reptiles

Five sea turtle species listed under the ESA and UES have the potential to occur in the Action Area (**Table 3-1**, **Table 3-2**). A summary of threats to sea turtles in the Action Area and a summary of sea turtle hearing is available in the FE-2 BA (U.S. Navy 2019 pp. 52-54) and are incorporated by reference.

Summary of Sea Turtles Near Kodiak Island. The only species of sea turtle with the potential to occur in the stage 1 booster drop zone is the leatherback sea turtle (*Dermochelys coriacea*) (**Table 3-1**). Four species of sea turtles have been observed very rarely in Alaska waters but the other species are extralimital and very unlikely to occur in this portion of the Action Area.

Summary of Sea Turtles in the BOA. Sea turtles spend most of their lives in the open ocean (NOAA 2020). Five species of sea turtle occur in the Pacific Ocean, and all are listed as endangered or threatened under the ESA (NOAA 2020) and have the potential to occur in the

ocean under the vehicle flight path. Only two of these species are likely to occur in the stage 2 and 3 booster drop zones: loggerhead turtle (*Caretta caretta*) and leatherback turtle (**Table 3-1**). The U.S. Army has determined that vehicle overflight activities outside the booster drop zones in the BOA would not result in stressors that would affect green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), or olive ridley (*Lepidochelys olivacea*) turtles in the BOA and olive ridley turtles are not discussed further in this BA.

Summary of Sea Turtles at Kwajalein Atoll. The only sea turtle species with the potential to be present in the Kwajalein Atoll portion of the Action area are green and hawksbill turtles (**Table 3-2**). Both of these species are listed under the ESA and are UES consultation species.

In addition to their marine distribution in Kwajalein Atoll waters, green and hawksbill turtles also have the potential to haul out and nest in terrestrial habitats on Illeginni Islet. No sea turtle nests or nesting activity have been observed on Illeginni Islet in over 20 years. Hauled out and nesting sea turtles and sea turtles nests are under the jurisdiction of the USFWS and are not addressed further in this BA.

3.2.1 Loggerhead Turtle (*Caretta caretta*)

Descriptions of loggerhead turtles, their distribution, threats, and populations in the pelagic Pacific Ocean and at Kwajalein Atoll are available on pages 54-55 of the FE-2 BA (U.S. Navy 2019).

Populations in the Booster Drop Zones. Loggerheads appear to use the entire North Pacific Ocean during development. There is evidence that turtles from the North Pacific Ocean DPS make two transoceanic crossings. The first crossing (west to east) is made immediately after they hatch from the nesting beach in Japan, and the second (east to west) is made when they reach either the late juvenile or adult life stage at the foraging grounds in Mexico. Offshore, juvenile loggerheads forage in and migrate through the North Pacific Gyre current as they move between North American developmental habitats and nesting beaches in Japan (Polovina et al. 2000, Polovina et al. 2004). Loggerheads have primarily been recorded using productive North Pacific open ocean habitats from 28-40° N where sea temperatures are 15-25 degrees Celsius (Polovina et al. 2004). Loggerhead turtles are likely to occur in the stage 3 booster drop zone and have the potential to occur in the stage 2 booster drop zone (Scarponi et al. 2018).

3.2.2 Green Turtle (*Chelonia mydas*)

Descriptions of green turtles, their distribution, threats, and populations in the pelagic Pacific Ocean and at Kwajalein Atoll are available on pages 55-58 of the FE-2 BA (U.S. Navy 2019). The only portion of the Action Area where green turtles occur and have the potential to be exposed to Proposed Action Stressors is at Kwajalein Atoll.

3.2.3 Leatherback Turtle (*Dermochelys coriacea*)

Descriptions of leatherback turtles, their distribution, threats, and populations in the pelagic Pacific Ocean and at Kwajalein Atoll are available on pages 58-59 of the FE-2 BA (U.S. Navy 2019).

Populations in the Booster Drop Zones. Leatherback sea turtles are known to forage at higher latitudes in the North Pacific during the summer months (March-August) when water temperatures are higher and increased primary production allows for greater prey abundance (Benson et al. 2011, Bailey et al. 2012). The GOA is not known to be a high-use area for leatherback turtles (Benson et al. 2011). Between 1960 and 2006, only 19 leatherback turtle observations were documented in Alaska (U.S. Navy 2016). No density estimates are available for leatherbacks in the GOA, but leatherbacks may be present in the Action Area in the summer to fall months in extremely low (but unknown) numbers.

3.2.4 Hawksbill Turtle (*Eretmochelys imbricata*)

Descriptions of hawksbill turtles, their distribution, threats, and populations in the pelagic Pacific Ocean and at Kwajalein Atoll are available on pages 59-61 of the FE-2 BA (U.S. Navy 2019). The only portion of the Action Area where hawksbill turtles occur and have the potential to be exposed to Proposed Action Stressors is at Kwajalein Atoll.

3.3 Fish

The marine environment of the Action Area provides a diversity of fish habitat. There are twelve species of fish requiring consultation in the Action Area (**Table 3-1**, **Table 3-2**). A summary of threats to fish in the Action Area and a summary of fish hearing is available on pages 62-63 in the FE-2 BA (U.S. Navy 2019) and are incorporated by reference.

Summary of Fish Near Kodiak Island. Individuals belonging to 14 Evolutionarily Significant Units (ESUs) of 5 salmon and steelhead species have the potential to occur in the nearshore waters off Kodiak Island (**Table 3-1**) (NMFS 2019). These anadromous fish ESUs spawn in waters of the west coast of Oregon, Washington, California, and British Columbia but may occur in the GOA during the marine phase of their life cycles (NMFS 2019). The density and distribution of salmonids in this area likely varies yearly, seasonally, with ocean conditions and prey density, and remains unknown for the Action Area and much of the GOA. Critical habitat has been designated for several salmon and steelhead ESUs and DPSs; however, no critical habitat for these listing units occurs in the Action Area.

Summary of Fish in the BOA. Due to the large size of the BOA, there are a diversity of oceanic habitats for fish from epipelagic to deep benthic and seamount habitats, and therefore a wide diversity of fish species. The ESA-listed oceanic giant manta ray (*Manta birostris*) has the potential to occur in the stage 3 booster drop zone. Several ESU/DPUs of steelhead and salmon also have the potential to occur in the stage 2 booster drop zone (**Table 3-1**). However,

most of these species are more likely to occur in more coastal areas and if they occur in the stage 2 booster drop zone is it would likely be at very low densities.

Summary of Fish at Kwajalein Atoll. Fish habitats in the Action Area at Kwajalein Atoll including many reef habitats typical of atolls in the central Pacific, protected lagoon habitats, and deeper ocean habitats surrounding Kwajalein Atoll. There are seven species of fish that require consultation under the UES that have the potential to occur in the Action Area (**Table 3-2**). The bigeye thresher shark (*Alopias superciliosus*), oceanic whitetip shark (*Carcharhinus longimanus*), oceanic giant manta ray, and Pacific bluefin tuna (*Thunnus orientalis*) are primarily open ocean species and have the potential to occur in deep ocean waters near Kwajalein Atoll. Relatively little is known about scalloped hammerhead sharks (*Sphyrna lewini*), but this species does have an affinity for coastal environments where it is known to give birth to live young. Juvenile scalloped hammerheads are known to occur in relatively shallow nearshore waters, and adults are known to occur in deeper coastal waters. This species may be found in both nearshore and deeper ocean waters of Kwajalein Atoll. The reef manta ray (*Manta alfredi*) is a shallow water species found primarily in or near reef habitats and may be present near Illeginni Islet. The humphead wrasse is reef-associated and found in reef habitat throughout Kwajalein Atoll including the waters surrounding Illeginni Islet.

3.3.1 Bigeye Thresher Shark (*Alopias superciliosus*)

Descriptions of bigeye thresher sharks, their distribution, threats, and populations in the pelagic Pacific Ocean and in deep ocean waters at Kwajalein Atoll are available on pages 63-65 of the FE-2 BA (U.S. Navy 2019). Bigeye thresher sharks are likely to occur along the flight corridor and may occur in the stage 3 booster drop zone. However, these fish are not ESA-listed and are therefore not consultation species in the BOA. The bigeye thresher shark is listed as a consultation species under the UES and is known to occur in deeper waters of the RMI.

3.3.2 Oceanic Whitetip Shark (*Carcharhinus longimanus*)

Descriptions of oceanic whitetip sharks, their distribution, threats, and populations in the pelagic Pacific Ocean and in deep ocean waters at Kwajalein Atoll are available on pages 65-66 of the FE-2 BA (U.S. Navy 2019). Oceanic whitetip sharks would not occur in the booster drop zones but occur in occur deeper waters of the RMI.

3.3.3 Humphead Wrasse (*Cheilinus undulatus*)

Descriptions of humphead wrasses, their distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on pages 66-68 of the FE-2 BA (U.S. Navy 2019). Humphead wrasse would not occur in the booster drop zones but are known to occur in reef habitats at Illeginni Islet and elsewhere in Kwajalein Atoll.

3.3.4 Reef Manta Ray (*Manta alfredi*)

Descriptions of reef manta rays, their distribution, threats, and populations at Kwajalein Atoll are available on pages 68-69 of the FE-2 BA (U.S. Navy 2019). Reef manta rays would not occur in the booster drop zones and are not ESA-listed but are likely to occur in reef habitats at Illeginni Islet and elsewhere in Kwajalein Atoll.

3.3.5 Oceanic Giant Manta Ray (*Manta birostris*)

Descriptions of oceanic manta rays, their distribution, threats, and populations in the pelagic Pacific Ocean and in deep waters of Kwajalein Atoll are available on pages 69-70 of the FE-2 BA (U.S. Navy 2019).

Populations in the Booster Drop Zones. Oceanic giant manta rays have the potential to occur in the stage 3 booster drop zone (Lawson et al. 2017). These fish are commonly sighted along productive coastlines with upwelling and primarily occurs near offshore pinnacles and seamounts (Marshall et al. 2011b). This species is thought to spend the majority of its time in deep water with occasional visits to coastal areas (Defenders of Wildlife 2015). No density estimates are available for giant manta rays in the Action Area. However, the stage 3 booster drop zone is at the northern extent of occurrence for this species (Lawson et al. 2017) and densities are likely very low.

3.3.6 Chum Salmon (*Oncorhynchus keta*)

Species Description and Distribution. Chum salmon spawn in freshwater habitats from Monterey Bay, California, all the way around the Pacific Rim to Korea and Japan (NMFS 2004). All chum salmon are anadromous, and juveniles migrate out to sea almost immediately after emergence (NMFS 2004). Chum salmon usually spend a few days or weeks in estuaries before moving farther out to coastal areas where they feed in epipelagic waters for 2 to 4 years (Quinn and Myers 2005). North American populations then migrate north along the continental shelf and begin to move further offshore as they grow (Quinn and Myers 2005). Chum salmon are not likely to be found in coastal waters again until they migrate to spawning habitats at maturity (Quinn and Myers 2005). Chum salmon prefer zooplankton and micronekton as prey, and their spatial and temporal distribution and abundance are likely linked to the distribution and abundance of prey as well as to physical ocean characteristics such as temperature and currents (Quinn and Myers 2005).

Populations in the Action Area.
Booster Drop Zones. One ESA-listed chum salmon ESU has the potential to occur in the Action Area, the Hood Canal Summer-run ESU (NMFS 2020). While the distribution and abundance of the Hood Canal Summer-run ESU chum salmon in the GOA is unknown, some information about chum salmon (from all populations) is available for the GOA. In general, juvenile chum salmon are found in more coastal habitats with immature salmon moving further offshore as they grow and mature (Echave et al. 2012). The proportion of the total aggregation of chum salmon in the GOA that belong to the Hood Canal Summer-run ESU is unknown, but it is likely a

small fraction of the total chum salmon numbers there. Juvenile chum salmon from this ESU are considered to be rare in the stage 1 booster drop zone and immature chum salmon from this ESU to be infrequent in the BOA.

Kwajalein Atoll. This species does not occur in this portion of the Action Area.

3.3.7 Coho Salmon (*Oncorhynchus kisutch*)

Species Description and Distribution. Coho salmon occur throughout the North Pacific where they spawn in rivers and streams from California to Alaska, the Aleutians, and portions of Russia, Korea, and Japan (Stout et al. 2012). After hatching, young coho salmon generally remain in freshwater rivers and streams for 18 months before transitioning to marine habitats of the Pacific (Stout et al. 2012). During their approximately 18-month marine phase (Stout et al. 2012), coho salmon migrate slowly along the coast and are more commonly found in coastal and inland waters than further offshore (Quinn and Myers 2005). Some male coho salmon are known to mature and spawn after only 5 to 7 months at sea (Stout et al. 2012). The marine range of North American coho salmon extends from the Oregon-California border northward along the coast to the central Aleutians and further offshore throughout the eastern and central North Pacific (Quinn and Myers 2005).

Populations in the Action Area.
Booster Drop Zones. Coho salmon from the threatened Lower Columbia River ESU have the potential to occur in the Action Area (NMFS 2020) but are more likely to be found in coastal waters than in offshore waters. These fish are also more likely to be found in marine waters near their spawning locations (off British Columbia, Washington, and Oregon) than in Alaskan waters (Quinn and Myers 2005, Johnson et al. 1991). Coho salmon from the Lower Columbia River ESU are considered to be very rare in the booster drop zones with unknown but likely very low densities.

Kwajalein Atoll. This species does not occur in this portion of the Action Area.

3.3.8 Steelhead (*Oncorhynchus mykiss*)

Species Description and Distribution. The current range of steelhead extends from the US-Mexico border north to Alaska and west to Kamchatka (NMFS 2004). The anadromous forms of this species spend up to 7 years in fresh water before moving to the ocean where they spend up to 3 years in salt water prior to returning to spawn (NMFS 2004, Quinn and Myers 2005). This species is able to spawn more than once and some types are known to move between freshwater and saltwater habitats each year (NMFS 2004, Quinn and Myers 2005). Juvenile North American steelhead migrate long distances to offshore ocean waters and are known to range across almost the entire North Pacific south to 40°58' N (Quinn and Myers 2005). In a 1990 study (Pearcy et al. 1990) off the coast of Washington and Oregon, steelhead made up an increasing portion of the at-sea trout catch as distance from shore increased; from 25% in waters out 9.3 km (5.8 km) up to 86% of the catch in waters greater than 46.3 km (28.8 mi) offshore.

Populations in the Action Area.
Booster Drop Zones. Five ESA-listed ESUs of steelhead have the potential to occur in the Action Area (**Table 3-1**) (NMFS 2020): Lower Columbia River ESU, Middle Columbia River ESU, Snake River Basin ESU, Upper Columbia River ESU, and Upper Willamette River ESU. While the exact distributions of fish from these ESUs at-sea are unknown, steelhead are known to occur far offshore (Myers et al. 2005). It is unlikely that these fish would be found in the waters of the stage 1 booster drop zone off Kodiak. It is likely that some immature steelhead would be found in the BOA waters, including the stage 2 and 3 drop zones, and is possible that a small (but unknown) number of these steelhead would be from these ESA-listed ESUs.

Kwajalein Atoll. This species does not occur in this portion of the Action Area.

3.3.9 Sockeye Salmon (*Oncorhynchus nerka*)

Species Description and Distribution. In the North Pacific, sockeye salmon spawn in rivers on the west coast of North America from the Columbia River north to the Noatak River in Alaska, as well as in Japan north to the Anadyr River in Asia (NMFS 2004). Sockeye salmon generally spawn in streams near lakes or in lakes, and juvenile fish use lake habitats for 1 to 3 years before migrating to the ocean (NMFS 2004). Juvenile fish then use marine habitats of the North Pacific for 1 to 4 years before returning to their natal streams to spawn (NMFS 2004). Other populations of sockeye salmon are nonanadromous or resident and remain in lake environments through most of their lives (NMFS 2004). The marine distribution of sockeye salmon is primarily epipelagic waters of the open ocean where they feed on zooplankton and micronekton and these fish are not commonly found in coastal waters until they return to spawn (Quinn and Myers 2005). During their marine phase, North American sockeye populations tend to migrate along the continental shelf northward towards Alaska or westward along the Aleutians and the eastern Bering Sea (Quinn and Myers 2005). As these fish grow larger, they tend to move further offshore; however, timing and movement depends on the physical characteristics of the ocean (water temperature and currents) and on distribution and abundance of their zooplankton prey (Quinn and Myers 2005).

Populations in the Action Area.
Booster Drop Zones. Sockeye salmon from the Snake River ESU have the potential to occur in the Action Area both in coastal habitats and BOA waters. Juvenile sockeye salmon in the GOA are generally found in continental shelf waters with lower abundance levels than those seen in the Bering Sea (Echave et al. 2012). Immature sockeye salmon are found farther from shore along the shelf break and over deeper oceanic waters (Echave et al. 2012). It is possible that a very small but unknown number of Snake River ESU sockeye salmon could occur in the booster drop zones.

Kwajalein Atoll. This species does not occur in this portion of the Action Area.

3.3.10 Chinook Salmon (*Oncorhynchus tshawytscha*)

Species Description and Distribution. On the west coast of North America, chinook salmon historically spawned in fresh water from southern California north to Point Hope, Alaska in the Chukchi Sea (NMFS 2004). These anadromous fish have two life history types, one "stream-type" that remains in freshwater for a year or more before migrating to the ocean and a second "ocean-type" that migrates to the ocean within their first year (NMFS 2004). The ocean-type is known to have coastal-oriented, ocean migrations where they are found predominantly in coastal ocean waters before returning to freshwater habitats to spawn (NMFS 2004). The stream-type populations undertake more extensive offshore ocean migrations at sea between their freshwater life history stages (NMFS 2004). Chinook salmon off much of the Oregon coast and northward tend to migrate north and are found throughout eastern North Pacific waters (Quinn and Myers 2005) including the GOA. The duration of the marine phase for chinook salmon varies depending on their life-history type and other factors, but typically lasts 2-4 years (Quinn and Myers 2005). In general, the at-sea abundance of chinook salmon (regardless of type), is higher in coastal waters than in offshore waters (Echave et al. 2012, Quinn and Myers 2005, Myers et al. 2005).

Populations in the Action Area.
Booster Drop Zones. Six ESA-listed chinook salmon ESU/DPSs have the potential to occur in the Action Area (NMFS 2020). Snake River Spring/Summer ESU and Snake River Fall ESU populations occur in the Snake River Basin which covers portions of Idaho, Oregon, and Washington. The Upper Willamette River ESU occurs in Oregon. The Puget Sound ESU, Upper Columbia River Spring ESU, and Lower Columbia River ESU populations occur primarily in Washington State. In a study of at-sea recoveries of coded-wire tagged salmon, Chinook salmon that originated from Idaho were primarily recovered off the west coast of Canada with a few recoveries in coastal waters of Alaska (Myers et al. 2005). Therefore, Snake River ESUs are considered rare in the Action Area. Chinook salmon that originated from Oregon, Washington, and British Columbia were recovered in coastal waters throughout the Northeast Pacific from Oregon north through Alaska along the Aleutians and into the Bering Sea (Figures 5-7 in Myers et al. 2005). Quinn and Myers (2005) cited data that chinook salmon from Oregon were caught primarily in waters off British Columbia (56%) and Alaska (25%). While fish from these ESUs are likely to occur in coastal waters of the GOA and are considered infrequent in the BOA of the GOA, if individuals from these ESUs are present in the Action Area they would be at very low but unknown densities.

Kwajalein Atoll. This species does not occur in this portion of the Action Area.

3.3.11 Scalloped Hammerhead Shark (*Sphyrna lewini*)

Descriptions of scalloped hammerhead sharks, their distribution, threats, and populations in the tropical and temperate Pacific Ocean and at Kwajalein Atoll are available on pages 70-71 of the FE-2 BA (U.S. Navy 2019). This species does not occur in the booster drop zones.

3.3.12 Pacific Bluefin Tuna (*Thunnus orientalis*)

Descriptions of Pacific bluefin tuna, their distribution, threats, and populations in the tropical and temperate Pacific Ocean and at Kwajalein Atoll are available on pages 71-72 of the FE-2 BA (U.S. Navy 2019). This species is not listed under the ESA and does not occur in the booster drop zones. Pacific bluefin tuna are listed as consultation species under the UES and have the potential to occur in the RMI.

3.4 Corals

No ESA-listed coral species are known to occur in the booster drop zones. Therefore, this section describes the UES-listed consultation coral species with the potential to occur in the Kwajalein Atoll portion of the Action area.

The marine environment surrounding Illeginni Islet supports a community of corals that is typical of reef ecosystems in the tropical insular Pacific. In 2014, NMFS surveyed the reef habitats offshore of the payload impact area at Illeginni Islet (**Figure 3-2**) (NMFS-PIRO 2017a). NMFS estimated that these surveys covered all of the reef habitat area potentially affected by missile impact testing on the lagoon side and 99% of the reef area on the ocean side (NMFS-PIRO 2017a and 2017b). These data are still considered the best available information for coral species presence and density in the Action Area and are described in the FE-2 BA (U.S. Navy 2019). Based on these NMFS surveys (NMFS-PIRO 2017a), seven UES-consultation coral species (*Acropora microclados*, *A. polystoma*, *Cyphastrea agassizi*, *Heliopora coerulea*, *Pavona venosa*, *Pocillopora meandrina*, and *Turbinaria reniformis*) have the potential to be subject to the effects of the Proposed Action as adults. An additional 15 UES-consultation species have the potential to occur in the Action Area as larvae (see **Table 3-3**).

Generally, coral cover and diversity near Illeginni Islet are moderate to high on the lagoon reef slopes and around to the southern and western seaward reef crest and slopes, while abundance and diversity appear lower off the seaward northwestern side of the islet. Offshore of the Illeginni impact area, deeper ocean-side habitats (up to 4 m or 13 ft) include raised limestone plateaus which are highly colonized by corals separated by deep coral and cobble valleys (NMFS-PIRO 2017a). Shallower ocean-side habitats include areas with high coral colonization as well as an area that is primarily pavement and cobble with small patches of coral (NMFS-PIRO 2017a). Habitats on the lagoon side of the impact area have less coral cover, mostly consisting of small scattered coral aggregates with some large patches of *Montipora digitata* (NMFS-PIRO 2017a). Illeginni harbor has a sandy bottom with dense seagrass beds but supports a diversity of coral species on both the wall and bottom habitats including nine consultation coral species.

Figure 3-2. NMFS 2014 Marine Resource Survey Areas at Illeginni Islet, Kwajalein Atoll.

All shallow-water corals of the Marshall Islands are found throughout much of the insular Pacific and the coral triangle (i.e., the area surrounding Indonesia and the Philippines) (Sakashita and Wolf 2009). No known shallow-water coral species are endemic to the Marshall Islands. Within Kwajalein Atoll, all coral species found at Illeginni Islet in NMFS/USFWS biennial inventories are found on at least one other Kwajalein Atoll islet (n = 11 islets) (see Table 4-7 on page 77 in U.S. Navy 2019) and at other locations in the Marshall Islands (Beger et al. 2008, Pinca et al. 2002, USFWS and NMFS 2012).

A summary of general coral characteristics, coral reproduction, threats to corals, corals in the BOA and corals in the vicinity of Illeginni Islet can be found on pages 73-76 in the FE-2 BA (U.S. Navy 2019).

3.4.1 Coral Species Not Affected

The Proposed Action has the potential to impact coral species by direct contact from impact debris or ejecta from crater formation on land or by shock waves from impact. These activities would only have the potential to affect adult coral colonies in habitats near the payload impact area. No human activity, equipment operation, or introduction of hazardous materials is expected in the nearshore marine environment as no man-made debris is expected to reach the water and there is a very low probability of any ejecta from crater formation reaching the water.

Only seven UES-consultation coral species have been recorded as adults in the area of potential effect offshore of Illeginni Islet. The other 15 UES-consultation species with the potential to occur in the Action Area (**Table 3-3**) are only likely to occur in the Action Area as gametes or larvae. Four of these species, *Acropora tenella*, *A. vaughani*, *Leptoseris incrustans*, and *Pavona cactus*, occur on lower reef slopes which occur well below areas that may be affected by the Action, and for this reason, adults would not be adversely affected by the Proposed Action. Two other species are only known to occur in Illeginni harbor, *Pavona decussata* and *Turbinaria mesenterina*, and are not known or expected to be near the impact zone on Illeginni Islet. The other species listed in **Table 3-3** have either not been recorded near Illeginni Islet or have been recorded at other locations near Illeginni Islet but have not been recorded in the area potentially affected by impact debris or shock waves (NMFS-PIRO 2017a). Adults of the species listed in **Table 3-3** are not expected to be exposed to stressors related to the payload impact and would not be affected by the Proposed Action.

Table 3-3. Consultation Coral and Mollusk Species Not Affected by the Proposed Action.

Scientific Name	Common Name	Species Description in FE-2 BA (pages)
Corals		
Acanthastrea brevis		77-78
Acropora aculeus		78-79
A. aspera		79
A. dendrum		79-80
A. listeri		80-81
A. speciosa		82-83
A. tenella		83-84
A. vaughani		84
Alveopora verrilliana		84-85
Leptoseris incrustans		86-87
Montipora caliculata		87-88
Pavona cactus		88
P. decussata		88-89
Turbinaria mesenterina		90-91
T. stellulata		92
Mollusks		
Pinctada margaritifera	Black-lipped pearl oyster	95-96
Tridacna gigas	Giant clam	97-98

At various times of the year the gametes (eggs and sperm) and larvae of reef-associated invertebrates may occur in ocean waters. For corals, this is generally July to December and particularly the week following the August and September full moons. The densities of coral larvae are difficult to predict, but studies of coral larvae during peak spawning report 0.1 to 1 planktonic larvae per cubic meter (m^3) (per 35.31 cubic foot [ft^3]) in waters 5 km (2.7 nm) away from the reef, and 0.3 per m^3 (0.05 per ft^3; brooding species) to 16 per m^3 (0.45 per ft^3; spawning species) in waters directly over the reef during reproduction (Hodgson 1985). Eggs, larvae, and planulae are not homogenously distributed but sometimes travel in semi-coherent aggregations (slicks) or become concentrated along oceanic fronts (Hughes et al. 2000, Jones et al. 2009). Larval densities in the Action Area, especially for UES-consultation species, are likely to be near the lower range except during peak spawning when density may approach the upper range. Since there would only be one flight test with limited activities in the marine environment, the Proposed Action would have no effect on gamete or larvae concentrations of UES-consultation coral species.

3.4.2 *Acropora microclados*

Descriptions of *Acropora microclados*, its distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on page 81 of the FE-2 BA (U.S. Navy 2019). During NMFS surveys of the reef habitats offshore of the payload impact area at Illeginni Islet, this species was observed at very low densities in ocean-side reef areas (**Table 3-4**, NMFS-PIRO 2017a).

3.4.3 *Acropora polystoma*

Descriptions of *Acropora polystoma*, its distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on page 82 of the FE-2 BA (U.S. Navy 2019). During NMFS surveys of the reef habitats offshore of the payload impact area at Illeginni Islet, this species was observed at very low densities in ocean-side reef areas (**Table 3-4**, NMFS-PIRO 2017a).

3.4.4 *Cyphastrea agassizi*

Descriptions of *Cyphastrea agassizi*, its distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on pages 85-86 of the FE-2 BA (U.S. Navy 2019). During NMFS surveys of the reef habitats offshore of the payload impact area at Illeginni Islet, this species was observed at low densities in lagoon-side reef areas (**Table 3-4**, NMFS-PIRO 2017a).

Table 3-4. Presence and Density Estimates for UES Consultation Coral and Mollusk Species in Reef Habitats Offshore of the Illeginni Islet Payload Impact Area.

Species	Ocean Side Survey Area		Lagoon Side Survey Area	
	Mean Colonies or Individuals (per m^2)	99% UCL (per m^2)	Mean Colonies or Individuals (per m^2)	99% UCL (per m^2)
Corals				
Acropora microclados	0.0004	0.0017		
Acropora polystoma	≤0.0004	0.0017		
Cyphastrea agassizi			0.0003	0.0013
Heliopora coerulea			0.16	0.45
Pavona venosa			0.0003	0.0013
Pocillopora meandrina	0.3	0.58		
Turbinaria reniformis			≤0.0003	0.0013
Mollusks				
Hippopus hippopus	0.0003	0.0015	0.002	0.006
Tectus niloticus			0.00006	0.0003
Tridacna squamosa			0.0002	0.0011

Sources: NMFS-PIRO 2017a and 2017b, Kolinski 2018 personal communication.
Abbreviations: m^2 = square meter, UCL = upper confidence limit

3.4.5 *Heliopora coerulea*

Descriptions of *Heliopora coerulea*, its distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on page 86 of the FE-2 BA (U.S. Navy 2019). During NMFS surveys of the reef habitats offshore of the payload impact area at Illeginni Islet, this species was observed in lagoon-side reef areas (**Table 3-4**, NMFS-PIRO 2017a).

3.4.6 *Pavona venosa*

Descriptions of *Pavona venosa*, its distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on pages 89-90 of the FE-2 BA (U.S. Navy 2019). During NMFS surveys of reef habitats offshore of the payload impact area at Illeginni Islet, this species was observed at very low densities in lagoon-side reef areas (**Table 3-4**, NMFS-PIRO 2017a).

3.4.7 Cauliflower Coral (*Pocillopora meandrina*)

Descriptions of *Pocillopora meandrina*, its distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on page 90 of the FE-2 BA (U.S. Navy 2019). During NMFS surveys of the reef habitats offshore of the payload impact area at Illeginni Islet, this species was observed at relatively high densities in ocean-side reef areas (**Table 3-4**, NMFS-PIRO 2017a).

3.4.8 *Turbinaria reniformis*

Descriptions of *Turbinaria reniformis*, its distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on pages 91-92 of the FE-2 BA (U.S. Navy 2019). During NMFS surveys of the reef habitats offshore of the payload impact area at Illeginni Islet, this species was observed at very low densities in lagoon-side reef areas (**Table 3-4**, NMFS-PIRO 2017a).

3.5 Mollusks

No ESA-listed mollusk species are known to occur in the booster drop zones. Therefore, this section describes the UES-listed consultation mollusk species with the potential to occur in the Kwajalein Atoll portion of the Action area.

Five mollusk species that require consultation under the UES have the potential to occur in the Action Area (**Table 3-2**). In 2014, NMFS surveyed the reef habitats offshore of the payload impact area at Illeginni Islet (NMFS-PIRO 2017b) as described in the FE-2 BA (U.S. Navy 2019). These data are still considered the best available information for consultation mollusk species presence and density in the Action Area and are incorporated by reference from the FE-2 BA (U.S. Navy 2019). Based on these NMFS surveys (NMFS-PIRO 2017b), three UES-consultation mollusk species (*Hippopus hippopus*, *Tectus niloticus*, and *Tridacna squamosa*) are likely to occur in the Action Area and have the potential to be subject to the effects of the Proposed Action as adults. Two additional UES-consultation species, *Pinctada margaritifera*

and *Tradacna gigas*, have the potential to occur in the Action Area as adults but are considered very unlikely.

3.5.1 Mollusk Species Not Affected

The Proposed Action has the potential to impact mollusk species by direct contact from impact debris or ejecta from crater formation on land or by shock waves from impact. These activities would only have the potential to affect adult mollusks in habitats near the payload impact area. No human activity, equipment operation, or introduction of hazardous materials is expected in the nearshore marine environment as no man-made debris is expected to reach the water, visible debris on land would be recovered, and there is a very low probability of any ejecta from crater formation reaching the water.

Pinctada margaritifera and *Tradacna gigas* have not been recorded in the area of potential effect offshore of Illeginni Islet and are not likely to occur in the Action Area as adults. Adults of these species are not expected to be exposed to stressors related to the payload impact and would not be affected by the Proposed Action.

The black-lipped pearl oyster (*Pinctada margaritifera*) has been observed on the lagoon-side reef slope during biennial resource surveys at Illeginni Islet (see Table 4-8 on page 94 of U.S. Navy 2019). Since *Pinctada margaritifera* is a reef slope dwelling species, it occurs below the areas that have the potential to be affected by the Proposed Action in the vicinity of Illeginni islet. Therefore, this species would not be affected by direct contact or any other Proposed Action stressors.

The giant clam *Tridacna gigas* has been observed at biennial survey locations at Illeginni Islet and throughout Kwajalein Atoll (see Table 4-8 on page 94 of U.S. Navy 2019). This species was observed at all surveyed Kwajalein Atoll islets since 2010 but had a relatively low distribution at these islets. While *Tridacna gigas* was found at 40% of sites (2 of 5) at Illeginni Islet, including at a lagoon reef crest site and in Illeginni harbor, this species has not been observed in habitats near the payload impact location (NMFS-PIRO 2017a and 2017b). Since adults of this species is not known to occur in the area potentially affected by direct contact, *Tridacna gigas* would not be affected by the Proposed Action.

Larvae of all the mollusk species listed in **Table 3-2** have the potential to occur in the Action Area; however, the Proposed Action would not affect larval concentrations at Kwajalein Atoll and would have no effect on these species. Giant clams (*Hippopus* and *Tridacna* species) are synchronous spawners where release of sperm is triggered by the presence of a spawner with ripe eggs (Munro 1993). Due to the limited time frame of gamete viability (viable up to 8 hours in *T. squamosa* but fertilization success decreased within hours of spawning [Neo et al. 2015]), viable gametes are not likely to be found far from adult clams. Giant clam larvae are considered the dispersal phase where ambient currents and larval swimming speed influence long-distance dispersal (Neo et al. 2015). This long-distance dispersal is limited by the time period during which larvae are able to survive before settlement/recruitment. For most giant clam species, the period from spawning to settlement is approximately 14 days (Ellis 1997, Neo et al. 2015).

Black-lipped pearl oysters are also broadcast spawners, producing 40-50 million eggs per female (Thomas et al. 2014). First stage larvae form within 24 hours of fertilization and the pelagic larval stage lasts for 15 to 30 days before larvae metamorphose and settle to the bottom (Thomas et al. 2014). Top shell snails (*Tectus niloticus*) females release more than 1 million eggs (SPC 2016) and pelagic larvae are free-swimming for at least 3 to 5 days before metamorphosis and subsequent settlement on substrate (SPC 2016). Due to the short time between fertilization and settlement in these mollusk species and their time-limited dispersal capability, the abundance of mollusk larvae (especially viable larvae) is likely extremely low in the Action Area. Since there would only be one flight test with limited activities in the marine environment, the Proposed Action would have no effect on gamete or larvae concentrations of UES-consultation mollusk species.

3.5.2 *Hippopus hippopus*

Descriptions of *Hippopus hippopus*, its distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on pages 94-95 of the FE-2 BA (U.S. Navy 2019). During NMFS surveys of the reef habitats offshore of the payload impact area at Illeginni Islet, this species was observed at low densities in both ocean-side and lagoon-side reef areas (**Table 3-4**, NMFS-PIRO 2017b).

3.5.3 Top Shell Snail (*Tectus niloticus*)

Tectus niloticus, a consultation species, is inclusive of *Trochus maximus*, *Trochus niloticus*, and *Tectus maximus*. Most biological authorities currently synonymize all of these under the name *Tectus niloticus* (the commercial top shell snail), based on genetic information available since 2008 (see Bouchet 2012). Descriptions of *Tectus niloticus*, its distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on pages 96-97 of the FE-2 BA (U.S. Navy 2019). During NMFS surveys of the reef habitats offshore of the payload impact area at Illeginni Islet, this species was observed at low densities in lagoon-side reef areas (**Table 3-4**, NMFS-PIRO 2017a).

3.5.4 *Tridacna squamosa*

Descriptions of *Tridacna squamosa*, its distribution, threats, and populations in reef habitats at Kwajalein Atoll are available on pages 94-95 of the FE-2 BA (U.S. Navy 2019). During NMFS surveys of the reef habitats offshore of the payload impact area at Illeginni Islet, this species was observed at low densities in lagoon-side reef areas (**Table 3-4**, NMFS-PIRO 2017a).

3.6 Critical Habitats

Critical habitat for three marine mammal species occurs in the Action Area. Critical habitat for North Pacific right whales and Steller sea lions occurs on and or near Kodiak Island, Alaska. Critical habitat for Hawaiian monk seals occurs in the Hawaiian Islands. Critical habitat for northern sea otters (*Enhydra lutris kenyoni*) also occur near the stage 1 booster drop zone but this habitat is under the jurisdiction of the USFWS and is addressed in a separate evaluation. No critical habitat has been designated in the RMI.

3.6.1 Critical Habitat Not Affected

The Proposed Action would have no effect on designated critical habitat for North Pacific right whales or Hawaiian monk seals.

Designated critical habitat for North Pacific right whales includes an offshore area near Kodiak Island (**Figure 3-3**) (73 FR 19000 [8 April 2008]). This area was designated as critical habitat primarily because the majority of North Pacific right whale sightings in the GOA had been documented within it and also because it supports high prey densities (71 FR 38277 [6 July 2006]). The primary constituent elements essential for conservation of North Pacific right whales are “species of large copepods and other zooplankton in areas where they concentrate in densities sufficient to support and encourage feeding” (71 FR 38277). This designated critical habitat is approximately 54 km (34 mi) south of PSCA’s Launch Pad 1. The Proposed Action would not alter the presence or density of prey species such as large copepods and other zooplankton; therefore, the Proposed Action would have no effect on designated critical habitat for North Pacific right whales and it is not discussed further in this BA.

The flight path crosses over designated critical habitat for the Hawaiian monk seal. Critical habitat for the Hawaiian monk seal includes terrestrial areas used for pupping, nursing, and haul-out as well as marine habitat within 10 m (33 ft) of the seafloor out to the 200 m (656 ft) depth contour (80 FR 50925 [August 21, 2015]). This critical habitat includes areas around the main Hawaiian Islands and the Northwestern Hawaiian Islands. While the FT 3 vehicle flight path would cross the Northwestern Hawaiian Islands, no part of the Proposed Action would affect Hawaiian monk seal critical habitat and it is not discussed further in this BA.

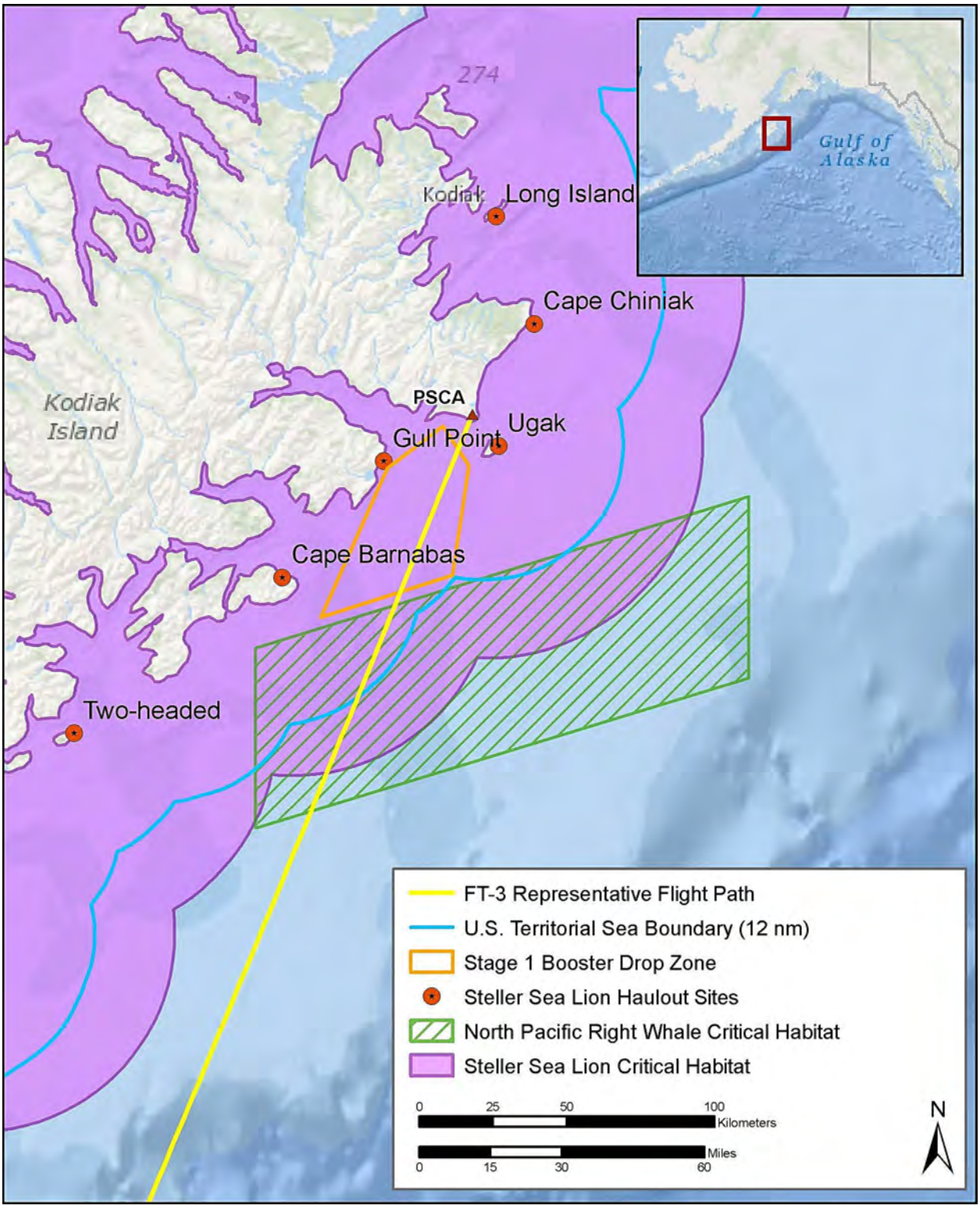


Figure 3-3. Designated Critical Habitat for ESA-listed Species in the Action Area.

3.6.2 Steller Sea Lion Critical Habitat

Steller sea lion critical habitat areas were designated by the NMFS on August 27, 1993 (50 CFR 226.202). Much of the designated Steller sea lion critical habitat is centered on major rookery and haul-out sites as defined in 58 FR 45281. The final rule designating critical habitat states that “the physical and biological habitat features that support reproduction, foraging, rest, and refuge are essential to the conservation of the Steller sea lion”. Steller sea lion Western DPS critical habitat includes a terrestrial zone (0.9 km [0.6 mi] landward from the baseline of major rookeries and haul-outs), an air zone (0.9 km [0.6 mi] above the terrestrial critical habitat), an aquatic zone (37 km [23 mi] seaward from the baseline of major rookeries and haul-outs), and special foraging areas (58 FR 45281). Special foraging areas do not occur in the Action Area. As the Action Area for the Proposed Action is not expected to extend into terrestrial or air zones of sea lion critical habitat, the following description focuses on the aquatic zone.

The essential component of Steller sea lion aquatic critical habitat is adequate food resources (58 FR 45281), especially for lactating adult females, young-of-the-year, and juveniles. Lactating females must remain close to their pups and generally forage within 37 km (23 mi) of their rookery (58 FR 45281). Juvenile sea lions also tend to forage in the shallower waters within 37 km (23 mi) of haul-outs (58 FR 45281). As juveniles are less efficient foragers than adults and do not dive as deep in search of prey (58 FR 45281), it is essential that adequate prey resources are available in their foraging waters.

There are several Steller sea lion haul-outs near the Action Area: at Cape Barnabas, north of Dangerous Cape at Gull Point, Ugak Island, Cape Chiniak, and Two-headed (**Figure 3-3**) (58 FR 45281). Steller sea lion critical habitat includes 37-km (23-mi) buffers around these haul-out sites. The stage 1 booster drop zone occurs within this designated critical habitat (**Figure 3-3**).

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4.0 EFFECTS OF THE PROPOSED ACTION

This section describes how the Proposed Action has the potential to directly or indirectly affect listed species, their habitats, and/or designated critical habitats. Direct effects are the immediate effects of the Proposed Action on species, their habitats, or designated critical habitat. Indirect effects are effects of the Proposed Action which occur at a later point in time. The following describes the elements of the Proposed Action that may act as stressors (listed in **Table 2-3** and **Table 2-4**) on ESA-listed and UES-consultation species and analysis of the effects of those stressors on those species or on critical habitats. As described in **Section 2.3**, many of the stressors for the Proposed Action are of the same type and magnitude as the FE-2 action; therefore, portions of the FE-2 BA (U.S. Navy 2019) are incorporated by reference in this BA as indicated in the text.

4.1 Exposure to Elevated Sound Levels

The Proposed Action has the potential to result in elevated noise levels both in air and underwater. The primary elements of the Proposed Action that would result in elevated noise levels are: (1) sonic booms, (2) vehicle component splashdown noise, (3) impact of the payload, (4) vessel operation, and (5) human activity and equipment operation.

Elevated sound levels could affect the behavior and hearing sensitivity in marine mammals, sea turtles, and fish in the Action Area. 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 as well as on the hearing ability and physiology of the organism. Detailed descriptions of general sound characteristics, the potential responses of consultation organisms to elevated noise levels, effect thresholds in consultation organisms, and analysis methodology can be found on pages 101-111 in the FE-2 BA (U.S. Navy 2019) and in the NMFS BO for FE-2 activities (NMFS 2019). Noise effect thresholds for consultation organisms are summarized in **Table 4-1**.

Elevated noise levels from sonic booms and stage 1 booster splashdown would have no effect on the primary constituent elements of Steller sea lion critical habitat.

Table 4-1. Thresholds for PTS, TTS, and Behavioral Disruption in Functional Hearing Groups from Single (Non-continuous) Exposure to Impulsive In-water Sounds.

Functional Hearing Group	PTS threshold (SPLpeak)	TTS Threshold (SPLpeak)	Behavioral Disruption
Low-frequency Cetaceans (*Balaenoptera* and *Megaptera* whales)	219 dB	213 dB	160 dB
Mid-frequency Cetaceans (*Delphinus*, *Grampus*, *Stenella*, and *Tursiops* dolphins; *Feresa*, *Globicephala*, *Mesoplodon*, *Orcinus*, *Peponocephala*, and *Physeter* whales)	230 dB	224 dB	160 dB
High-frequency Cetaceans (*Kogia* whales)	202 dB	196 dB	160 dB
Otariid Pinnipeds (sea lions)	232 dB	226 dB	160 dB
Sea Turtles	230 dB(1)	224 dB	160 dB SELcum
Fish	229 dB(2)	186 dB SELcum(2)	150 dB

Note: All sound pressures in this table are in dB SPL_{peak} re 1 µPa unless indicated.
Sources: U.S. Navy 2019, NMFS 2019, NOAA 2018, Finneran and Jenkins 2012, Popper et al. 2014
Abbreviations: dB = decibels, PTS = Permanent Threshold Shift, SEL = Sound Exposure Level, SPL = Sound Pressure Level, TTS = Temporary Threshold Shift
(1) The PTS threshold listed for sea turtles is based on the non-lethal injury threshold in Finneran and Jenkins 2012.
(2) The PTS threshold for fish with swim bladders is based on the mortality/mortal injury threshold in NMFS 2015b and Popper et al. 2014. Thresholds in fish are not specific to auditory injury.

Sonic Booms. Exposure to sonic booms would have insignificant to no effects on any of the consultation species in this BA. The payload would fly at speeds sufficient to generate sonic booms from close to launch and extending to impact at Illeginni Islet. Sonic booms create elevated pressure levels both in air and underwater. Proposed Action sonic booms are expected to be the same as those of the FE-2 action (**Table 2-3** and **Table 2-4**) (pages 101-102 in U.S. Navy 2019) except for the location where they would take place in the BOA. At its loudest (145 decibels [dB] in-water), the sonic boom near Kodiak Island and in the BOA would have no effect on ESA-listed species in these areas.

At its loudest (175 dB in-water), the sonic boom at Kwajalein Atoll would not exceed injury or temporary hearing alteration thresholds for consultation organisms. The maximum noise levels for sonic booms may exceed the behavioral disturbance threshold for consultation organisms near the surface. The effects of sonic booms on consultation species at Kwajalein Atoll were analyzed in the FE-2 BA (pages 101-116 of U.S. Navy 2019) and the NMFS BO on FE-2 activities (NMFS 2019) and the conclusions are the same for the Proposed FT-3 Action. Because of the expected sound intensity loss at the air-water interface, the rapid attenuation of the sound in water, and the short duration of the sound, the low intensity sonic boom noise would at most cause temporary disturbance such as changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the individual fitness (NMFS 2019). Animals would be expected to return to normal behaviors within moments of exposure to FT-3 sonic boom noise, and the noise is expected to have insignificant effects on UES-listed cetaceans, sea turtles, and fish in the Action Area.

Splashdown Noise. The effects of exposure to splashdown noise caused by falling vehicle components in nearshore waters of Alaska and in the BOA would be insignificant or discountable for all ESA-listed species considered in this BA. The expected maximum SPLs for component splashdown would be the same as for the FE-2 action (maximum 218 dB in-water) and exposures would be very brief (less than one second). While the location for the elevated noise levels would be different than for the FE-2 action, the effects on ESA-listed species in the BOA are not expected to be different, for the same reasons described in the FE-2 BA (U.S. Navy 2019) and the NMFS BO (NMFS 2019).

Only ESA-listed cetaceans in the low-frequency functional hearing group (*Balaenoptera* and *Megaptera* whales) and ESA-listed fish in the booster drop zones (**Table 3-1**) might be exposed to sound pressures above the temporary threshold shift (TTS) threshold. As detailed in the FE-2 BA, sound pressure above TTS would only extend out 6.3 m (20.7 ft) from splashdown for low-frequency cetaceans and out 39.8 m (130.6 ft) for fish (U.S. Navy 2019). Based on the methodology in the FE-2 BA and the best available density estimates for consultation species in the Action Area (**Table 4-2**), the number of expected exposures to sound pressures greater than the TTS threshold was calculated (**Table 4-2**). Even when summed across all components, the maximum number of exposures to noise levels above the TTS threshold for any ESA-listed marine mammal was estimated to be less than 0.000001 individuals. This corresponds to a 1 in 1 million chance of being exposed to noise loud enough to cause TTS. Since these estimates are based on conservative assumptions, these are likely overestimates of exposure. Density estimates are not available to ESA-listed fish in the Action Area but these species would have similarly low densities and corresponding exposure risk. Based on these analyses the risk of adverse acoustic effects is so low as to be discountable in the booster drop zones.

ESA-listed species in the booster drop zones may be exposed to very brief sounds above the behavioral disturbance threshold. However, as NMFS describes in their BO for FE-2 activities, “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 exposure” (NMFS 2019). Exposure to splashdown noise would have insignificant behavioral disturbance effects.

Payload Impact Noise. Expected SPLs for FT-3 payload impact would be less than 140 dB referenced to (re) 20 micropascals (µPa) at 18 m (59 ft) from impact and would last no more than a couple of seconds. Using a conservative approach that does not account for refraction loss and assuming impact would be at least 18 m (59 ft) from the shoreline, in-water sound pressures from impact are expected to be less than 166 dB (re 1 µPa). Using a cylindrical spreading model for shallow waters sound pressures might be above 160 dB re 1 µPa only 1.8 m (6.1 ft) from shore and above 150 dB re 1 µPa only 8.6 m (28.2 ft) from shore. No UES-consultation cetaceans, sea turtles, or fish are expected to be in this area; therefore, payload impact noise would have no effect on these species.

Table 4-2. Estimated Marine Mammal Density and Number of Exposure to Elevated Sound Pressures and Direct Contact in the FT-3 Booster Drop Zones.

Scientific Name	Common Name	Stage 1 Booster Drop Zone			Stage 2 Booster Drop Zone			Stage 3 Booster Drop Zone		
		Density[1] (per km^2)	Number of Potential TTS Exposures	Number of Direct Contact Exposures	Density[2] (per km^2)	Number of Potential TTS Exposures	Number of Direct Contact Exposures	Density[3] (per km^2)	Number of Potential TTS Exposures	Number of Direct Contact Exposures
Cetaceans										
Balaenoptera borealis	Sei whale	0.0001	9.9E-10	6.0E-08	0.0001	9.9E-10	1.4E-07	0.0001	9.9E-10	3.4E-08
Balaenoptera musculus	Blue whale	0.0001	9.9E-10	1.1E-07	0.0014	1.4E-08	3.3E-06	0.0001	9.9E-10	6.6E-08
Balaenoptera physalus	Fin whale	0.0680	6.8E-07	5.8E-05	0.0040	4.0E-08	7.5E-06	0.0235	2.3E-07	1.2E-05
Eschrichtius robustus[4]	Gray whale	0.0487	4.8E-07	2.5E-05	0.0001	9.9E-10	1.2E-07	-	-	-
Western North Pacific DPS[4]		ND			ND			-	-	-
Eubalaena japonica	North Pacific right whale	0.00001	9.9E-11	5.2E-09	0.00001	9.9E-11	1.2E-08	-	-	-
Megaptera novaeangliae[5]	Humpback whale							0.0001	9.9E-10	3.4E-08
Mexico DPS[5]		0.0098	9.7E-08	5.9E-06	0.0001	1.0E-09	1.5E-07	ND		
Western North Pacific DPS[5]		0.0005	4.6E-09	2.8E-07	0.00001	5.0E-11	7.0E-09	ND		
Physeter macrocephalus	Sperm whale	0.0030	-	1.1E-06	0.0030	-	3.8E-06	0.0014	-	4.2E-07
Pinnipeds										
Eumetopias jubatus	Steller sea lion									
Western DPS		0.0098	-	2.2E-06	0.0098	-	5.6E-06	-	-	-

Abbreviations: DPS = distinct population segment, km^2 = square kilometers, ND = no data, TTS = Temporary Threshold Shift, "-" = does not occur in this area or no exposures.

(1) Density estimates for the stage 1 booster drop zone from inshore/nearshore estimates in Rone et al. 2017 and U.S. Navy 2014.

(2) Density estimates for the stage 2 booster drop zone derived from offshore estimates in the GOA from Rone et al. 2017 and U.S. Navy 2014.

(3) Density estimates for the stage 3 booster drop zone based on estimates and models for the U.S. Navy's Hawaii Range Complex from Hanser et al. 2017. Where possible average densities were calculated for the portion of the model area overlapping the stage 3 booster drop zone area.

(4) Density estimates for gray whales include whales from all DPSs in the GOA and are not specific to ESA-listed populations. Gray whales in the GOA are likely from unlisted Eastern Populations. It is possible that a small (but unknown) number of these whales are from the Western DPS.

(5) Density estimates for humpback whales included whales from all DPSs. Humpback whales feeding in the GOA may be from the Hawai`i DPS (89%), the Mexico DPS (10.5%), and the Western North Pacific DPS (0.5%) (Wade et al. 2016) and it was assumed the same DPSs may be represented in the stage 1 and 2 booster drop zones.

As for the FE-2 test flight (U.S. Navy 2019), acute and temporary acoustic exposures such as those associated with FT-3 payload impact would cause temporary consequences, if any, for some of the more specialized marine invertebrates. While temporary disruption of feeding or predator avoidance behaviors (Mooney et al. 2010) in invertebrates such as mollusks are possible, any exposed UES-listed corals or mollusks in nearshore reefs are expected to be unaffected by payload impact noise (NMFS 2019). As concluded by NMFS for the FE-2 action (NMFS 2019), noise associated with the FT-3 test would have no effects on UES-listed corals and mollusks.

Vessel Noise. Noise from vessel operation would likely range from 150 to 190 dB re 1 µPa depending on the vessel type (NMFS 2019). Vessels would be moving and sounds would be continuous. While some marine mammals, sea turtles, or fish might be exposed to sounds loud enough to cause behavioral disturbance, the low intensity noise would at most cause temporary disturbance such as changes in swimming direction or speed, feeding, or socializing, that would have no measurable effect on the individual fitness (NMFS 2019). Animals would be expected to return to normal behaviors after the vessel passed and the noise is expected to have insignificant effects on UES-listed cetaceans, sea turtles, and fish in the Action Area. Vessels noise is expected to have no effect on UES-listed corals or mollusks.

Human Activity and Equipment Operation. Pre-test and post-test human activity and equipment operation is planned only in terrestrial areas. Because of the substantial loss of noise intensity at the air-water interface, little, if any, increase in noise would occur in the marine environment. UES-listed animals would not be exposed to human activity and equipment operation noise and would not be affected.

4.2 Exposure to Direct Contact or Shock Waves

The Proposed Action would result in vehicle components, including spent rocket motors and payload fairings, splashing down into the booster drop zones near Kodiak Island and in the BOA, as well as impact of the payload on land at Illeginni Islet. These falling components would directly impact aquatic and/or terrestrial habitats and have the potential to directly contact consultation organisms. Payload impact on land may also result in ejecta and shock waves radiating out from the point of impact.

Splashdown of Vehicle Components. It is discountable that any ESA-listed species would be exposed to falling vehicle components in the booster drop zones of the BOA or nearshore waters off Kodiak Island. The components of the three vehicle booster assemblies as well as the payload shroud (aka nose fairing) would splash down in the ocean. The three booster stages would fall into the respectively numbered booster drop zones while the shroud is expected to splash down in the stage 2 booster drop zone. Approximate component dimensions are listed in **Table 2-1** and **Table 2-3**. The consequences of direct contact for marine mammals, sea turtles, and fish are described in the FE-2 BA along with the methodology for calculating

exposure (pages 118-121 of U.S. Navy 2019) which is also used in analyses for the Proposed FT-3 Action.

Based on the methodology in the FE-2 BA and the best available density estimates for consultation species in the Action Area (**Table 4-2**), the number of expected exposures to direct contact from falling vehicle components was calculated (**Table 4-2**). Even when summed across all components, the maximum number of exposures to direct contact from vehicle components for any ESA-listed marine mammal was estimated to be 0.00008 individuals. This corresponds to a 1 in 12,900 chance of being exposed to direct contact for the highest density species (i.e., fin whales) in the Action Area. These estimates are based on conservative analysis assumptions including that all animals would be at or near the surface 100 percent of the time and that the animals are stationary; therefore, these are likely overestimates of exposure. Density estimates are not available to ESA-listed fish or sea turtles in the booster drop zones, but these species would have similarly low densities and corresponding exposure risk. Based on these analyses the risk of adverse direct contact effects is so low as to be discountable in the booster drop zones.

Splashdown of the stage 1 booster would not destroy or modify the primary constituent elements of Steller sea lion critical habitat. Specifically the limited amount of material splashing down in the stage 1 booster drop zone would not alter the presence or density of sea lion prey species; therefore, the Action would have no effect on designated critical habitat for Steller sea lions.

Impact of Payload on Illeginni Islet. Only terrestrial and nearshore marine areas are at risk from direct contact and shock waves due to payload impact. No UES-listed cetaceans or deep-water fish species would be in the area of potent direct contact. Therefore, there would be no effect of direct contact on cetaceans or deeper-water fish species. No UES-consultation 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.

The seven consultation coral species and three consultation mollusk species identified in **Table 3-4** as well as the humphead wrasse and sea turtles, have the potential to be impacted by falling debris or the concussive forces of the shock wave resulting from payload impact. The baseline conditions for these species in the area of potential effect is the same as described in the FE-2 BA (U.S. Navy 2019). However, additional information regarding debris dispersion upon payload impact was available for the FT-3 program; therefore, the risk to these species is reanalyzed in this BA. Overall, these UES-consultation coral, mollusk, fish, and sea turtle species are not likely to be adversely affected by direct contact or shock waves.

Direct Contact at Illeginni Islet. Corals, mollusks, humphead wrasses, and sea turtles have the potential to be adversely affected if struck by a piece of debris ejected during crater formation. Larger pieces of debris (estimated maximum 2.3 kg or 5 lb) could crack or break parts of coral colonies or injure individual mollusks or fish. Empirical observations after reentry vehicle or payload impact on Illeginni Islet for previous tests found that most of the debris was contained

within or near the crater rim (USAF 2015) and the density of falling material ejected during crater formation decreases with distance from the impact point (U.S. Navy 2017). Based on modeling, the U.S. Army estimates that over 99 percent of all debris generated from FT-3 payload impact would fall on land. The less than 1 percent of debris that might reach water's edge would be relatively small fragments of natural debris (i.e., coral rubble from crater formation), generally less than 2.3 kg (5 lb) (Elder personal communication). Assuming the maximum crater size estimates, if less than 1 percent of ejected debris might reach the water, then less than 1.95 m^3 (1,950,000 cubic centimeters [cm^3]) of natural debris might reach the water. A 2.3 kg (5 lb) piece of coral rubble would correspond to an approximate 15.5-centimeter (cm, 6.1-inch) diameter sphere or a cube with 12.5 cm (4.9 inch) sides (based on 393 cm^3 volume per pound estimates for crushed coral gravel available online). U.S. Army modeling indicated debris would be less than 2.3 kg (5 lb) but that smaller (sand-like) particles would not reach the water. If it is assumed debris is 10 cm (3.9 inch) high pieces, the debris might cover a marine area up to 19.5 square meters (m^2, 23.3 square yards [yd^2]). This is the total area that the natural debris might cover, but the debris would be in pieces and dispersed across a larger area (potentially out 91 m or 300 ft from impact). Based on U.S. Army modeling, substrate ejecta may be somewhat clustered (Elder personal communication) but would still be scattered.

Only a portion of the area of potential direct contact effect offshore of the Illeginni Islet impact area is suitable habitat for UES-consultation species. Based on the 2014 NMFS surveys and the best professional judgment of NMFS survey divers, approximately 80 percent of the lagoon-side survey area (**Figure 3-2**) and 75 percent of the ocean-side survey area are considered potentially viable habitat for consultation coral, mollusk, and reef-associated fish species (NMFS 2019). Using these estimates of suitable habitat and assuming the ejecta would be equally distributed on the lagoon and ocean sides of the islet (i.e., half of debris on each side); approximately 7.8 m^2 (9.3 yd^2) of lagoon-side suitable habitat and 7.3 m^2 (8.7 yd^2) of ocean-side suitable habitat may be impacted by debris. 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).

Based on the estimated area of suitable habitat that ejecta might cover in the marine environment, the number of potential coral and mollusk exposures to direct contact was calculated based on the density of coral colonies and mollusks reported by NMFS in 2017 (NMFS-PIRO 2017a, 2017b) (**Table 4-3**). Colonies of only two, relatively high density UES-consultation coral species are likely to have exposures to direct contact: *Pocillopora meandrina* and *Heliopora coerulea* (**Table 4-3**). Based on the mean density for these species, up to two *Pocillopora meandrina* colonies and one *Heliopora coerulea* colony might be exposed.

Table 4-3. Estimated Numbers of Consultation Coral Colonies and Individual Mollusks Potentially Exposed to Debris Generated by FT-3 Payload Impact.

Species	Ocean Side				Lagoon Side			
	Mean Colonies or Individuals (per m^2)	99% UCL (per m^2)	Potentially Affected Habitat (m^2)	Number of Colonies or Individuals (mean to UCL)	Mean Colonies or Individuals (per m^2)	99% UCL (per m^2)	Potentially Affected Habitat (m^2)	Number of Colonies or Individuals (mean to UCL)
Corals								
Acropora microclados	0.0004	0.0017	7.3	<0.01 to 0.01				
Acropora polystoma	≤0.0004	0.0017	7.3	<0.01 to 0.01				
Cyphastrea agassizi					0.0003	0.0013	7.8	<0.01 to 0.01
Heliopora coerulea					0.16	0.45	7.8	1.25 to 3.51
Pavona venosa					0.0003	0.0013	7.8	<0.01 to 0.01
Pocillopora meandrina	0.3	0.58	7.3	2.19 to 4.24				
Turbinaria reniformis					≤0.0003	0.0013	7.8	<0.01 to 0.01
Coral Subtotal				2 to 4				1 to 4
Mollusks								
Hippopus hippopus	0.0003	0.0015	7.3	<0.01 to 0.01	0.002	0.006	7.8	0.02 to 0.05
Tectus niloticus					0.00006	0.0003	7.8	<0.01
Tridacna squamosa					0.0002	0.0011	7.8	<0.01 to 0.01
Mollusk Subtotal				0				0

Note: The species in this table include those found during a 2014 assessment of the reef areas offshore of the Illeginni Islet Impact Zone (NMFS-PIRO 2017a and 2017b). Coral colony and individual mollusk mean densities and 99% UCL provided by NMFS-PIRO (2017a and 2017b).
Abbreviations: m^2 = square meter, UCL = upper confidence limit

As described by NMFS in their 2019 Biological Opinion for the FE-2 action, the response of corals to exposure to ejecta and ground borne shock waves would depend on the scale and intensity of the exposure as well as on the morphology of the coral (NMFS 2019). Plate forming corals such as *Acropora microclados* are more easily broken than large massive or encrusting forms such as *Pavona venosa* (NMFS 2019). *Pocillopora meandrina* forms fairly compact bushy colonies with flattened branches radiating out (CBD 2018), while *Heliopora coerulea* colony growth forms are highly variable depending on habitat (Sakashita and Wolf 2009). Not all corals exposed to debris would be damaged but the most likely realized effects would be cracks in the colony or broken branches or plates. Based on the size and dispersion of the debris, complete pulverization of a colony is not likely.

Partial fracturing of a coral colony skeleton and contact from debris would injure the soft, living tissues of those portions of the colony. Coral 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). The break could expose the coral to threats from algae or sponge growth infection by diseases that may prevent regrowth (NMFS 2019). As detailed by NMFS

(2019), since these corals are colonial organisms with hundreds to thousands of genetically-identical interconnected polys, affecting some polyps of a colony does not necessarily constitute harm to the individual (defined as a colony) as the colony can continue to exist even if the colony is damaged.

U.S. Army modeling also estimates that smaller, sand-like particles would not reach the water. Since a shoreline or shallow water payload impact is not planned or expected, corals and mollusks are not likely to be buried by or have their soft tissues scoured by large amounts of small payload ejecta.

Direct contact may affect but is not likely to adversely affect the coral and mollusk species considered to be at risk in this BA (those in **Table 4-3**). Of the species in **Table 4-3**, the chances of direct contact exposure are considered discountable for all species except *Pocillopora meandrina* and *Heliopora coerulea*. For *Pocillopora meandrina* and *Heliopora coerulea* direct contact exposure is expected to have insignificant effects for the following reasons:

- Ejected debris would be most likely near the water's edge where habitat suitability for consultation corals is lowest (NMFS 2019). Therefore, calculations based on suitable habitat for the whole survey area are likely overestimates of potential effect for these species.
- The NMFS has indicated that the distribution and density reports likely overestimated the number of coral and mollusk species that may be within the area of potential effect at Illeginni Islet (NMFS 2019). Therefore, calculations based on these density data are likely overestimates of potential effect.
- Exposure to ejecta from payload impact at this range would probably be limited to cracks and or loss of branches (as opposed to pulverizing the entire colony). Any cracking or loss of branches would likely injure or destroy soft tissue; however, it would not necessarily result in mortality of the colony. Given the low number of potentially exposed colonies, the chances of debris causing mortality in a colony are considered insignificant.

Humphead wrasses have the potential to be injured if exposed to direct contact from debris; however, several factors make this highly unlikely. No humphead wrasse were observed in the 2014 surveys of the areas offshore of the Illeginni Islet impact area. This is a highly mobile species recorded in nearby habitats and up to 8 adult and 100 juvenile humphead wrasses were projected to in the area of potential effect for previous missile testing at Illeginni (NMFS-PIRO 2017a). However, humphead wrasses and are generally not found at the surface (NMFS 2019) where they would be most vulnerable to effects from direct contact. These fish are most commonly found in waters a few meters to at least 60 m (197 ft) deep (NMFS 2019) and any debris would rapidly loose velocity upon entering the water. In addition, NMFS stated that the humphead wrasses observed near Illeginni Islet have been observed beyond the reef crest around 91 m (300 ft) from the shoreline (NMFS 2019). It is highly unlikely that any humphead wrasse would be contacted by ejecta. While considered unlikely, any effects from debris entering the water would be limited to temporary behavioral responses. Fish would be expected

to return to normal behaviors within moments of exposure. Debris is expected to have insignificant effects on UES-listed fish in the Action Area.

Sea turtles are very unlikely to be in marine areas where ejecta might land. Green and hawksbill turtles may occur infrequently around Illeginni Islet, but they would occur in low numbers and are typically found in waters near the reef edge, which is over 150 m (500 ft) from the shore (NMFS 2019). Even if turtles were in waters closer to the shore where they might be exposed to ejecta sinking to the bottom, the ejecta would be fairly slow moving after entering the water and any effects would be limited to temporary behavioral disturbance. Sea turtle behavior would return to normal within moments of exposure with no measurable fitness effects (NMFS 2019). As with debris in terrestrial areas, ejecta in the marine environment would have insignificant effects on sea turtles. The potential effects of the Proposed Action on nesting and hauled out sea turtles on Illeginni Islet are evaluated in a separate document evaluating the effects on species under USFWS jurisdiction.

Shock Waves at Illeginni Islet. Shock waves have the potential to crack or fragment corals depending on the intensity of the shock wave and the morphology of the coral. For previous tests, shock waves resulting from payload impact that were strong enough to damage corals were estimated to extend as far as 37.5 m (123 ft) from the point of impact if on the shoreline (U.S. Navy 2019). No shoreline impact is planned or expected for the FT-3 test; therefore, shock waves intense enough to damage corals would not propagate that far into the marine environment and would be less intense in the marine environment. While the exact distance of the payload impact from the shoreline is unspecified due to operational security concerns, the U.S. Army concludes that shock waves strong enough to damage corals would not occur in habitat suitable for UES consultation corals and mollusks for a nominal payload impact. Therefore, shock waves would have no effect on UES-listed coral species.

Exposure to intense ground borne shock waves could injure the soft tissues of 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 would not be strong enough to injure these species. Therefore, shock waved would have no effect on UES-consultation mollusks.

Humphead wrasses have the potential to be injured by the concussive shock waves; however, several factors make this highly unlikely for the Proposed Action. 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, NMFS stated that the humphead wrasses observed near Illeginni Islet have been observed beyond the reef crest around 91 m (300 ft) from the shoreline (NMFS 2019). As with elevated noise levels discussed in **Section 4.1**, 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 FT-3 shock wave pressures and the shock waves are expected to have insignificant effects on UES-listed fish in the Action Area.

4.3 Exposure to Hazardous Materials

For all species considered in this BA, exposure to hazardous materials as a result of the Proposed Action would have insignificant effects.

Booster Drop Zones. Any substances of which the launch vehicle is constructed or that are contained on the launch vehicle and are not consumed during flight or spent motor jettison (**Table 2-2**) would fall into the booster drop zones when the stage booster assemblies and nose fairing are released. As described in the FE-2 BA (pages 132-133 of U.S. Navy 2019), hazardous materials would be rapidly diluted in seawater and ESA-listed species would not be exposed to chemicals in sufficient concentrations to adversely affect individuals.

Vehicle components are expected to sink to the ocean floor where consultation organisms are not likely to be in contact with these materials. One possible exception is the gray whale, which is known to feed by filtering benthos such as amphipods by scooping up substrate from the sea floor (Moore et al. 2007, Ferguson et al. 2015). Gray whales primarily feed by filtering substrate in waters 20 to 40 m (66 to 131 ft) deep where prey are most abundant but may feed in waters up to 100 m (328 ft) deep (Johnson et al. 1983). Water depths in the stage 1 booster drop zone range from approximately 30 to 170 m (100 to 550 ft). Most gray whales observed feeding in 1999-2005 surveys east of Kodiak Island (Moore et al. 2007) were in waters near the entrance to Ugak Bay; therefore, it is possible that a small number of gray whales may feed in the booster drop zone. If gray whales fed in areas where debris were deposited, it is possible that they could ingest intercept debris and be harmed. As discussed in **Section 3.1.5**, the GOA is considered to be within the range of the Eastern population of gray whales (not listed under the ESA), and it is assumed that the majority of gray whales in the Action Area belong to this population. It is possible that a very small (but unknown) number of gray whales in the GOA may be from the endangered Western DPS of gray whales. Because ESA-listed populations are likely extremely low in the Action Area, it is considered discountable that a Western DPS gray whale would ingest and be adversely affected by debris resulting from the Proposed Action.

Introduction of hazardous materials as a result of stage 1 booster splashdown would not destroy or modify the primary constituent elements of Steller sea lion critical habitat. Specifically, the limited amount of material entering the stage 1 booster drop zone would not alter the presence or density of sea lion prey species; therefore, the Action would have no effect on designated critical habitat for Steller sea lions.

Kwajalein Atoll. 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 (**Section 2.4**). Sources or hazardous material and potential effects would be the same as those

described on pages 134-136 of the FE-2 BA (U.S. Navy 2019) with the exception that the FT-3 payload would contain only a fraction of the total tungsten (approximately 10 percent).

As with FE-2, it is possible that a very small amount of tungsten may remain in soils at Illeginni Islet despite cleanup efforts. A description of the potential effects of deposition of tungsten at Illeginni Islet is on pages 133-135 of the FE-2 BA (U.S. Navy 2019) including the results of soil and groundwater monitoring after previous tests. Additional soil and groundwater testing was conducted after the FE-2 test. Tungsten was detected in most of the groundwater samples collected from Illeginni Islet wells in 2019 and tungsten samples in several of the samples exceed the U.S. Environmental Protection Agency residential tap water screening levels (RGNext 2019). Tungsten was also detected in the soil at Illeginni Islet in 2019 but at levels below the limits of quantification for the study (RGNext 2019). Soil testing conducted before the FE-2 test indicated that soil tungsten concentrations were below the U.S. Environmental Protection Agencies screening levels for soils in residential and industrial areas (U.S. Navy 2019). It is not clear at this time, if tungsten may migrate into marine environments or how much; however, it is likely that any tungsten introduced into the marine environment would be quickly dispersed and diluted by ocean currents and wave action.

Considering the small quantities of hazardous materials contained in the payload, the planned land impact, the planned cleanup of man-made materials, and the dilution and mixing capabilities of the ocean and lagoon waters, it is considered discountable that materials released during test activities would be present in sufficient quantities or concentrations to adversely affect any consultation cetacean, fish, sea turtle, or invertebrate in the Action Area.

4.4 Human Activity and Equipment Operation

Most of the human activities and equipment operation related to the Proposed Action would take place in terrestrial environments at Illeginni Islet. The only UES-consultation organisms with the potential to be affected by human activity and equipment operation on Illeginni Islet are hauled out or nesting sea turtles. The potential effects of the Proposed Action on nesting and hauled out sea turtles on Illeginni Islet is evaluated in a separate document evaluating the effects on species under USFWS jurisdiction.

Human activity and equipment operation in marine areas of Kwajalein Atoll 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. Nearshore reef-associated species including corals and mollusks would not be affected by human activity and equipment operation. For other motile cetacean, sea turtle, and fish species, response to FT-3 human activity and equipment operation would likely be limited to short-term behavioral reactions such as avoidance behavior. This type of response is not expected to have any measurable effect on fitness of individuals and animals would be expected to return to normal behaviors within minutes of cessation of activity. Human activity and equipment operation are

expected to have insignificant effects on UES-listed cetaceans, sea turtles, and fish in the Action Area.

4.5 Vessel Strike

Consultation organisms have the potential to be affected by vessel strike primarily by being at the surface when a vessel travels through Kwajalein Atoll waters. Vessel traffic as a result of the Proposed Action is expected to be the same as that described in the FE-2 BA (pages 130-132 in U.S. Navy 2019). Organisms at the surface, such as cetaceans and sea turtles that must surface to breath air, are at risk of being struck by vessels or their propellers. Several measures would be in place to reduce the chances of a cetacean or sea turtle being struck by a vessel (**Section 2.4**), including the requirement that vessel operators watch for and avoid marine protected species where possible based on ocean conditions. Based on the expected low density of cetaceans and sea turtles in the Action Area and implementation of avoidance measures, the risk of vessel strike for these species is considered discountable.

It is also discountable that vessels would strike UES-consultation fish in the Action Area. The fish species listed in **Table 3-2** are agile animals capable of avoiding oncoming vessels and are only infrequently found near the ocean surface since they do not need to surface to breathe (NMFS 2019). The Proposed Action would involve no anchoring (vessels would use Illeginni Harbor); therefore, vessels and anchors would not contact the substrate and would have no effect on UES-consultation invertebrates.

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5.0 CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the Action Area. These types of actions that are reasonably certain to occur in the Action Area have not changed since preparation of the FE-2 BA (U.S. Navy 2019). Future federal actions that are unrelated to the Proposed Action are not considered in the cumulative effects section of BAs as they require their own separate consultation pursuant to Section 7 of the ESA. Therefore, this analysis of cumulative effects considers the effects of the FT-3 test program and the activities and considerations in Section 6.0 of the FE-2 BA (Table 6-1 on page 141 of U.S. Navy 2019).The foreseeable future action and environmental considerations are the same as those listed and described in the FE-2 BA (pages 141-145 in U.S. Navy 2019) and are incorporated by reference.

The U.S. Army has concluded that Proposed Action activities would have discountable or insignificant effects for all ESA-listed and UES-consultation species in the Action Area. Additional information on the potential for cumulative effects on listed resources, including cumulative effects related to climate change, can be found on pages 145-151 of the FE-2 BA (U.S. Navy 2019). The U.S. Army has identified no portions of the Proposed Action which would have interactive or cumulative effects on protected species beyond those analyzed for the Proposed Action in this BA.

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6.0 CONCLUSIONS

Based on analyses of all of the potential stressors in the Action Area, the U.S. Army has determined that the Proposed Action would have no effect on the 15 coral species and two mollusk species listed in **Table 3-3**, olive ridley turtles, or the North Pacific DPS of green turtles. 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.

The U.S. Army has determined that the Proposed Action "may affect but is not likely to adversely affect" 19 cetacean species, four sea turtle species, 12 fish species, seven coral species, and three mollusk species listed under the ESA or listed as consultation species under the UES (**Table 6-1**). Based on the analysis in **Section 4.0** and summarized in **Table 6-1**, the effects of the Proposed Action on these species would be insignificant or discountable.

The U.S. Army has determined that the Proposed Action would have no effect on North Pacific right whale or Hawaiian monk seal critical habitat and is not likely to adversely affect Steller sea lion critical habitat.

Table 6-1. UES Consultation Species Not Likely to be Adversely Affected by the Proposed Action.

Scientific Name	Common Name	ESA Listing Status	UES Listing Status	Booster Drop Zones			Kwajalein Atoll				
				Elevated Sound	Direct Contact	Hazard. Materials	Elevated Sound	Direct Contact	Hazard. Materials	Human Activity	Vessel Strike
Cetaceans											
Balaenoptera borealis	Sei whale	E		◎	◎	◎	–	–	–	–	–
Balaenoptera musculus	Blue whale	E	UES	◎	◎	◎	◎	○	◎	◎	◎
B. physalus	Fin whale	E	UES	◎	◎	◎	◎	○	◎	◎	◎
Delphinus delphis	Short-beaked common dolphin		UES	–	–	–	◎	○	◎	◎	◎
Eschrichtius robustus	Gray whale (Western North Pacific DPS)	E		◎	◎	◎	–	–	–	–	–
Eubalaena japonica	North Pacific right whale	E		◎	◎	◎	–	–	–	–	–
Feresa attenuata	Pygmy killer whale		UES	–	–	–	◎	○	◎	◎	◎
Globicephala macrorhynchus	Short-finned pilot whale		UES	–	–	–	◎	○	◎	◎	◎
Grampus griseus	Risso's dolphin		UES	–	–	–	◎	○	◎	◎	◎
Kogia breviceps	Pygmy sperm whale		UES	–	–	–	◎	○	◎	◎	◎
Megaptera novaeangliae	Humpback whale Western North Pacific DPS	E	UES	◎	◎	◎	◎	○	◎	◎	◎
	Mexico DPS	T		◎	◎	◎	–	–	–	–	–
Mesoplodon densirostris	Blainville's beaked whale		UES	–	–	–	◎	○	◎	◎	◎
Orcinus orca	Killer whale		UES	–	–	–	◎	○	◎	◎	◎
Peponocephala electra	Melon-headed whale		UES	–	–	–	◎	○	◎	◎	◎
Physeter macrocephalus	Sperm whale	E	UES	–	–	–	◎	○	◎	◎	◎
Stenella attenuata	Pantropical spotted dolphin		UES	–	–	–	◎	○	◎	◎	◎
S. coeruleoalba	Striped dolphin		UES	–	–	–	◎	○	◎	◎	◎

Scientific Name	Common Name	ESA Listing Status	UES Listing Status	Booster Drop Zones			Kwajalein Atoll				
				Elevated Sound	Direct Contact	Hazard. Materials	Elevated Sound	Direct Contact	Hazard. Materials	Human Activity	Vessel Strike
S. longirostris	Spinner dolphin		UES	–	–	–	◎	○	◎	◎	◎
Tursiops truncatus	Bottlenose dolphin		UES	–	–	–	◎	○	◎	◎	◎
Pinnipeds											
Eumetopias jubatus	Steller sea lion (Western DPS)	E		◎	◎	◎	–	–	–	–	–
Sea Turtles											
Caretta caretta	Loggerhead turtle (North Pacific Ocean DPS)	E		◎	◎	◎	–	–	–	–	–
Chelonia mydas	Green turtle (Central West Pacific DPS)	E	UES	–	–	–	◎	◎	◎	◎	◎
Dermochelys coriacea	Leatherback turtle	E		◎	◎	◎	–	–	–	–	–
Eretmochelys imbricata	Hawksbill turtle	E	UES	○	○	○	◎	◎	◎	◎	◎
Fish (non-larval)											
Alopias superciliosus	Bigeye thresher shark		UES	–	–	–	◎	○	◎	◎	◎
Carcharhinus longimanus	Oceanic whitetip shark	T	UES	–	–	–	◎	○	◎	◎	◎
Cheilinus undulatus	Humphead wrasse		UES	–	–	–	◎	◎	◎	◎	◎
Manta alfredi	Reef manta ray		UES	–	–	–	◎	◎	◎	◎	◎
M. birostris	Oceanic giant manta ray	T	UES	◎	◎	◎	◎	◎	◎	◎	◎
Oncorhynchus keta	Chum Salmon (Hood Canal Summer run ESU)	T		◎	◎	◎	–	–	–	–	–
Oncorhynchus kisutch	Coho Salmon (Lower Columbia River ESU)	T		◎	◎	◎	–	–	–	–	–
Oncorhynchus mykiss	Steelhead Lower Columbia River ESU Middle Columbia River ESU Snake River Basin ESU Upper Columbia River ESU Upper Willamette River ESU	T		◎	◎	◎	–	–	–	–	–

Scientific Name	Common Name	ESA Listing Status	UES Listing Status	Booster Drop Zones			Kwajalein Atoll				
				Elevated Sound	Direct Contact	Hazard. Materials	Elevated Sound	Direct Contact	Hazard. Materials	Human Activity	Vessel Strike
Oncorhynchus nerka	Sockeye Salmon (Snake River ESU)	E		◎	◎	◎	–	–	–	–	–
Oncorhynchus tshawytscha	Chinook Salmon Lower Columbia River ESU Puget Sound ESU Snake River Fall ESU Upper Willamette River ESU	T		◎	◎	◎	–	–	–	–	–
	Upper Columbia River Spring ESU	E		◎	◎	◎	–	–	–	–	–
Sphyrna lewini	Scalloped hammerhead (Indo-West Pacific DPS)	T	UES	–	–	–	◎	◎	◎	◎	◎
Thunnus orientalis	Pacific bluefin tuna		UES	–	–	–	◎	○	◎	◎	◎
Corals											
Acropora microclados			UES	–	–	–	○	◎	◎	○	○
A. polystoma			UES	–	–	–	○	◎	◎	○	○
Cyphastrea agassizi	Agassiz's coral		UES	–	–	–	○	◎	◎	○	○
Heliopora coerulea	Blue coral		UES	–	–	–	○	◎	◎	○	○
Pavona cactus			UES	–	–	–	○	◎	◎	○	○
Pocillopora meandrina		C	UES	–	–	–	○	◎	◎	○	○
Turbinaria reniformis			UES	–	–	–	○	◎	◎	○	○
Mollusks											
Hippopus hippopus	Giant clam		UES	–	–	–	○	◎	◎	○	○
Tectus niloticus	Top shell snail		UES	–	–	–	○	◎	◎	○	○
Tridacna squamosa	Giant clam		UES	–	–	–	○	◎	◎	○	○

● = may affect and likely to adversely affect, ◎ = may affect but not likely to adversely affect, ○ = no effect, "-" = does not occur in or is not listed in this portion of the Action Area, C = candidate for listing under the ESA, E = ESA endangered, T = ESA Threatened, UES = listed as a consultation under Section 3-4 of the UES

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