



# 2020 GLOBAL DEFENDER

A GUIDE TO USASMDC

U.S. Army Space and  
Missile Defense Command





# SMDC BY THE NUMBERS



## Commander's Message

Lt. Gen. Daniel L. Karbler

I'm humbled and honored to lead the U.S. Army Space and Missile Defense Command and the Joint Functional Component Command for Integrated Missile Defense. At no other time in my 32-plus years in the Army have I seen these two commands so relevant to the complex challenges we face today and tomorrow.

Our commands are uniquely organized to conduct joint, global operations for space and missile defense and comprise multi-compo Soldiers, Airmen, Sailors and dedicated Civilians geographically postured to support diverse missions.

USASMDC connects Soldiers and the joint force to space capabilities around the world through the 1<sup>st</sup> Space Brigade. It provides reliable, assessable and secure satellite communication to joint force commanders at home and abroad through the U.S. Army Satellite Operations Brigade. Our Soldiers in the 100<sup>th</sup> Missile Defense Brigade stand watch around-the-clock and protect our homeland from intercontinental ballistic missile threats. The joint team within JFCC IMD provides information and expertise critical to supporting and accomplishing global missile defense. The highly skilled Soldiers and Civilians within the Space and Missile Defense Center of Excellence and the Technical Center develop trained and ready space and missile defense experts equipped with the technology and capabilities to win on the battlefield.

The Chief of Staff of the Army, Gen. James McConville, emphasizes the principle that winning matters. By providing space, missile defense and high altitude capabilities, not only to our Army but to the joint force and our allies and partners around the world, USASMDC and JFCC IMD are a key part of making sure the nation wins.

The U.S. faces adaptive competitors, and to win, our Army must move fast, innovate and be willing to accept prudent risk to ensure our adversaries won't consider today as the day to test us. What we do at USASMDC and JFCC IMD is critical to warfighter readiness and ensures our joint forces can shoot, move and communicate on the complex battlefields of not only today, but also tomorrow. We secure the joint force's dominance in an increasingly multi-domain environment.

Through the *Global Defender* we'll highlight the commands' capabilities and showcase the work of the heart of our teams: our agile, innovative and empowered Service members and Civilians. It's our people who make us strong; it's our people who make winning possible.

*Secure the High Ground! Vigilant for the World!*

One team of professionals providing space, missile defense, and high altitude forces and capabilities to support joint warfighting readiness in all domains.



A global command with personnel assigned to **11** time zones at **23** worldwide locations

**\$1.2** billion budget executed in fiscal year **2019**, **40** percent supporting customers

**800** operational forces forward-deployed worldwide

**5,000,000** force tracking reports distributed daily by Force Tracking Mission Management Center

**4** Joint Tactical Ground Stations delivering early ballistic missile warning

**5** Wideband Satellite Communications Operations Centers

**5** Forward-Based Mode AN-TPY2 Radar Missile Defense Batteries

**4** Regional Satellite Communications Support Centers

**15,888** Army personnel trained annually

**169** space and missile defense courses

**2,800** dedicated USASMDC employees worldwide

**3** active duty Army Astronauts

The mission of USASMDC is complex: develop and provide current and future global space, missile defense and high altitude capabilities to the Army, joint force, our allies and partners to enable multi-domain combat effects; enhance deterrence, assurance and detection of strategic attacks; and protect the nation.



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THE 2020  
GLOBAL DEFENDER:  
A GUIDE TO USASMDC

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**On front cover:** 49<sup>th</sup> Missile Defense Battalion Military Police Soldier patrols during an exercise at Fort Greely, Alaska; Wideband Satellite Communications Operations Center Soldiers in Landstuhl, Germany; Army Space Support Team 16 Soldiers train at Fort Carson, Colorado; Technical Center Concepts Analysis Laboratory general engineer works with a Pulsed Network Analyzer.

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# USASMDC



**CSM Finis A. Dodson,  
Command Sergeant  
Major:**

“The empowered noncommissioned officers and enlisted Soldiers of SMDC are the backbone of this organization. They are highly trained, disciplined and fit – a cohesive team ready to fight and win.”



**James B. Johnson  
Jr., Deputy to the  
Commander:**

“Our people are our greatest asset. The civilians of this uniquely organized command provide continuity and have a significant role in ensuring America’s warfighters maintain a strategic and tactical edge.”



*A ground-based interceptor is emplaced at the Missile Defense Complex at Fort Greely, Alaska. The MDC is operated by the Soldiers of the 49<sup>th</sup> Missile Defense Battalion. (U.S. Army photo)*

The U.S. Army Space and Missile Defense Command is the Army’s force modernization proponent and operational integrator for global space, missile defense and high altitude capabilities.

USASMDC provides trained and ready space and missile defense forces and capabilities to the warfighter and nation. It builds future space and missile defense forces for tomorrow by researching, testing and integrating space, missile defense, cyber, directed energy, hypersonic and related technologies for the future.

The common link uniting USASMDC’s 2,800 Soldiers and civilians across 11 time zones and 23 dispersed locations is a commitment to defending the nation and its allies.

Along with the command’s Technical Center and Space and Missile Defense Center of Excellence, there are three major subordinate military elements, the 100<sup>th</sup> Missile Defense Brigade (Ground-based Midcourse Defense), the 1<sup>st</sup> Space Brigade and the U.S. Army Satellite Operations Brigade.

The missile defense brigade operates the Ground-based Midcourse Defense System and functions as the missile defense component of the missile defense enterprise of the command. The GMD mission is conducted in support of U.S. Northern Command and manned by Army National Guard and active-component Soldiers in Colorado and Army National Guard Soldiers in Alaska and California.

Operating under the brigade are Soldiers of the 49<sup>th</sup> Missile Defense Battalion. These Soldiers not only operate the GMD system but provide security for the Missile Defense Complex at Fort Greely, Alaska.

Leading the command in space operations is the 1<sup>st</sup> Space Brigade. The brigade consists of the 1<sup>st</sup> Space Battalion and 2<sup>nd</sup> Space Battalion, as well as the 117<sup>th</sup> Space Battalion under a direct support relationship.

The 1<sup>st</sup> Space Brigade conducts continuous space force enhancement and space control operations in support of combatant

commanders, enabling and shaping decisive operations. In 2019 the brigade grew with the addition of the five Missile Defense Batteries, formerly assigned to the 100<sup>th</sup> Missile Defense Brigade, forward-stationed across U.S. Indo-Pacific Command, U.S. European Command and U.S. Central Command. The batteries operate the forward-based mode AN/TPY-2 radars, conducting ballistic missile tracking operations in support of theater and homeland defense, as well as conducting space surveillance and data collection.

Providing satellite communications for the command is the U.S. Army Satellite Operations Brigade. Established May 1, 2019, the brigade executes continuous tactical, operational and strategic satellite communications payload management across the full spectrum of operations in support of combatant commands, services, U.S. government agencies and international partners. The brigade consists of the 53<sup>rd</sup> Signal Battalion, formerly assigned to the 1<sup>st</sup> Space Brigade, and the SATCOM Directorate, formerly a part of the USASMDC G-6 staff.

The Technical Center manages science and technology, research and development, and conducts test programs for space, integrated air and missile defense, directed energy, hypersonic and related technologies. It develops and transitions space and missile defense technology to the warfighter to address current and future capability gaps in persistent communication; intelligence, surveillance and reconnaissance; force protection; and strike. It provides critical technologies that meet today’s requirements and addresses future needs enabling warfighter effectiveness in the core competencies of directed energy, space, high altitude systems, cyberspace and missile defense.

The Space and Missile Defense Center of Excellence is the command’s architect for future force design. The team is charged to design, build, modernize, train and educate Army space and missile defense forces and is the Army’s force modernization proponent responsible for managing Army change to doctrine, organization, training, materiel, leadership and education, personnel, facilities and policy.

It develops and integrates innovative doctrine, concepts, and capabilities; trains and educates agile, adaptive, and ready Soldiers and leaders; executes life-cycle management for FA40 Army space operations officers; develops the Army space cadre; and enables informed decision making through studies, analysis, modeling and simulation within the capabilities of Army and joint space, missile defense and high altitude.

USASMDC is also the proponent for the Army astronaut program and provides support to NASA with an Army astronaut detachment assigned to Johnson Space Center in Houston, Texas. Army astronauts help the Army define its requirements for the space program and enhance the Army’s use of space capabilities.

The USASMDC commanding general also has several other responsibilities: he serves as the senior commander of both Fort Greely, Alaska, and U.S. Army Garrison – Kwajalein Atoll, Republic of the Marshall Islands, where he is responsible for the care of service members, families and civilians, and to enable unit readiness; he is the Army’s Air and Missile Defense Enterprise Integrator; and he serves as the commander of U.S. Strategic Command’s Joint Functional Component Command for Integrated Missile Defense.



**COL David Stewart,  
Deputy Commander  
for Operations:**

“Our highly talented and capable space and missile defense forces meet the nation’s call every day. Their skills are a critical component to Army and joint readiness and provide a strategic advantage for Army senior leaders and combatant commanders.”



**CW5 Wesley Klees,  
Command Chief  
Warrant Officer:**

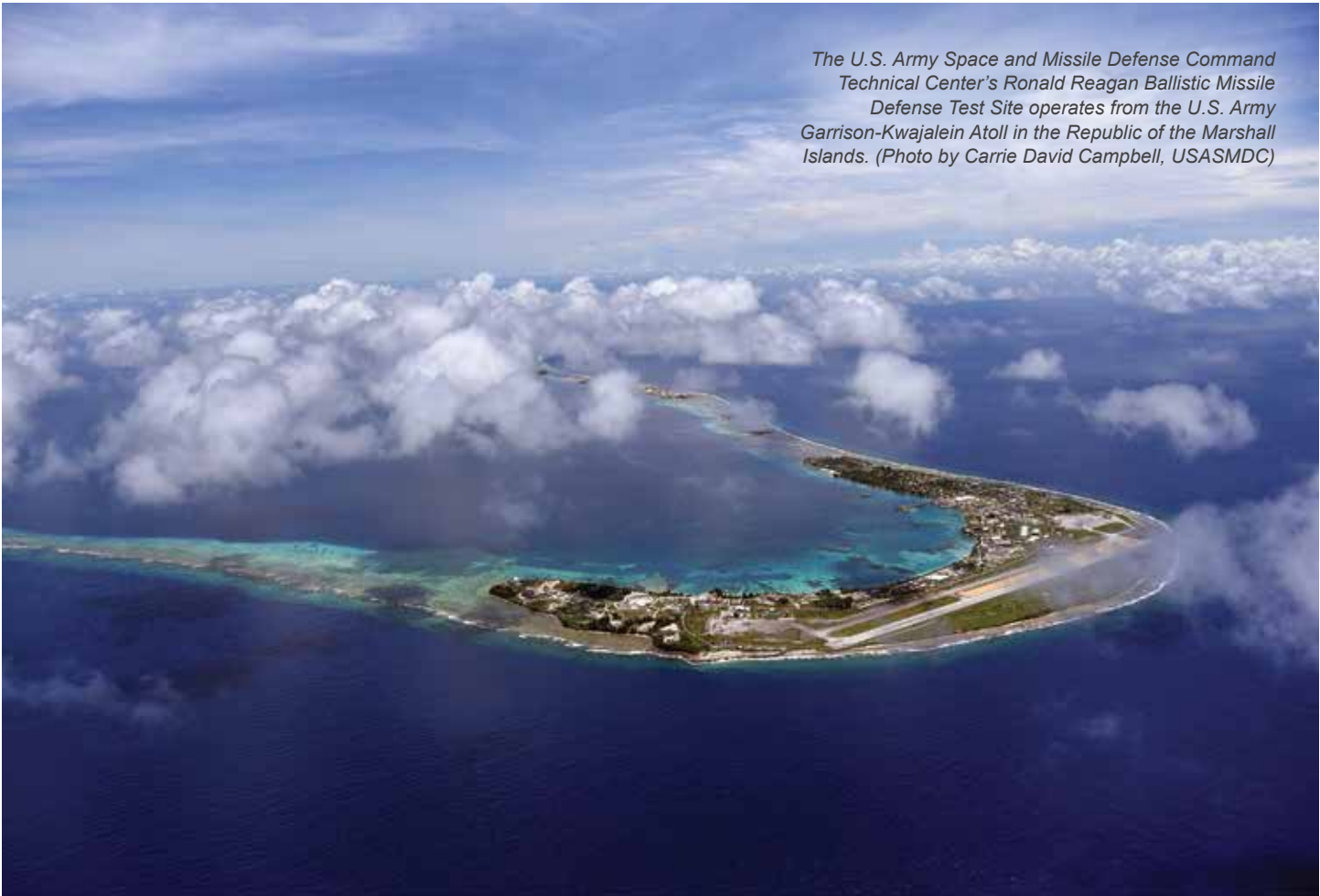
“Our warrant officers serve at SMDC locations around the world enabling critical space and missile defense capabilities through their experienced leadership and unique technical expertise.”







# USASMDC mission, capabilities critical to warfighter readiness



*The U.S. Army Space and Missile Defense Command Technical Center's Ronald Reagan Ballistic Missile Defense Test Site operates from the U.S. Army Garrison-Kwajalein Atoll in the Republic of the Marshall Islands. (Photo by Carrie David Campbell, USASMDC)*

The past year has brought significant changes to the U.S. Army Space and Missile Defense Command including standing up a satellite operations brigade and renaming the Future Warfare Center, but through it all, the command remained focused on providing space, missile defense and high altitude capabilities so combatant commanders can fight and win today.

“At no other time in my 32-plus years have I seen this command so relevant to the complex challenges that America faces,” said Lt. Gen. Daniel L. Karbler, USASMDC commanding general, during his Change of Command on Dec. 6, 2019. “What we do is critical to warfighting readiness and ensures our Soldiers can shoot, move and communicate on the complex battlefields of not only today, but also tomorrow.”

With the stand up of U.S. Space Command in August, USASMDC now supports both U.S. Strategic Command and U.S. Space Command providing space and missile defense capabilities on behalf of the Army. USASMDC’s support to these combatant commands assures the integration and synchronization of the Army’s space and missile defense operations.

During 2019 USASMDC took an internal look at the command to determine how it could be better organized to address the Army’s role in space and combined the 53<sup>rd</sup> Signal Battalion and personnel from the G-6 planning staff who manage satellite communication efforts to build and activate the U.S. Army Satellite Operations Brigade.

The brigade brings a full-time operational focus to the Army’s military satellite communications mission and brings SATCOM organizations under a single command entity, led by an Army colonel. It aligns functions within the command under an operational commander, improving effectiveness, efficiency and oversight while reducing redundancy and bureaucracy.

Transforming to better support the warfighter, USASMDC’s Future Warfare Center transitioned to the Space and Missile Defense Center of Excellence, mirroring other Army centers of excellence. This name change better encompasses the activities and functions the SMDCoE performs for the Army. The SMDCoE is where concepts begin for space, high altitude and global missile defense and where those concepts are integrated into the fight. The SMDCoE is the Army’s force modernization proponent for space and missile defense, responsible for developing doctrine, organization, training, materiel, leadership/ education, personnel and facility solutions.

Shifting from research and development to operations, USASMDC’s 1<sup>st</sup> Space Brigade Soldiers worked 24/7/365 providing essential satellite communications and theater missile warning in support of critical worldwide defense missions. In 2019 the brigade grew with the addition of the five Missile Defense Batteries, formerly assigned to the 100<sup>th</sup> Missile Defense Brigade. The batteries operate the forward-based mode AN/TPY-2 radars conducting ballistic missile tracking operations in support of theater and homeland defense, as well as conducting space surveillance and data collection.

In addition, the 100<sup>th</sup> Missile Defense Brigade, which operates the nation’s Ground-based Midcourse Defense System, participated in a historic test highlighting their critical, no-fail mission to protect the homeland against a

ballistic missile launch. On March 25, 2019, two ground-based interceptors launched from Vandenberg Air Force Base, California, in an anti-ballistic missile test called Flight Test Ground-based Midcourse Defense System-11, or FTG-11. The test concluded within minutes as the two GBIs successfully hit their marks, obliterating them high above Earth. FTG-11 was the first-ever salvo test of the GMDS, and at its core were National Guard Soldiers representing Alaska, California and Colorado.

Army astronauts supported by USASMDC’s astronaut detachment at Johnson Space Center in Houston, Texas, had a banner year. The detachment currently has three astronauts, Col. (Dr.) Andrew “Drew” Morgan, Lt. Col. Anne McClain and Lt. Col. Frank Rubio. In June 2019 McClain returned from a six-month rotation on the International Space Station as a flight engineer for Expedition 58/59. Morgan successfully launched from the cosmodrome in July 2019 for a nine-month mission as a flight engineer for Expedition 60/61/62. Rubio graduated from the astronaut program in January 2020.

As the demand for space and missile defense capabilities increases, the command’s agile and adaptive service members and civilians will continue to perform the critical strategic missions that support Soldiers and the joint force every day.



*Staff Sgt. Angel L. Perez Asencio, weapons operator, 49<sup>th</sup> Missile Defense Battalion, serves on A Crew at the Missile Defense Complex at Fort Greely, Alaska, Nov. 21, 2019. (Photo by Army National Guard Staff Sgt. Zachary Sheely)*



# 100<sup>th</sup> Missile Defense Brigade



**COL Christopher M. Williams**  
Commander



**CSM Jeffery F. Coker**  
Command Sergeant Major

## PURPOSE

The 100<sup>th</sup> Missile Defense Brigade operates the Ground-based Midcourse Defense System and functions as a component of the missile defense enterprise of the U.S. Army Space and Missile Defense Command. It is a role they have fulfilled for more than 16 years. The GMD mission is the ultimate defense of the homeland, conducted in support of U.S. Northern Command, and manned by U.S. Army National Guard and active-component Soldiers in Colorado, Alaska and California. The 100<sup>th</sup> Missile Defense Brigade is tasked with conducting a presidentially directed national security mission to defend the United States against the threat of intercontinental ballistic missile attack.

The brigade is headquartered in Colorado Springs, Colorado. The team includes brigade staff, Headquarters and Headquarters Battery and five Missile Defense Element crews serving at Schriever Air Force Base, Colorado. The 49<sup>th</sup> Missile Defense Battalion, the brigade's major subordinate element, is located at Fort Greely, Alaska.

Missile Defense Element crews from the 100<sup>th</sup> Missile Defense Brigade man and control the GMDS 24/7/365. They are responsible for the strategic-level execution of the GMD mission to protect the homeland. These five-Soldier crews provide both operational and tactical recommendations to the commander of USNORTHCOM while synchronizing operations and conducting fire distribution.

## IMPACT

### Missile Defense Element

Soldiers of the 100<sup>th</sup> Missile Defense Brigade are part of a unique multi-

component organization. The brigade headquarters consists mainly of full-time active guard and reserve Colorado Army National Guardsmen. The unit also includes a small contingent of active-component Army Soldiers. Although a National Guard organization, all of its Soldiers are full-time active duty, Title 10 or Title 32.

To perform their national security mission, all 100<sup>th</sup> Missile Defense Brigade Army National Guard Soldiers, to include the 49<sup>th</sup> Missile Defense Battalion, operate in a dual status. This allows them to automatically transition between Title 10 federal active-duty and Title 32 National Guard status. The brigade and battalion commanders are uniquely authorized by the president to simultaneously command Soldiers in both statuses.

A small contingent of California Army National Guard Soldiers operate at Vandenberg Air Force Base, California, performing liaison and asset management of the ground-based interceptors located there. There is also a detachment of Soldiers and Department of the Army civilians located at Fort Drum, New York. This detachment is responsible for the security of the In-Flight Interceptor Communications System Data Terminal.

While GMD Army National Guard Soldiers are able to move between operational crew positions and staff, or between GMD units in the three states, the 100<sup>th</sup> Missile Defense Brigade does not rotate its forces like active-component Army units. This is because there are no other GMD units in the Army. The brigade and battalion have no sister units because they are truly one of a kind. As such, life-cycle management decisions are determined within the brigade and their respective National Guard states.



100<sup>th</sup> Missile Defense Brigade (Ground-based Midcourse Defense) Soldiers practice medevac procedures at Butts Army Airfield, Fort Carson, Colorado, June 12, 2019, as part of a situational training exercise. The Soldiers conducted squad-level movement, maneuver and assault operations using simulated rounds, aided by the 2-135<sup>th</sup> General Support Aviation Battalion of the Colorado Army National Guard, who provided one UH-60 Black Hawk helicopter for airlift and medevac training and operations. (Photo by Army National Guard Staff Sgt. Zachary Sheely)

## Training

To be gunnery-table certified to operate the GMD Fire Control System, a Soldier is required to complete the seven-week GMD Fire Control Qualification Course at Schriever Air Force Base. The Soldier will then undergo position and crew training directly with their newly assigned crew and will then be gunnery-table certified with the crew by the USASMDC Operational Readiness Evaluation team. This entire process of certification may take anywhere from three to six months to complete, depending on the Soldier's previous qualifications and school availability dates.

USASMDC oversees the rigorous GMD training and gunnery-table certification program. The minimum passing academic score for any GMD written examination or hands-on, practical certification is 90 percent due to the critical no-fail nature of the GMD mission.

## System

The GMDS utilizes leap-ahead concepts and technologies through a spiral development acquisition process. The tip of

the spear for the GMDS is its ground-based interceptor with an Exoatmospheric Kill Vehicle. Once the ground-based interceptor is outside the atmosphere, the boost vehicle releases the EKV on an intercept trajectory toward a hostile missile's warhead.

From release, the EKV seeks out the target using multicolor sensors, a cutting-edge onboard computer and a series of rocket boosters used for independent course correction in space. The EKV hones in on its target with pinpoint accuracy and destroys it by direct collision using only kinetic energy.

The GMD enterprise is a system of systems, involving shooters, sensors, and command, control and communication systems. GMD sensors consist of space-based infrared satellites, upgraded early warning radars COBRA Dane, transportable X-band radars (AN/TPY-2), Aegis weapon system radar on select U.S. Navy warships, and the massive Sea-based X-band radar. These sensors provide information to the GMD Fire Control system to calculate precise intercept points for the ground-based interceptors and EKVs.



# 49<sup>th</sup> Missile Defense Battalion



Sgt. Kyle Martin, a military police Soldier with the 49<sup>th</sup> Missile Defense Battalion, scans his sector as part of his duties of posting security and safeguarding the Missile Defense Complex at Fort Greely, Alaska, November 21, 2019. The ground-based interceptor military police security company of the 49<sup>th</sup> Missile Defense Battalion is in charge of patrolling, securing and protecting the Missile Defense Complex. (U.S. Army photo by Sgt. Lilybeth Garcia-Torres)

## PURPOSE

Soldiers of the 49<sup>th</sup> Missile Defense Battalion operate and secure the Ground-based Midcourse Defense System at Fort Greely, Alaska, and are an integral piece of the homeland defense mission to protect the U.S. from intercontinental ballistic missiles using ground-based interceptors. The 49<sup>th</sup> Missile Defense Battalion shares the same presidentially directed national security mission to defend the United States against the threat of an ICBM attack as its higher headquarters, the 100<sup>th</sup> Missile Defense Brigade.

## IMPACT

The primary functions of the 49<sup>th</sup> Missile Defense Battalion are the services of the Fire Direction Center and a military police company.

Fire Direction Center crews operate the GMDS 24/7/365 in conjunction with 100<sup>th</sup> Missile Defense Brigade personnel at Schriever Air Force Base, Colorado. They are responsible for the tactical-level execution of the GMD mission to protect the homeland – that is to say they “fight the current fight.” These five-Soldier crews provide tactical recommendations to the commander of U.S. Northern Command while synchronizing and coordinating activities on the Missile Defense Complex, or MDC.

The 49<sup>th</sup> Missile Defense Battalion’s military police ground-based interceptor security company is a one-of-a-kind

MP company and is the only MP company in the U.S. Army Space and Missile Defense Command. The Soldiers of Alpha Company conduct 24/7/365 site security operations at the MDC. The MDC is a national defense critical site and is the location where 40 of the nation’s ground-based interceptors are emplaced.

These MPs perform their duties in some of the most austere conditions in the United States, with winter temperatures plummeting to 50 degrees below zero (60 below with wind chill), and with fewer than four hours of sunlight in the winter months. In this harsh environment, the MP Soldiers also support the U.S. Army Cold Region Test Center by testing the latest cold weather gear and other equipment.

Epitomizing diversity in support of the mission, Alpha Company’s Soldiers hail from all over the nation, including Puerto Rico, New York and South Carolina. This company is where the entire nation comes together to support the defense of the homeland.

The 49<sup>th</sup> Missile Defense Battalion is manned exclusively by active Guard and reserve Alaska Army National Guardsmen. All 49<sup>th</sup> Missile Defense Battalion Army National Guard Soldiers operate in a dual status, Title 10 and Title 32. The battalion consists of the battalion staff, Headquarters and Headquarters Battery, five Fire Direction Center crews and Alpha Company.



# GMD Soldiers at forefront of historic missile defense test



The ‘lead’ ground-based interceptor launches from Vandenberg Air Force Base, California, March 25, 2019, in the first-ever salvo engagement test of a threat-representative intercontinental ballistic missile target. The two ground-based interceptors successfully intercepted a target launched from the Ronald Reagan Ballistic Missile Defense Test Site on Kwajalein Atoll. (Photo by Lisa Simunaci, Missile Defense Agency)

Two ground-based interceptors were launched from Vandenberg Air Force Base, California, March 25, in an anti-ballistic missile test that made history.

The two multistage, solid fuel boosters were each tipped with a state-of-the-art Exoatmospheric Kill Vehicle. They propelled from ground-based silos and punctured the earth’s atmosphere at thousands of feet per second, bound for a violent collision in space with a sophisticated intercontinental ballistic missile-like target launched from the Ronald Reagan Ballistic Missile Defense Test Site, more than 5,000 miles away.

The test, known as Flight Test Ground-based Midcourse Defense-11, or simply FTG-11, concluded within minutes as the two GBIs successfully hit their marks, obliterating them high above earth. FTG-11 was the first-ever salvo test of the Ground-based Midcourse Defense System and at its core were National Guard Soldiers representing Alaska, California and Colorado.

“This was the most significant flight test in the history of missile defense,” said Lt. Col. Michael Strawbridge, 100<sup>th</sup> Missile Defense Brigade director of operations. “To compare it to something else in human history, I would liken it to space travel or putting a man on the moon. It was that complex.”

The test took less than an hour, but it was the culmination of years of work, planning, training and development.

“We were high-fiving each other after we knew the intercept was a success,” said Maj. Terri Homestead-Lopez, a Fire Direction Center crew director. “It was exciting to see the system work and see our training pay off.”

Homestead-Lopez’s crew at the 49<sup>th</sup> Missile Defense Battalion at Fort Greely, Alaska, performed the tactical level of the engagement, while the 100<sup>th</sup> Missile Defense Brigade crew at the Missile Defense Element at Schriever Air Force Base in Colorado Springs provided operational overwatch.

“We go through so much training it becomes second nature,” said Homestead-Lopez. “When you actually see it in real life, it gives you another level of security and confidence.”

While GMDS is the joint effort of many agencies, it is the Soldiers of the 100<sup>th</sup> Missile Defense Brigade and its subordinate command, the 49<sup>th</sup> Missile Defense Battalion, who operate the fire control system; dictate the tactics, techniques and procedures; fight the battle; and ultimately defend the homeland from ICBM attack.



# 1<sup>st</sup> Space Brigade



**COL Eric D. Little**  
Commander



**CSM Robert Bell**  
Command Sergeant  
Major

## PURPOSE

The 1<sup>st</sup> Space Brigade conducts space operations to deliver decisive combat power in support of the Army and joint warfighting communities. Headquartered in Colorado Springs, Colorado, the brigade supports joint forces and their critical dependence on space capabilities and products through the unique mission sets of its subordinate battalions and associated unit battalion.

## IMPACT

The 1<sup>st</sup> Space Brigade supports warfighters around the world through the activities of two subordinate battalions and one associated unit relationship. The subordinate battalions include the 1<sup>st</sup> Space Battalion, which stood up in 1999, and the 2<sup>nd</sup> Space Battalion, which stood up in 2017. The brigade itself was activated in 2005 to fill a capability need that became particularly important as the Global Positioning System, Army Space Support Teams and long-haul satellite communications became essential battlefield components.

The 1<sup>st</sup> Space Battalion consists of a Headquarters and Headquarters Company; 1<sup>st</sup> Space Company with four Joint Tactical Ground Stations in Europe, Korea, Japan and Qatar; 2<sup>nd</sup> Space Company with six Army Space Support Teams; and 4<sup>th</sup> Space Company with six space control detachments.

The 2<sup>nd</sup> Space Battalion consists of a Headquarters and Headquarters Company; 3<sup>rd</sup> and 5<sup>th</sup> Space Companies with five ARSSTs each; and 8<sup>th</sup> Space Company with three space control detachments. Both space battalions integrate and synchronize

space technical operations and support. They also react to assigned contingency activities in support of Army, joint and combined forces, and civil authorities.

In fiscal year 2019 the 1<sup>st</sup> Space Brigade grew with the addition of the five Missile Defense Batteries forward-stationed across U.S. Indo-Pacific Command, U.S. European Command and U.S. Central Command. The batteries operate the forward-based mode AN/TPY-2 radars conducting ballistic missile tracking operations in support of theater and homeland defense. Additionally, the FBM radar can conduct space surveillance and data collection.

The brigade has an associated unit relationship with the Colorado Army National Guard's 117<sup>th</sup> Space Battalion, which stood up in September 2001. The 117<sup>th</sup> Space Battalion currently has 12 ARSSTs in the 217<sup>th</sup> and 1158<sup>th</sup> Space Companies.

Currently, 25 percent of the brigade's forces are globally dispersed at stations in 17 locations in 11 countries and six time zones. This includes locations throughout U.S. Northern Command, EUCOM, INDOPACOM and CENTCOM areas of responsibility. Significantly, 60 percent of the brigade's strength execute 24/7/365 missions with the JTAGs, MDBs and current deployments.

The 1<sup>st</sup> Space Brigade is in constant support of combat operations worldwide. The capabilities the 1<sup>st</sup> Space Brigade Soldiers leverage in space translate to mission success across all domains and warfighting functions.



*The 1<sup>st</sup> Space Brigade provides a number of space capabilities to the Army, joint force and its partners such as the Joint Tactical Ground Station, shown here. (Photo by Carrie David Campbell, USASMDC)*



*Spc. Fabion Juarez performs preventive maintenance checks and services at the Misawa Air Base, Japan, Joint Tactical Ground Station. Juarez belongs to Detachment D, 1<sup>st</sup> Space Company, 1<sup>st</sup> Space Battalion, 1<sup>st</sup> Space Brigade. (U.S. Army photo by 1<sup>st</sup> Sgt. Robert Segin)*



# 1<sup>st</sup> Space Battalion

*Spc. Chelsey Cooper and Sgt. David Camp, Army Space Support Team 26, 4<sup>th</sup> Space Company, 1<sup>st</sup> Space Battalion, conduct a Table VIII exercise at Fort Carson, Colorado, Dec. 18, 2019, as part of their yearly certification process. (U.S. Army photo by Sgt. Dennis DePrisco)*



### PURPOSE

The 1<sup>st</sup> Space Battalion generates space combat power and provides the Army’s contribution – as the nation’s strategic land power – to the joint fight in, from and through space. Its purpose is to provide teams of Soldiers who know how to fight, know how to plan, and are experts in space operations. The 1<sup>st</sup> Space Battalion serves as a headquarters for command and control of Army space forces and is located at Fort Carson, Colorado.

### IMPACT

The 1<sup>st</sup> Space Battalion postures to meet operational requirements with trained and ready space forces capable of meeting the demands of modern warfare and leading multi-domain warfighting efforts across all levels of war. The battalion consists of four companies, each with a specific contribution to space operations, operating 24/7/365 conducting space operations across 10 locations globally.

The Headquarters Company executes deployments in support of training and operational requirements. It ensures the readiness of forward-stationed units and remains prepared to support multiple, global contingencies.

1<sup>st</sup> Space Company provides four Joint Tactical Ground Stations – one each in Italy, Qatar, Korea and Japan. Each

detachment can “see” and report missile launches and battlespace characterization events within a hemisphere of the Earth and disseminate the warning to joint force commanders and other users around the globe.

2<sup>nd</sup> Space Company supports the warfighter with six Army Space Support Teams. ARSSTs are the Army’s only element designed to provide the warfighter direct space support to operations and to special technical operations. They are experts in all space mission areas and provide a surge capability to integrate space into the planning and operations of joint task forces and corps.

4<sup>th</sup> Space Company has six deployable Electronic Detachments. These detachments deploy globally to monitor friendly satellite communications and report on sources of interference. When directed, E-Dets support emergency communications operations. E-Dets directly contribute to the joint force’s ability to maneuver to positions of advantage across the electromagnetic spectrum.

In addition to the routine operations of multiple combatant commands, the battalion’s Soldiers are currently supporting Operation Inherent Resolve, Operation Freedom’s Sentinel and Operation Spartan Shield.

# 2<sup>nd</sup> Space Battalion

### PURPOSE

The 2<sup>nd</sup> Space Battalion is a U.S. Army Reserve unit based on Fort Carson, Colorado. As part of the 1<sup>st</sup> Space Brigade, the battalion’s mission is to plan, integrate, synchronize and execute space situational awareness, space and technical operations support, and assigned contingency activities in support of the Army, joint and combined forces, and civil authorities.

### IMPACT

The 2<sup>nd</sup> Space Battalion comprises a Headquarters and Headquarters Company, 3<sup>rd</sup> Space Company, 5<sup>th</sup> Space Company and 8<sup>th</sup> Space Company.

The 3<sup>rd</sup> and 5<sup>th</sup> Space Companies each consist of five Army Space Support Teams. ARSST teams provide situational

awareness of space capabilities, space assets, space products and the impact of space on operations.

8<sup>th</sup> Space Company has three deployable Space Situational Awareness Detachments that provide monitoring and resolution of electromagnetic interference. Using Mobile Integrated Ground Suite, or MIGS, capabilities, these detachments ensure space situational awareness while maintaining space and information superiority. These detachments have the ability to conduct emergency communications operations when directed.

As the Army Reserves only space battalion, the citizen-Soldiers of 3<sup>rd</sup> and 5<sup>th</sup> Space Companies are an integral part of the Army’s warfighting capability and are part of the Ready Force X.



*Capt. Jessica Loggins and 1<sup>st</sup> Lt. Brayton Kline, Army Space Support Team 16, 5<sup>th</sup> Space Company, 2<sup>nd</sup> Space Battalion, learn to operate a SIPR and NIPR access point, or SNAP, as part of monthly readiness training at Fort Carson, Colorado. (U.S. Army photo by 1<sup>st</sup> Sgt. Robert Segin)*



# 117<sup>th</sup> Space Battalion

### PURPOSE

The Colorado Army National Guard's 117<sup>th</sup> Space Battalion's global presence provides space support to the warfighter through space planning expertise, capabilities, products, and space domain awareness.

The 117<sup>th</sup> Space Battalion performs the difficult task of training the citizen-Soldiers assigned to the unit. This allows their service members to develop as ordinary citizens working in various occupations throughout Colorado and the United States while simultaneously providing significant contributions toward the sustainable readiness of the 1<sup>st</sup> Space Brigade.

### IMPACT

The battalion's composition includes two space companies, the 217<sup>th</sup> and 1158<sup>th</sup>. Each space company mans, trains and equips six Army Space Support Teams.

ARSSTs deploy and integrate with a host unit to provide direct support to Army brigades and higher echelons, special operations forces, and Marine Expeditionary Forces. The ARSST provides the commander and staff with situational understanding of the space domain to contribute to current and future operations.

During the Iraq and Afghanistan conflicts, the 117<sup>th</sup> Space Battalion provided multiple ARSSTs to combatant commanders. In 2018 the 117<sup>th</sup> Space Battalion qualified three ARSST teams in preparation for global support to exercises and deployments.

In its ongoing support to exercises and missions, the 117<sup>th</sup> Space Battalion provided support for Key Resolve; Warfighter 18-5 in Camp Atterbury, Indiana; Warfighter 19-1 in Camp Atterbury; and Warfighter 19-5 in Fort Indiantown Gap, Pennsylvania.

These exercises provide critical space-based technical results and training for numerous units. In 2019 the battalion deployed one ARSST in support of Operation Spartan Shield and will deploy one more in 2020.

The 117<sup>th</sup> Space Battalion remains a unique hallmark of global military operations. The battalion continues to support the Department of Defense, allies and mission partners as the United States deters aggression and is a stabilizing force in the world today. The battalion will continue the advancement of space for the warfighter far into the future.

Army Space Support Team 26, comprising Soldiers from the 1158<sup>th</sup> Space Support Company, 117<sup>th</sup> Space Battalion, Colorado Army National Guard, deploy to Southwest Asia in support of Operation Spartan Shield to provide space-based products that enhance warfighter intelligence and operational capabilities. From left are: Capt. Jennifer Staton, Staff Sgt. Joseph Fauskee, Sgt. Miranda Yost, Capt. Andrew Schaaf, Spc. Ambrose Solis and Spc. Kasey Kelly. (U.S. Army photo by 1<sup>st</sup> Sgt. Robert Segin)



# Marine Corps Lands at 1<sup>st</sup> Space Brigade

Bill Winters, space systems trainer, 1<sup>st</sup> Space Battalion, conducts space operations systems training for Marines from the I Marine Expeditionary Force, Camp Pendleton, California, during a weeklong training exchange. Students from left are: Maj. Nicklaus Dugo, Maj. Jonathon Ajinga and Lt. Col. Aaron Klein. (U.S. Army photo by Sgt. Dennis DePrisco)



Marines from the I Marine Expeditionary Force spent one week with the Space Soldiers from the 1<sup>st</sup> Space Battalion, 1<sup>st</sup> Space Brigade at Fort Carson, Colorado, training on software employed by Army Space Support Teams and learning how the ARSSTs integrate into different staff functions that utilize space-based products.

"The training we received was focused on how we can create a team similar in capability to an Army Space Support Element," said Lt. Col. Joseph Horvath, space operations officer, Marine Forces, U.S. Strategic Command.

The Marine Corps is currently experimenting with a concept to utilize space operations personnel organic to the MEF to create a team similar in capability to an ARSST. This Marine Space Support Team would support MEF staff with space operations expertise and provide the commander situational awareness of the space domain, and plan, integrate and coordinate space capabilities, space control and space situational awareness activities across all warfighting functions.

"One aspect we were able to focus on was how the integration into Army units differs from the way they would integrate into their Marine and Navy units for different exercises and combat operations," said Matthew Burnett,

senior military operations analyst and ARSST team trainer for 1<sup>st</sup> Space Battalion.

The training also provided the I MEF team an opportunity to practice battle drills, develop tactics and standard operating procedures before the execution of its MEF exercise in January.

"I MEF team was able to review the Space Operations System tool suite and went through a series of master scenario events lists taken from ARSST training tables," said Horvath. "We also received feedback on Army space lessons learned and guidance on developing tactics, techniques and procedures and standard operating procedures."

"The MSST concept is currently in the experimental phase, which will be complete when all three MEFs have been trained, about spring of 2021," said Horvath.

The Marine Corps will be working with the brigade to bring teams from each MEF for similar training over the next year.

"Ideally this training would become an annual training event for the Marine Space Support Teams," said Horvath. "The Marine Corps fully expects to leverage ARSSTs and space control teams whenever possible in the future."



# U.S. Army Satellite Operations Brigade



**COL Tonri Brown**  
Commander



**SGM Christopher Mann**  
Command Sergeant Major

### PURPOSE

The U.S. Army Satellite Operations Brigade executes continuous tactical, operational and strategic satellite communications payload management through its Wideband and Narrowband Consolidated SATCOM Systems Experts, Wideband SATCOM Operations Centers, Regional SATCOM Support Centers and an Electromagnetic Interference mitigation detachment across the full spectrum of operations in support of combatant commands, services, U.S. government agencies and international partners.

### IMPACT

On May 1, 2019, the U.S. Army Space and Missile Defense Command reorganized its elements to form Task Force Eagle. In October the Task Force was redesignated as the U.S. Army Satellite Operations Brigade. The brigade consolidates all assigned SATCOM missions under a new major subordinate element to align for efficient command and control up to the joint force commander level to include U.S. Space Command through the Combined Forces Space Component Command, the operational supported commander for space.

The reorganization is transparent to the warfighter, who continues to receive the same outstanding level of support through the same processes and will better align functions within the command under an operational commander. This reorganization improves effectiveness, efficiency and oversight while reducing redundancy and bureaucracy within the SATCOM enterprise. It ensures seamless military SATCOM support globally through continuous 24/7/365 operations at five Wideband SATCOM Operations Centers and four Regional SATCOM Support Centers to all

elements of the Department of Defense, U.S. government agencies and U.S. allies and partners, providing unity of command and establishing a single unit responding to the needs of the warfighter.

As the Army's only Satellite Operations Brigade, it is composed of active and reserve component Soldiers, Department of the Army civilians, and Australian military and civilian employees. The brigade has globally stationed forces within the U.S. Northern Command, U.S. European Command and U.S. Indo-Pacific Command areas of responsibility, but support every combatant command and nine Wideband Global Satellite partners (Australia, Canada, Denmark, Luxembourg, Belgium, Netherlands, New Zealand, Czechoslovakia and Norway).

Subordinate organizations include the 53<sup>rd</sup> Signal Battalion (Satellite Control), formerly assigned to 1<sup>st</sup> Space Brigade, and the SATCOM Directorate, formerly a part of the USASMD C G-6 staff.

The 53<sup>rd</sup> Signal Battalion provides wideband payload control, transmission control, and defensive space control ensuring the DOD wideband constellations' continuous support to peacetime, contingency, surge and crisis action plans supporting DOD, U.S. government agencies and allied partners. The 53<sup>rd</sup> Signal Battalion sustains, operates and maintains five geographically dispersed WSOCs with two located in Maryland and one each in Hawaii, Germany and Japan. The WSOCs responsibilities include controlling terminal communications and satellite access, maintaining operational databases, responding to anomalies and alarms, evaluating the quality of communications links and the



*U.S. Army Satellite Operations Brigade, 53<sup>rd</sup> Signal Battalion Soldiers work on an antenna at the Wideband Satellite Communications Operations Center at Fort Meade, Maryland. The newly established brigade executes continuous tactical, operational and strategic satellite communications payload management in support of combatant commands, services, U.S. government agencies and international partners. (Photo by Carrie David Campbell, USASMD C)*

implementation of restoral plans. WSOCs stand prepared to support joint operations for the next major conflict, while fighting through a denied, degraded and disrupted space operating environment.

The SATCOM Directorate executes U.S. Space Command's assigned Consolidated SATCOM System Expert, or C-SSE, mission for both wideband and narrowband SATCOM systems and maintains 24/7/365 watch officer support. The wideband C-SSE operationally manages the payloads on the Wideband Global SATCOM and Defense SATCOM systems and the Global Broadcast Service, which is a broadband service carried

over the WGS. The narrowband C-SSE operationally manages the payloads on the last remaining Fleet SATCOM systems satellite, the Ultra High Frequency Follow-On and the Mobile User Objective System.

The SATCOM Directorate manages the four RSSCs, and executes the wideband and narrowband SATCOM international partner agreements that DOD has with international and coalition partners. The SATCOM Directorate manages three memoranda of understanding valued at more than \$2 billion and 20 other international SATCOM exchange arrangements across 11 international partners.



# 53<sup>rd</sup> Signal Battalion



Soldiers from the 53<sup>rd</sup> Signal Battalion, U.S. Army Satellite Operations Brigade, service equipment at one of the battalion's five Wideband Satellite Operations Centers. (U.S. Army photo)

### PURPOSE

The 53<sup>rd</sup> Signal Battalion (Satellite Control) is the only Army Signal Satellite Control Battalion. Previously part of the 1<sup>st</sup> Space Brigade, the unit transferred to the new U.S. Army Satellite Operations Brigade in 2019. The battalion is the only unit in the Department of Defense that conducts payload and transmission control of both the Defense Satellite Communications System and the Wideband Global Satellite communication constellations.

The battalion's management of these constellations provides assured communications connectivity for mission-critical subscribers ranging from the president of the United States, DOD, U.S. government agencies, all branches of the U.S. military, and international partners all engaged in conducting global operations.

Soldiers of this globally dispersed battalion accomplish their vital missions, "Fight SATCOM," and provide support 24/7/365 from the Wideband SATCOM Operations Centers located at Fort Detrick and Fort Meade, Maryland; Landstuhl, Germany; Wahiawa, Hawaii; Fort Buckner, Okinawa, Japan; and the Battalion Satellite Operations Center headquarters at Fort Carson, Colorado.

### IMPACT

The 53<sup>rd</sup> Signal Battalion supports Operation Inherent Resolve, Operation Freedom's Sentinel and Operation Resolute Support and more than 75 exercises and operations for U.S. Northern Command, U.S. Africa Command, U.S. Central Command, U.S. European Command, U.S. Southern Command, U.S. Pacific Command and all joint service component commands.

The Soldiers of the 53<sup>rd</sup> Signal Battalion are uniquely qualified to execute garrison, tactical, strategic and space operations, while remaining a crucial enabler for all joint and military operations within the continental U.S. and in support of global operations. The battalion's SATCON mission set supports joint and military commands that require well-trained Soldiers and precise technical expertise to manage a multitude of communications systems and networks.

The battalion trains and develops the most technically competent Soldiers, tactically sound in their ability to maneuver equipment and conduct operationally based responsibilities to support any mission, anywhere.

# Satellite Communications Support

### PURPOSE

The Satellite Communications Directorate within the U.S. Army Satellite Operations Brigade executes U.S. Space Command's assigned mission for both wideband and narrowband SATCOM systems. The Wideband Consolidated SATCOM System Expert, or C-SSE, operationally manages the payloads on the Wideband Global SATCOM, or WGS System. Other satellite payloads managed include the legacy Defense SATCOM System, or DSCS; and the Global Broadcast Service, or GBS, which is a broadband service carried over the WGS. The Narrowband C-SSE operationally manages the payloads on the last remaining Fleet SATCOM systems satellite; the Ultra High Frequency Follow-On, or UFO systems; and the Mobile User Objective System, or MUOS.

From Peterson Air Force Base, Colorado, the C-SSEs and their 24/7/365 watch officers support wideband and narrowband military satellite communications for the entire Department of Defense, other U.S. government users, and international partners to deliver beyond-line-of-sight communications. The directorate manages the four Regional SATCOM Support Centers, or RSSCs, and executes the wideband and narrowband SATCOM international partner agreements that the DOD has with international and coalition partners. The directorate manages three memoranda of understanding valued at \$2.16 billion and 20 other international SATCOM exchange arrangements across 11 international partners. The directorate's IP team delivers operational management and international agreement expertise to

forums for exploratory discussions and negotiations across more than seven SATCOM expansion areas including NATO, arctic SATCOM and medium-earth orbit opportunities.

### IMPACT

The wideband constellation provides flexible and reliable long-haul, high-capacity communications worldwide. Military wideband SATCOM accounts for 70 percent of all DOD beyond-line-of-sight throughput. The military narrowband constellation provides critical all-weather tactical links to forces on the move using highly mobile radios. Field units are demanding more real and near-real time intelligence, warning and battle damage data to support continuously updated and shared situational awareness. SATCOM enables first-in and last-out communications for hundreds of thousands of warfighters worldwide.

The four geographically dispersed RSSCs provide 24/7/365 SATCOM planning, engineering and satellite payload management for all DOD SATCOM systems. The RSSCs are located at Wheeler Army Airfield, Hawaii; Peterson Air Force Base, Colorado; MacDill Air Force Base, Florida; and Patch Barracks, Stuttgart, Germany. The RSSCs work with regional SATCOM users planning and authorizing critically required connectivity for system users across the full range of military operations including diplomatic, humanitarian assistance, disaster relief and scientific missions in zones where the communications infrastructure can be destroyed, degraded or is simply non-existent.



U.S. Army Satellite Operations Brigade leadership, Col. Tonri Brown and Command Sgt. Maj. Christopher Mann, second and third from left, visit with Regional Satellite Communications Support Center-East Soldiers, from left, Master Sgt. Daniel Sanker, Staff Sgt. Brett Cater and Staff Sgt. Ethan Wilkinson. (U.S. Army photo)





## SATOPS Brigade works to connect users around the world

Staff Sgt. Steven Waldorf Jr., left, and Sgt. Aaron Grimsley, 53<sup>rd</sup> Signal Battalion, work on equipment at the Wideband Satellite Communications Operations Center at Wahiawa, Hawaii, in April 2019. The five globally dispersed WSOCs provide payload and transmission control of Department of Defense satellite communication constellations. (Photo by Carrie David Campbell, USASMDC)



The Narrowband Division within the U.S. Army Satellite Operations Brigade is taking a giant leap toward connecting users around the world with the Mobile User Objective System satellite constellation.

Currently, Legacy UHF satellite communication (FLTSAT, UFO and MUOS) can support the warfighter only when they are in the same region. Users must have a direct line of sight to the same satellite to communicate with others on the network.

Now, U.S. Space Command is about to sign into effect MUOS providing worldwide communications capability through the use of Wideband Code Division Multiple Access, or WCDMA, networks that utilize an integrated ground and satellite constellation architecture. What this will provide is the ability for any user on the network to talk to another user anywhere in the world using different satellites. MUOS takes communications from a regional capability to a worldwide capability.

Company commanders on the battlefield will be able to communicate over radio to their higher headquarters' Defense Switched Network phone. A platoon in the middle of a firefight can reach air support from hundreds of miles away by the touch of a transmission button. Joint

forces now have another tool to correspond quickly and effectively with all members joined on the network to create an architecture unrivaled in the field of worldwide communications.

"It is a combination of four satellites on orbit and four associated ground system sites around the world," said Rodger Pitt, Narrowband SATCOM Plans Branch chief. "Those four sites are interconnected via terrestrial fiber and provide worldwide communications for mobile small platforms, such as radios, in the UHF spectrum. So you and I can be anywhere in the world, communicating through different satellites via voice or digitally."

By utilizing UHF signal and IP routing, a numeric designation that identifies its location on the internet, users on different platforms are able to communicate from radios (land, maritime or airborne) to other service members who are using MUOS WCDMA radios, Legacy UHF SATCOM radios, DSN phones or NIPR/SIPR computer terminals throughout the world.

"On behalf of the warfighter, we will plan and work across the narrowband community of interest to make sure that UHF SATCOM will continue to support the warfighter for decades to come," said Pitt.



## THE FACES of USASMDC







**Thomas Webber**  
Director



**Jennifer Stephenson**  
Acting Deputy Director

### PURPOSE

The U.S. Army Space and Missile Defense Command Technical Center supports the joint warfighter by providing disruptive and critical technologies that meet today's requirements and address future needs, enabling warfighter dominance in multi-domain operations. The Technical Center manages science and technology, research and development, and conducts test programs for space, integrated air and missile defense, directed energy, hypersonic and related technologies. As part of the Army Science and Technology enterprise, the Technical Center contributes to the current fight and enables the next generation to prevail in conflicts to come.

The Technical Center consists of the Space and Strategic Systems Directorate, Air and Missile Defense Directorate and the Ronald Reagan Ballistic Missile Defense Test Site located on Kwajalein Atoll in the central Pacific Ocean, which is part of the Department of Defense Major Range and Test Facility Base. The Technical Center impacts the warfighter and joint force in four major areas: directed energy, tactical space technologies, test and evaluation, and space operations.

### IMPACT

#### Directed Energy

The Technical Center is the Army lead for high-energy laser technology development. This technology can be effectively employed in a variety of mission areas and offers unique performance attributes that will contribute directly to addressing existing operational capability gaps. High-energy lasers have the potential to be a low-cost, effective complement to kinetic energy to address rocket, artillery and mortar threats; unmanned aerial systems; and cruise

missiles. Additionally, the center is exploring the use of high-power microwave technology for use in interdicting unmanned aerial systems and defeating improvised explosive devices and other improvised threats.

#### Tactical Space Technologies

As the Army lead for space research, development and engineering, the Technical Center identifies, develops, demonstrates and integrates space technologies in the areas of responsive space and space superiority. To meet Army operational needs, focus areas include persistent beyond line-of-sight communications via small satellites for forces deployed in remote areas; functionally effective resolution imagery via small satellites; solutions for assured position, navigation and timing; ground command and control systems to reduce operator burden; and direct downlink of tactical data feeds.

#### Test and Evaluation

The Technical Center is an invaluable part of the Army Test and Evaluation Enterprise and provides a suite of low-cost ballistic missile targets for use in developmental and operational air and missile defense testing, transportable and configurable launchers, and test support. The Reagan Test Site provides test support to the Missile Defense Agency, the U.S. Air Force, NASA and others. Additionally, the Technical Center is providing Hypersonic Flight Test support from test planning and design phase through mission execution and post-flight analysis for the Army, Navy and Air Force.

#### Space Operations

The Reagan Test Site also supports the command's space object identification and space domain awareness missions in support of U.S. Space Command.

This mission includes space object tracking and characterization, providing critical orbital information on new foreign launches, and providing high-resolution images in support of the space domain awareness. The Reagan Test Site supports this mission 24/7/365.

The Technical Center collaborates and synchronizes its efforts across the Army with the Army Futures Command, Rapid Capabilities and Critical Technologies Office, program executive offices, centers of excellence, combatant commands, other services, industry and academia.

The Technical Center's Concepts Analysis Laboratory, or CAL, provides a hands-on environment for newly hired engineers, scientists and college interns. In addition to the CAL, the Technical Center operates the following laboratory facilities: The Payload Demonstration Lab, the Position Navigation and Timing Resiliency Lab and the High Energy Laser Lethality Lab – all located on Redstone Arsenal, Alabama – and the Laser Lab in Huntsville, Alabama. Additionally, the Technical Center is building a world-class Technology Complex on Redstone Arsenal, which will include directed energy, space, hypersonic and integrated air and missile defense lab facilities.

The Technical Center is geographically distributed in many sites, with its primary offices located at Redstone Arsenal. Other locations are the Reagan Test Site located at U.S. Army Garrison-Kwajalein Atoll in the Republic of the Marshall Islands; the Reagan Test Site Operations Center located in Huntsville; and the Solid State Laser Testbed located at White Sands Missile Range, New Mexico.

It is a lean organization with 150 Department of the Army civilians and seven military personnel and a budget of approximately \$849 million per year, split between about 45 percent direct funding and 55 percent reimbursable funding. Budget, personnel, contract and other recurring management activities are coordinated and executed by the Technical Center Business Management Office, which works under the oversight of the deputy director.

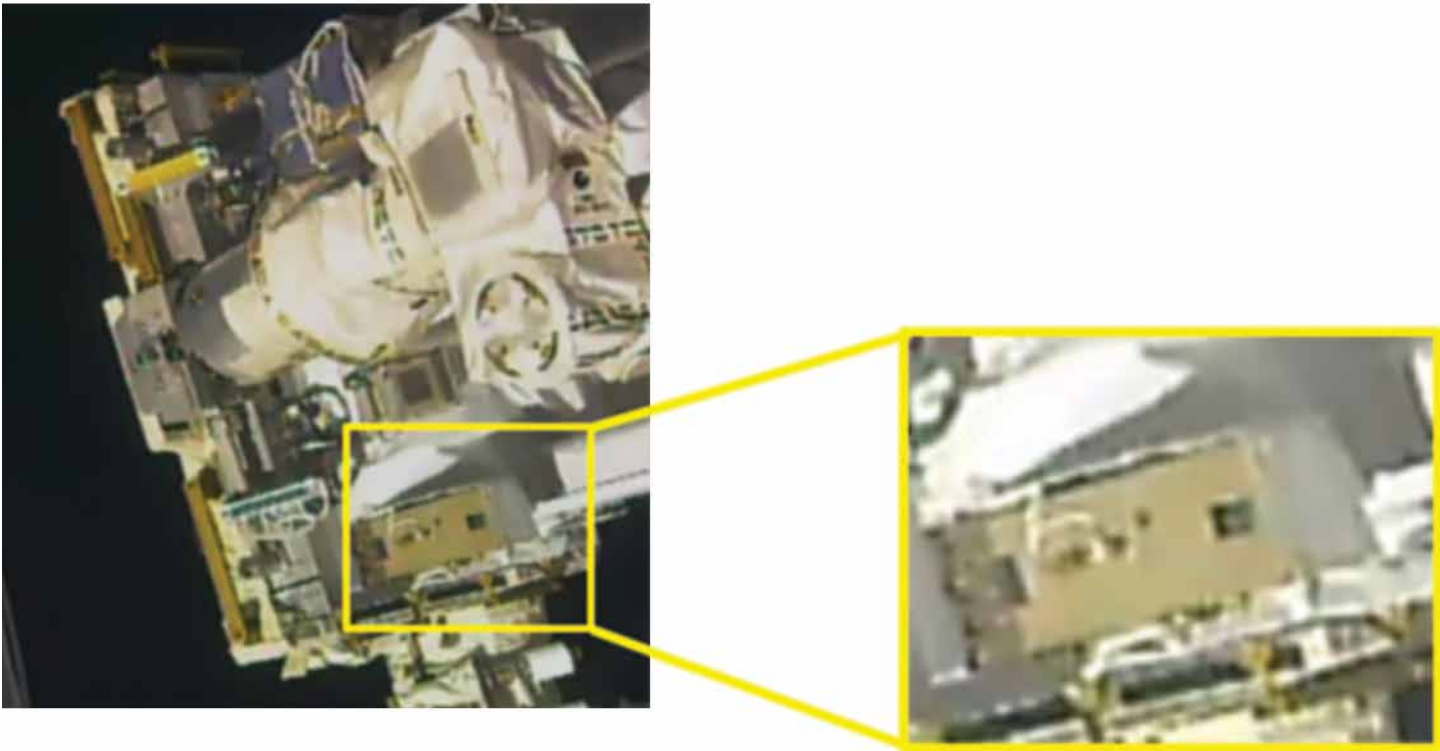
On a daily basis, the civilians, Soldiers and contractors of the Technical Center focus on achieving their vision of "Delivering Technologies and Solutions to Enable Warfighter Dominance." This contributes to the command's ability to enable dominant multi-domain combat effects, protect the homeland and support strategic success – wherever and whenever required.



*The Technical Center's Test Execution Support Division Black Dagger is a suite of threat representative, low-cost, short-range ballistic missile targets for use in missile defense testing. These targets utilize excess Army motors that are near the end of their operational life, but can be repurposed for flight testing. (U.S. Army photo)*



# Space and Strategic Systems Directorate



Army Cost Efficient Spaceflight Research Experiments and Demonstrations, or ACES RED, attaches to the International Space Station in May 2019 for direct exposure to space. The Space and Strategic Systems Directorate team is conducting a science mission with the operational ACES RED that will last until May 2021. (U.S. Army photo)

### PURPOSE

The Space and Strategic Systems Directorate develops, integrates, demonstrates and transitions space systems and payloads to provide for current and future Army and joint warfighter capabilities. The systems and payloads are primarily for program executive offices, program managers and joint users.

SSSD consists of three divisions: the Space Superiority Division, the Space Systems Division and the Command, Control and Integration Division. The directorate also represents the U.S. Army Space and Missile Defense Command Technical Center as a voting member on the Department of Space Experiments Review Board.

### CAPABILITIES

The Space Systems Division and Space Superiority Division research, identify, develop, demonstrate, integrate and transition tactically responsive technologies that are used for ground- and space-based platforms to provide capabilities across the entire spectrum of operations, especially in degraded and denied areas of operation. Missions include: tactical communications; intelligence,

surveillance and reconnaissance; and navigation warfare. Initiatives currently managed by these divisions include the small satellite Capability Technology Demonstration, the Jacobs Ladder Joint Capability Technology Demonstration and the Army Cost Efficient Spaceflight Research Experiments and Demonstrations.

The Command, Control and Integration Division researches, identifies, develops, demonstrates, integrates and transitions cyberspace, communications, and space data exploitation/integration technologies aligned with Army and joint warfighter requirements to enhance operational warfighter capabilities across the entire spectrum of operations. This division develops and initiates structured research, development and acquisition processes for space data exploitation technologies, advanced communications and cyber vulnerability protection for emerging systems and technologies. The C2I division develops and provides laboratory capability for demonstrating ground-based satellite payload command and control, as well as a laboratory to develop, demonstrate and assess the resiliency of position, navigation and timing technologies.

# Air and Missile Defense Directorate

### PURPOSE

The Air and Missile Defense Directorate provides disruptive and critical technologies that meet today's requirements and addresses future needs to enable warfighter dominance in the areas of directed energy, space, cyberspace, hypersonic, and integrated air and missile defense technologies.

In support of those efforts, the AMDD develops, integrates, demonstrates and transitions high-energy lasers, highpower microwave, interceptor and other technologies. It also provides low-cost targets and test execution support to various users to provide for current and future Army and joint warfighter capabilities. The AMDD includes the Office of the Director, the High Energy Laser Division, the Research and Advanced Concepts Division and the Test Execution Support Division.

### IMPACT

The Office of the Director provides the vision and direction for the entire directorate. It functions as the Technical Center adviser for directed energy, high-power microwave, and other air and missile defense technology development, program integration and system effectiveness. It provides programmatic guidance, technical review and resource planning and allocation to division chiefs, and advises on matters pertaining to the research and development of integrated air and missile defense technologies, low-cost targets and ground and flight test execution support.

The High Energy Laser Division designs, develops and conducts experiments on high-energy laser technologies, components and systems to meet warfighter needs and leads the U.S. Army Space and Missile Defense Command's efforts to chart the future for directed energy of the Army. The division conducts basic and applied research projects on lasers, beam control and lethality at Redstone Arsenal, Alabama; the University of Alabama in Huntsville; and White Sands Missile Range, New Mexico. The Division conducts high energy laser weapon technology research and development, evaluation and demonstration for defensive/offensive applications. The division conducts research and development, evaluations and demonstration of high-energy laser weapon system fire control, including detection, tracking, aim point selection, positive beam control, timeline management against multiple targets and effectiveness against targets.

The Research and Advanced Concepts Division develops and applies advanced technologies for integrated air and missile defense-related applications, to include research in weapons component development, integration, performance and lifecycle design in support of the Army, combatant commands and Department of Defense agencies.

The division conducts applied research and development and provides disruptive, innovative, high-risk, high-payoff technologies to enhance the capability and affordability for integrated air and missile defense capabilities and related applications. Also among its functions are the development of high-power electrically based weapons technologies, concepts and demonstrators for integrated air and missile defense and other battlefield applications in support of the Fires Center of Excellence electric fires capability needs. It also conducts advanced development of technologies and methods to counter improvised explosive devices.

The Test Execution Support Division designs, fabricates and demonstrates a suite of low-cost, threat-representative targets for use in Army and other government agency customer flight test programs. It also provides high-fidelity, threat-representative targets and interceptor mass surrogate sled vehicles in support of live fire test and evaluation as required by Congressional Law, Title



10. It conducts test planning to meet customer requirements and provides accurate budget and schedule projections.

Black Dagger Target undergoes vibration testing at the NASA Wallops Flight Facility in Wallops, Virginia, in 2018, in support of the Black Dagger Risk Reduction Flight. (U.S. Army photo)



# Concepts Analysis Laboratory

### PURPOSE

The Concepts Analysis Laboratory was established in 2004 to provide a hands-on environment for the Technical Center’s newly hired engineers, scientists and college interns.

CAL employees provide support to the following efforts:

- Small satellites – modeling and simulation, ground station development, ground station operations, antenna design, propulsion research, fabrication and testing, and flat-sat testing
- Operation of truth sensor for counter-rocket, artillery and mortar, and counter-unmanned aerial system testing at Yuma Proving Ground, Arizona
- Image processing for future laser weapon systems
- Counter-unmanned aerial system testing with an impulse radar

### IMPACT

The CAL uses the Department of Defense’s Science, Mathematics and Research for Transformation, or SMART, scholarship program and the Department of Army intern program to hire the best and brightest engineers and scientists from all over the country.

Currently, the CAL has graduates/students from the University of Michigan, Arizona State University, University of Alabama in Huntsville, Georgia Tech, University of Alabama, University of Central Florida, Utah State University and many others.

The SMART program provides for all of the students’ educational expenses for a bachelor’s or master’s degree or doctorate in one of the science, technology, engineering or mathematics areas. It also includes a stipend, an internship in the CAL during summers and a permanent position when they graduate with their degree.

Graduates are required to work at the U.S. Army Space and Missile Defense Command for a period at least equivalent to their SMART scholarship period. The SMART



Molly Riebling and Jordan Dupree, U.S. Army Space and Missile Defense Command Technical Center Concepts Analysis Laboratory engineers operate the Precision Track and Search radar at Yuma Proving Ground, Arizona, in 2018. The PTS radar provides truth data for the counter-rocket, artillery and mortar, and counter-unmanned aircraft system testing. (U.S. Army photo)

graduates and Department of the Army interns work in the CAL for approximately two years on multiple projects in different Technical Center mission areas to help determine which division is the best fit for the engineer to transition into on a permanent basis.

The CAL facilities include a hardware lab area with lab benches, multiple 3D printers, circuit board mill and pick and place machine, cleanroom, collaborative office area and a large meeting/classroom with media wall.

The lab also has students from the University of Alabama in Huntsville’s Systems Management and Production Center who work up to 20 hours a week while they are pursuing their STEM degree. Several West Point cadets come for three-week internships each summer.

The CAL is also routinely asked to participate in outreach events such as Adventures in Engineering, Bring Your Child to Work Day and career days at area schools to encourage pursuit of degrees in the STEM areas.

# Reagan BMD Test Site



Personnel man the Kwajalein Mission Command Center at the Ronald Reagan Ballistic Missile Defense Test Site on the Kwajalein Atoll in the Republic of the Marshall Islands. (Photo by Carrie David Campbell, USASMDC)

### PURPOSE

The Ronald Reagan Ballistic Missile Defense Test Site, or RTS, is a vital national asset providing live-fire developmental and operational flight testing of offensive and defensive missile systems, equatorial satellite launch capability, space object tracking and characterization, and atmospheric science research. The unique range and test facility is located 2,300 miles west-southwest of Hawaii in the U.S. Army Garrison-Kwajalein Atoll, Republic of the Marshall Islands.

### IMPACT

RTS maintains, operates, improves and modernizes a diverse, world-class instrumentation suite, including radar, telemetry radio frequency systems, electro-optical systems, command and control systems, flight safety command-destruct systems, mission data networks and communication systems. The range and key instrumentation systems can be operated remotely from the RTS Operating Center located in Huntsville, Alabama.

The cornerstone of the RTS instrumentation capability is a suite of four of the world’s most sophisticated instrumentation-class radar systems, spanning the radio frequency spectrum, enabling RTS to support a broad range of missions. Combining long-range tracking radars able to detect and track multiple objects, as well as satellites in all orbits with high-resolution imaging radars,

RTS maintains a highly effective balance of tracking and radar imaging capability.

Strategic and tactical space surveillance operations are also conducted, contributing radar observations to the Department of Defense space surveillance network in support of requirements from the U.S. Space Command. In addition to satellite tracking and metric observations as well as surveillance of new space launches, RTS provides the space community with radar imaging data to support identification of on-orbit satellites. Because of the growing concern about the survivability of U.S. satellites, USSPACECOM works directly with U.S. Army Space and Missile Defense Command and RTS to maximize availability of range assets to support this critical mission area.

Geographically located in the middle of the Pacific Ocean, the RTS personnel provide testing and data collection capabilities not possible anywhere else. The suite of instrumentation managed and operated at RTS provides weapon system developers accurate data to continue refinement of the world’s most accurate strategic and tactical offensive and defensive missile systems that protect and defend Soldiers and the homeland while the unmatched sensitivity and range provide unparalleled 24/7/365 space situational awareness support to protect and defend orbiting U.S. and allied space systems.





## RTS provides unmatched testing capability for various mission partners

*Ronald Reagan Ballistic Missile Test Site successfully supports the Air Force Global Strike, Minuteman III, GT-232 operational test mission Oct. 2, 2019. Launch was initiated from Vandenberg Air Force Base, California, and impacted at the Kwajalein Atoll within the Kwajalein Missile Impact Scoring System. (U.S. Air Force photo by Staff Sgt. J.T. Armstrong)*



The U.S. Army Space and Missile Defense Command Technical Center's Ronald Reagan Ballistic Missile Defense Test Site contributed to the nation's defense in 2019 with numerous tests conducted for a variety of customers.

RTS functions as a test facility for U.S. missile defense as well as space operations and research programs. It is located at the U.S. Army Garrison-Kwajalein Atoll in the Pacific Ocean's Republic of the Marshall Islands. Notable tests RTS conducted in 2019 are: the U.S. Air Force Global Strike's Minuteman III developmental Flight Test Unit-1; Flight Test Ground-based Midcourse Defense System-11; Minuteman intercontinental ballistic missile tests; and NASA's Waves and Instabilities from a Neutral Dynamo.

"The technical capability at RTS is unmatched in the Department of Defense, ensuring its status as a vital national asset," said Col. Burr H. Miller, RTS director. "The strategic importance of the location of USAG-KA is immeasurable. The key to the success of RTS is the dedicated staff and highly skilled contractor workforce with continuous support from USASMDC staff and tireless efforts of USASMDC mission partners."

The Air Force's FTU-1 conducted real-world ICBM flight testing Feb. 6. On March 25, history was made with the first-ever salvo test of the Ground-based Midcourse Defense System during FTG-11 when two ground-based interceptors launched in an anti-ballistic missile test.

The two multi-stage, solid fuel boosters were each tipped with a state-of-the-art Exoatmospheric Kill Vehicle. They

propelled from silos at Vandenberg Air Force Base, California, at thousands of feet per second bound for collision with a sophisticated ICBM-like target launched from the Kwajalein Atoll. The test concluded within minutes as the two GBIs successfully hit their marks.

In 2019 RTS also provided support to numerous missions including Minuteman ICBMs tested with unarmed reentry vehicles to a target area in Kwaj. These missions, also known as Glory Trips by the U.S. Air Force, check the readiness, effectiveness and accuracy of the weapons system.

"RTS tracks and collects data on Glory Trips and other sub-orbital missions," Miller said. "Tracking and data collection is accomplished via a robust world-class and unmatched set of instrumentation at the Kwajalein Atoll and control center in Huntsville."

RTS also supported NASA during their second Waves and Instabilities from a Neutral Dynamo, or Too WINDY, mission June 19, 2019, to study disturbances in the upper atmosphere that interfere with communication and technology systems.

"Tracking and data collection is designed to specific missions in direct support of the flight test customer's mission objective," Miller said. "Collected data is processed by analysts and provided to flight test customers in the form of quick look reports immediately following test conclusion and detailed multi-sensor analysis 30 to 90 days post mission."



## THE FACES of USASMDC





# Space and Missile Defense Center of Excellence



**Richard De Fatta**  
Director



**COL James Crossley**  
Deputy Director

## PURPOSE

The Space and Missile Defense Center of Excellence was established in August 2019 from the Future Warfare Center. This change in organizational structure, design and designation was meant to bring the U.S. Army Space and Missile Defense Command more in line with existing Army organizations. The Space and Missile Defense Center of Excellence now becomes the U.S. Army's force modernization proponent, responsible for managing Army change to doctrine, organization, training, materiel, leadership and education, personnel, facilities and policy, or DOTMLPF-P, requirements for space, global ballistic missile defense and high altitude capabilities within the Army. In addition, the Air and Missile Defense Integration Division initially established under the G-3, then later moved directly under the commanding general, was moved to the Space and Missile Defense Center of Excellence to increase the synchronization and synergy of Army air and missile defense.

The Space and Missile Defense Center of Excellence represents Army equities across the joint community. Within the capabilities of Army and joint space, missile defense and high altitude, the Space and Missile Defense Center of Excellence trains and educates agile, adaptive and ready Soldiers and leaders, executes life-cycle management for U.S. Army space operations officers, develops the Army space cadre and enables informed decision-making.

To carry out its mission, The Space and Missile Defense Center of Excellence executes U.S. Army Training and Doctrine Command-established practices to meet force management responsibilities. This

includes performing concept development, capabilities determination and capabilities integration relative to DOTMLPF-P for process change, integration and transition for materiel development. Additionally, the organization executes the Army's institutional training and education for space and global ballistic missile defense mission areas. It is uniquely organized and geographically well-positioned to meet future Army needs.

## IMPACT

The Space and Missile Defense Center of Excellence is USASMDC's architect for future force design. Its unified but geographically dispersed team designs, builds, modernizes, trains and educates Army space and missile defense forces. It contributes to developing superior space, missile defense and high altitude capabilities that enable multi-domain effects to protect the homeland and support tactical to strategic success whenever and wherever required. It drives change to current force focused on combat-ready forces and capabilities. This effort is balanced with a constant view to the future by preparing or adopting leap-ahead concepts or technology through innovative solutions. Components of the organization include the U.S. Army Space Personnel Development Office, Capability Development and Integration Directorate, the U.S. Army Space and Missile Defense School and the AMD Integration Division. These organizations support the overall mission through steady accomplishment of operations that include:

- Training Army Soldiers, space cadre and missile defense operators through 200 formal course offerings with more than 15,000 students annually;

- Designing and documenting space and missile defense organizations;
- Performing/participating in wargames, experiments and studies;
- Advocating for Army space, missile defense and high altitude capabilities;
- Providing modeling and simulations for Army space and missile technology from concept to fielding and life-cycle management;
- Providing Functional Area 40 life-cycle management and space cadre sustainment, and serves as the single point of contact for all FA40 matters.

The Space and Missile Defense Center of Excellence has several notable activities for 2020 and many recent accomplishments including:

**U.S. Army Training and Doctrine Command Accreditation:** The U.S. Army Space and Missile Defense School maintained their "Institution of Excellence" (100 percent) rating in 2019. This rating covers the period 2017-2019.

**Army Space Training Division Created:** In May 2019, two lines of effort, Institutional and Operations, of the Army Space Training Strategy formed the Army Space Training Division within the U.S. Army Space and Missile Defense School. The ASTD provides denied, degraded and disrupted space operational environment training across the Army through institutional and operational training venues. These activities educate leaders and Soldiers at all levels to integrate space capabilities throughout the operations process to understand threats to U.S. space capabilities and how space capabilities enable and enhance Army systems.

**Talent Management Initiatives:** In fiscal year 2020, ASPDO will pilot two Talent Management Task Force initiatives for the Army. First is the Assured Functional Area Transfer initiative. This program gives 10-20 U.S. Military Academy and ROTC cadets with space-oriented science, technology, engineering and mathematics degrees the opportunity to "branch detail" to FA40. After commissioning, the officers will serve four years in their basic branch, then they are guaranteed to transfer to FA40. The second initiative is the



*Cpl. Rogelio Argueta, Patriot Launching Station Enhanced Operator-Maintainer, assigned with Task Force Talon, 94<sup>th</sup> Army Air and Missile Defense Command, gives commands during practice missile reload and unload drills on a Terminal High Altitude Area Defense system trainer at Andersen Air Force Base, Guam, Feb. 6, 2019. The U.S. Army Space and Missile Defense Command is the Army's Air and Missile Defense Enterprise Integrator. (U.S. Army photo by Capt. Adan Cazarez)*

direct commissioning program. This allows for the direct commissioning of individuals from the civil sector up to the grade of colonel, based on constructive credit. These initiatives will allow FA40 to continue to acquire necessary talent to maintain a human capital advantage into the future.

**Operational Analysis Support to Army Cross Functional Teams:** Completed multiple operational analyses that supported the Assured Position, Navigation and Timing Cross Functional Team, the Air and Missile Defense Cross Functional Team and the Long Range Precision Fires Cross Functional Team. Analyses provided force effectiveness metrics to Army leaders that directly enabled critical procurement and fielding decisions.

**Army Studies and Analysis Campaign Plan:** Completed 23 major operational analyses in fiscal year 2019; executing 18 in fiscal year 2020.

**Training and Education:** Approximately 15,000 space and ground-based midcourse defense Soldiers and civilians trained and educated annually.



# Capability Development Integration Directorate

## PURPOSE

The Space and Missile Defense Center of Excellence Capability Development and Integration Directorate conducts concept-to-capability development in support of force modernization efforts for current and emerging mission areas for the U.S. Army Space and Missile Defense Command approved by U.S. Space Command, U.S. Strategic Command, U.S. Northern Command and the Department of the Army.

The CDID also conducts wargaming, experimentation, studies and analysis; develops or adopts leap-ahead concepts and technology; and integrates doctrine, organization, training, materiel, leadership and education, personnel, facilities and policy, or DOTMLPF-P, solutions for multi-domain operations. It performs these responsibilities in support of Army Futures Command and as part of the Army Modernization Enterprise.

## IMPACT

The U.S. Army Training and Doctrine Command Capability Managers for Space and High Altitude and Strategic Missile Defense, or TCM SHA and TCM SMD, respectively, represent the TRADOC commanding general and report to the USASMDC commanding general. The TCM SHA serves as the Army's centralized fielded force integrator for SHA operations. The TCM SHA coordinates and synchronizes all DOTMLF-P solutions to provide SHA-required capabilities. The TCM SMD serves as the Army's user representative and centralized manager and integrator for all DOTMLPF-P considerations for strategic missile defense, and Army applications of the Command and Control, Battle Management and Communications System.

The Concept Development Division establishes the conceptual foundation for the command's future force development and force modernization focusing on the USASMDC-assigned mission areas of space, high altitude and global ballistic missile defense. Working with partners, the division conducts concept and technology exploration and assessment; integrates USASMDC force modernization proponenty equities in wargames, experimentation and studies; and develops and integrates



U.S. Army Training and Doctrine Command Capability Manager for Space and High Altitude serves as the capability developer for the 1<sup>st</sup> Space Brigade's Joint Tactical Ground Station units' theater missile warning systems as part of the U.S. Army Space and Missile Defense Command's force modernization proponenty for space. (Photo by Carrie David Campbell, USASMDC)

concepts and future force organizational design. This concept-to-capability development, warfighting capabilities determination, and DOTMLPF-P development and integration drives Army institutional decision-making processes such as the Total Army Analysis and the Program Objective Memorandums, directly contributing to the Army Modernization Enterprise's operationalization of multi-doman operations-capable force in 2028 and multi-domain operations-ready force in 2035.

The Decision Support Division provides the computational and network resources, cyber vulnerability testing, modeling and simulation, and operational analysis required to support major decisions concerning the acquisition of systems and the development of concept of operations that provide the best joint and Army space, missile defense, high energy laser and high altitude capabilities to current and future warfighters. The division conducts decision support across USASMDC, Joint Functional Component Command for Integrated Missile Defense and at the Army and joint levels. One such modeling and simulation supported by this division is the Extended Air Defense Simulation, a system-level simulation of air, space and missile warfare. EADSIM provides an integrated tool to support joint and combined force operations and analyses to model the performance and predict the effectiveness of ballistic missiles, surface-to-air missiles, aircraft and cruise missiles in a variety of user-developed scenarios.

# Space and Missile Defense School

## PURPOSE

The U.S. Army Space and Missile Defense School executes the Army's institutional training and education for space and global ballistic missile defense mission areas. The school coordinates and publishes the Army's doctrine for space and global ballistic missile defense, as well as assists the command's operational units in developing collective space and global ballistic missile defense training tasks. It also instructs and integrates space education at each Army center of excellence and proponent school as part of the Army Space Training Strategy.

## IMPACT

The school earned the U.S. Army Training and Doctrine Command's highest accreditation rating as an Institute of Excellence in 2017. Every three years, TRADOC reviews all aspects of training management and execution to include how the school analyzes, designs, develops, implements and evaluates space and missile defense training and education against the Army Enterprise Accreditation Standards. Additionally, TRADOC recognized several school-developed initiatives as Army best practices.

In May 2019, two lines of effort, Institutional and Operations, of the Army Space Training Strategy formed the Army Space Training Division within the U.S. Army Space and Missile Defense School. The ASTD provides denied, degraded and disrupted space operational environment training across the Army through institutional and operational training venues. These activities educate leaders and Soldiers at all levels to integrate space capabilities throughout the operations process to understand threats to U.S. space capabilities and how space capabilities enable and enhance Army systems.

The current and future missile defense courses include:

- Ground-Based Midcourse Defense Fire Control Qualification Course
- Army GMD Staff Course; GMD Senior Leader Course; GMD Missile Defense Officer Course; GMD North American Aerospace Defense Command/U.S. Northern Command Command and Control Course; GMD Master Gunner/



Staff Sgt. Daniel Romero, instructor at the Space and Missile Defense School, provides a demonstration of the Joint Tactical Ground Station Block II system to students attending the JTAGS Operators Course in June 2018 in Colorado Springs, Colorado. The course provides an understanding of JTAGS processes, procedures and equipment. (Photo by Dottie K. White, USASMDC)

- Top Gun Program (2019); GMD System Trainer Course; GMD Advanced Operator Course
- AN/TPY-2 Forward-Based Mode Sensor Manager Qualification Course; Leader Development Course
- Command and Control, Battle Management, and Communications Planner Course
- Engagement Coordination Course

The current and future space institutional training courses include:

- Space Operations Officer Qualification Course
- Space Senior Leader Seminar
- Army Space Cadre Basic Course (Phase 1 and 2)
- Satellite Communication Electromagnetic Interference Fundamentals Course
- Army Space Control Fundamentals Course
- Mobile Integrated Ground Suite Initial Qualification Training; MIGS Operators Course; MIGS Command and Control Technician Course; MIGS Advanced Qualification Training
- Advanced Space Control Systems Courses
- Fundamentals in Space Control Planning
- Space Control Planners Course
- Tactical Space Operations Courses Initial Qualifications Training; Tactical Space Operations Course Defense Support of Civil Authorities
- Joint Tactical Ground Station Initial Qualification; JTAGS Leader Development Course



# Air and Missile Defense Integration Division



Soldiers from Bravo Battery, 62<sup>nd</sup> Air Defense Artillery Regiment, 69<sup>th</sup> Air Defense Artillery Brigade, Fort Hood, Texas, conduct Terminal High Altitude Area Defense reload training on Fort Bliss, Texas. The U.S. Army Space and Missile Defense Command Commanding General serves as the Army's Air and Missile Defense Enterprise Integrator. (U.S. Army photo)

### PURPOSE

The Space and Missile Defense Center of Excellence Air and Missile Defense Integration Division is responsible for synchronizing the balanced implementation of Army AMD efforts for the U.S. Army Space and Missile Defense Command commanding general, who serves as the Army's AMD Enterprise Integrator.

These efforts include force planning and sourcing requirements, combat and materiel development, AMD acquisition and lifecycle management, and the orchestration of consistent strategic communication messaging themes among the AMD enterprise consisting of those agencies and organizations who develop, maintain, sustain, train and employ Army AMD assets.

### IMPACT

Army AMD is in the midst of great change, undergoing a huge transformation, and is one of the top five modernization priorities for the Chief of Staff of the Army. As such the CSA routinely requests USASMDC's commanding general's opinion and recommendations on Army AMD issues to shape the direction of this critical combat multiplier.

The AMD Integration Division was initially established under the G-3, then later moved directly under the commanding general to increase direct reporting

responsiveness. In 2019, the Space and Missile Defense Center of Excellence was established within USASMDC, and the decision was made to place the division under the CoE to increase the synchronization and synergy of Army AMD.

The AMD Integration Division now has the ability to execute in-depth coordination with the Strategic Missile Defense U.S. Army Training and Doctrine Command Capability Manager, as well as the missile defense doctrine writers in the Capability Development and Integration Division.

To balance today's operational requirements, while shaping the force and modernization efforts to counter future challenges, the AMD Integration Division led an effort across the AMD enterprise to develop and publish *AMD 2028*. This is a comprehensive strategy, articulating the Army's vision to provide combatant commanders with "a flexible, agile and integrated AMD force capable of executing multi-domain operations and defending the homeland, regional, joint and coalition forces, and critical assets in support of unified land operations."

The AMD Integration Division provides a comprehensive analytical perspective to keep the commanding general informed on Army AMD equities so he can make better recommendations to senior Army leaders.

# Army Space Personnel Development Office

### PURPOSE:

The Army Space Personnel Development Office executes Functional Area 40, or FA40, space operations officer life-cycle management. It ensures officers' skills, experience and education meet operational requirements and career growth aligns training and education requirements to operational needs and career professional development.

The U.S. Army, the largest user of space-based capabilities in the military, formalized an Army space cadre consisting of officers, enlisted and civilian personnel in 2006. The ASPDO conducts strategic planning, ensuring space cadre billets are identified, created and tracked to support space-related missions. Cadre functions include planning, developing, acquiring, integrating and operating space forces, applications and capabilities. ASPDO manages the processing and awarding of the Space Badge and 3Y, Q4 skill identifiers/additional skill identifiers, and S1A personnel development skill identifiers.

### IMPACT

The Army's space cadre, which spans all Army warfighting functions, has documented training and experience in the space domain and conducts daily missions. It is a diverse group with various areas of concentration, including military occupational specialties and occupational series with a common mission to develop, plan, acquire and operate space capabilities to fulfill mission requirements in the five space mission areas of intelligence, surveillance and reconnaissance; missile warning; environmental monitoring; satellite communications; and position, navigation and timing.

As the core of the Army space cadre, FA40s provide in-depth expertise and experience to leverage space-related assets that deliver space capabilities to the warfighter today, as well as develop and integrate space capabilities for the future. ASPDO also manages the Training with Industry and Advanced Civil Schooling programs for FA40s that help develop space officers' experience and skills that augment Army space initiatives.

ASPDO performs FA40 force management to ensure the right skill sets and experience are efficiently applied to



Army advantage as well as in consideration of the desired officer career path.

ASPDO is piloting two Talent Management Task Force initiatives for the Army. First is the Assured Functional Area Transfer initiative. This program gives 10-20 U.S. Military Academy and ROTC cadets, with space-oriented science, technology, engineering and mathematics degrees the opportunity to "branch detail" to FA40. After commissioning, the officers will serve four years in their basic branch, then they are guaranteed to transfer to FA40.

The second initiative is the direct commissioning program. This allows for the direct commissioning of individuals from the civil sector up to the grade of colonel based on constructive credit. These talent initiatives will allow FA40 to continue to acquire necessary talent to maintain a human capital advantage into the future.



The Army Space Personnel Development Office manages the processing and awarding of the Space Badge, Senior Space Badge and Master Space Badge, shown here. (Photo by Carrie David Campbell, USASMDC)



# Center of Excellence laboratories

### PURPOSE

The Space and Missile Defense Center of Excellence operates three major laboratories that support mission accomplishment and provide a test bed for future operations. They are the Simulation Center, or SimCenter, the Cyber Hardening Integration Lab and the Joint Air Defense Operations Center Developmental Laboratory.

### IMPACT

The SimCenter serves as one of the U.S. Army Space and Missile Defense Command major research and development facilities for space and missile defense research design and analysis of complex missile defense systems with state-of-the-art computational, modeling and simulation resources. The center provides services to the Missile Defense Agency and its program elements, the High Performance Computing Modernization Program and other joint activities. The SimCenter also offers local and remote organizations with large-scale computational assets and access to high-performance Department of Defense networks to meet customer mission requirements. The SimCenter provides the most appropriate hardware, software, network and communications tools and environments for each user program; the engineering services required to acquire and integrate cost- and mission-effective computer architectures for user programs; and a secure, cost-effective computing environment that optimizes resources for analysis tasks common to the USASMDC community.

The Cyber Hardening Integration Lab provides an environment in which systems can be replicated in a secure enclave and assessed against a comprehensive suite of cyber threats to determine mission resiliency against such threats. The CHIL team can determine if vulnerabilities exist; how those vulnerabilities impact a system's mission; and what can be done to mitigate, or



Bob Hill, left, and Charlie Wilcox discuss a server in the Space and Missile Defense Center of Excellence Simulation Center, one of the CoE's three major labs that support mission accomplishment and provide a test bed for future operations. (Photo by Carrie David Campbell, USASMDC)

even negate, the impact. Accordingly, the process provides for fixes of vulnerabilities before they ever show up in the "real" system. Although systems under assessment in the CHIL are operating in a virtual environment, the system components are not virtual but replicated hardware versions of the operational systems. As such, they are mirror images and respond exactly the same. This has the advantage over simulations, in that vulnerabilities in the assessments are the same as would happen in the operational systems, and, most importantly, fixes in the CHIL work exactly the same in the actual systems.

The Joint Air Defense Operations Center Developmental Laboratory provides a live test environment for the battle-management systems employed by the National Capital Region Integrated Air Defense System. The purpose is to enable effective integration of U.S. Army ground-based air defense capabilities into the North American Aerospace Defense Command air sovereignty systems that control the air defense of the homeland mission. The lab communications systems enable connectivity with distributed test assets across the continental U.S. so that Army and Air Force system program offices can assess the capabilities of all new systems or component upgrades to operate effectively as a systems of systems.



# Center of Excellence designation aligns USASMDC capabilities with Army structure

Staff Sgt. Daniel Romero, instructor at the Space and Missile Defense School, right, provides a demonstration of the Joint Tactical Ground Station system to a student attending the JTAGS Operators Course in June 2018 in Colorado Springs, Colorado. The course provides an understanding of JTAGS processes, procedures and equipment. (Photo by Dottie K. White, USASMDC)



In August 2019, the U.S. Army Space and Missile Defense Command's Future Warfare Center was designated as the Space and Missile Defense Center of Excellence, or SMDCoE.

The recognition as an Army Center of Excellence places the CoE on an equal footing with other Army centers of excellence, which will facilitate its activities across the Army, and better encompasses the activities and functions the SMDCoE performs for the Army.

The CoE now becomes the Army's force modernization proponent, responsible for managing Army change to doctrine, organization, training, materiel, leadership and education, personnel, facilities and policy, or DOTMLPF-P, requirements for space, global ballistic missile defense and high altitude capabilities within the Army.

The CoE drives change to current force focused on combat ready forces and capabilities. This effort is balanced with a constant view to the future by preparing or adopting leap-ahead concepts or technology through innovative solutions. Components of the organization include the U.S.

Army Space Personnel Development Office, Capability Development and Integration Directorate, the U.S. Army Space and Missile Defense School and the Air and Missile Defense Integration Division.

The CoE's mission also includes training, educating and developing world-class, highly skilled space and missile defense professionals supporting Army and joint operations at the strategic, operational and tactical levels. The CoE is also the personnel proponent responsible for life-cycle management of Army space operations officers, also known as Functional Area 40, or FA40, officers.

In addition, the AMD Integration Division initially established under the command's G-3 was moved to the CoE to increase the synchronization and synergy of Army AMD.

This change reflects the increasing importance of USASMDC's unique mission set to the Army. In today's multi-domain environment, the value of space and missile defense cannot be overstated, and the team will continue to provide warfighting advantage to the Army and joint force through the CoE.





The U.S. Army Space and Missile Defense Command provides support to NASA with an Army astronaut detachment assigned to the Johnson Space Center in Houston, Texas.

There are currently three astronauts. Col. Andrew Morgan, detachment commander, and Lt. Col. Anne McClain were both selected for the astronaut program in 2013, and Lt. Col. Frank Rubio was selected in 2017, joining the detachment as an astronaut candidate that August.

USASMDC astronauts serve as part of the flight crew for NASA space programs. The command’s astronaut detachment provides engineering expertise for human interface with space systems, and provides focus to NASA for Army space operations. Ultimately, astronauts and detachment personnel enhance the Army’s ability to dominate the battlefield of the 21<sup>st</sup> century by using space capabilities with human space operations support.

Army astronauts help the Army define its requirements for the space program and enhance the Army’s use of space capabilities. These Soldiers are Army ambassadors to NASA and the public.

Army astronauts bring leadership and technical skills to the job. Soldiers are trained to be flexible, technical, operationally focused and good at working in teams.

The Army has been active in space from when the first U.S. satellite, Explorer 1, rode into orbit on an Army Jupiter-C rocket to the boosters that took early American astronauts into space. By the late 1950s, however, much of that responsibility was transferred elsewhere, and the Army’s involvement was not resurrected until the 1980s when the Army again placed a greater emphasis on space capabilities and systems.

Today, the Army astronaut detachment continues to play key roles in manned and unmanned operational space systems for national space programs. Their role ensures space support for Army strategic, operational and tactical operations worldwide, develops space awareness throughout the Army,

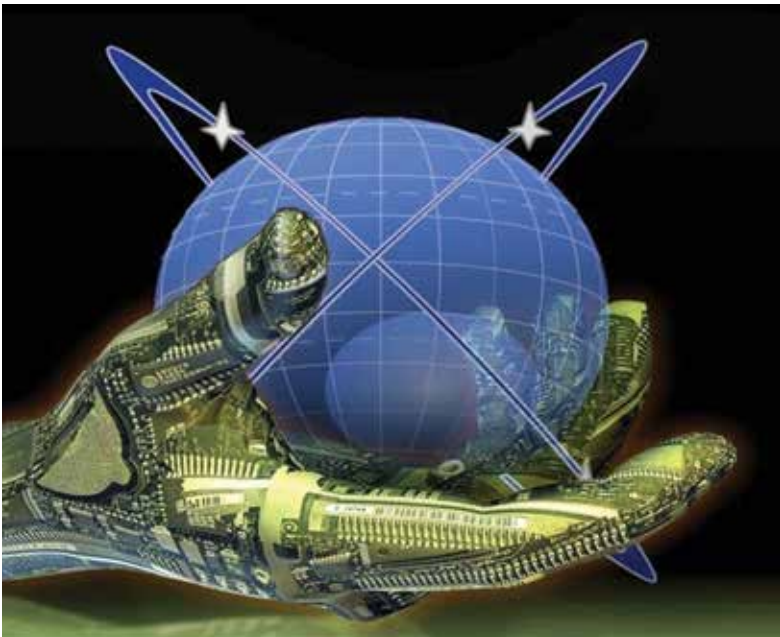
helps to determine requirements for Army space programs and provides operational advocacy for Army space initiatives.

McClain launched aboard the Soyuz MS-11 Dec. 3, 2018, to serve on the International Space Station as a flight engineer for Expedition 58 and 59, returning in June. Morgan launched in July to serve on the International Space Station as a flight engineer for Expedition 60, 61 and 62; he is scheduled to return in March.

There are 16 retired Army officers who have passed through the detachment. Some of them are still serving NASA as civilians.



Army astronaut Col. Andrew Morgan conducts a spacewalk Oct. 6, 2019, at the Port-6 (P6) truss structure worksite to upgrade International Space Station power systems.



The Chief Technology Officer serves as the U.S. Army Space and Missile Defense Command principal adviser for science and technology matters.

PURPOSE

The chief technology officer serves as the scout for the U.S. Army Space and Missile Defense Command’s leadership to uncover potentially game-changing innovations, concepts and technologies to support the command’s missions and enable multi-domain operations.

The CTO, as the principal adviser to the commanding general and the deputy to the commander for science and technology matters, provides timely and relevant near-, mid- and long-term information, planning and resourcing recommendations on science and technology matters.

The CTO accomplishes this by focusing outwardly to the science and technology elements of the Army, other services, combatant commands, joint organizations, other government agencies, industry and academia, looking for the most promising conceptual and technological breakthroughs.

In addition to maintaining awareness of the latest scientific and technological advances from U.S. and ally organizations, the CTO is the primary investigator within the command, gaining insight and awareness of adversary and potential adversary science and technology efforts.

IMPACT

In 2019 the CTO maintained a two-way information highway linking the command to military, industrial and academic science and technology worlds.

In the “receive” mode, by scouring the technological world for promising capabilities, the USASMDC CTO was first to gain access to a promising technology that could bring innovative space launch capability to the Department of Defense.

In the “transmit” mode, numerous outside entities looking for expertise in providing space support to the ground warfighter turned to the CTO. Examples include: the U.S. Army Futures Command’s Mad Scientist organization, the Physics Department at the U.S. Military Academy, and the combatant command science and technology forums. As a result, these and many other organizations are fully aware of the Army’s space and missile defense needs and are on the lookout for novel ways of meeting them.

The office leads the Redstone Arsenal CTO Roundup, a quarterly meeting for the exploration and collaboration of mutual science and technology interests across all organizations on Redstone Arsenal. By gathering the senior science and technology directors, the CTO Roundup provides a forum for better situational awareness of science and technology efforts across diverse organizations. In 2019 the FBI joined as a full member and hosted the Summer Roundup.

Assessments conducted in 2019 for the commanding general played a major role in forming the new U.S. Army Satellite Operations Brigade, and led to better cybersecurity in the acquisition of the Israeli Iron Dome force protection system.

As the command’s science and technology scout, the CTO will continue to work closely with internal and external organizations to ensure that U.S. warfighters have the game-changing technologies needed to accomplish any mission quickly and return home safely.





## DOING BUSINESS WITH THE COMMAND

The U.S. Army Space and Missile Defense Command has a robust Small Business Program utilizing small businesses of all types in its acquisitions that include small business, small disadvantaged business, service-disabled veteran-owned small business, women-owned small business, and historically underutilized business zone small business concerns.

The USASMDC Office of Small Business Programs ensures small businesses are provided the maximum opportunity to be included in USASMDC's complex procurements in the areas of space, missile defense, directed energy, hypersonic, high altitude, cyber and other related research and development technologies. Support of the small business program is good for the nation and helps build a strong industrial base necessary to provide warfighters the defense products and services they need. Supporting the Department of the Army's commitment to small business is a team effort throughout the command.

## DOING BUSINESS WITH THE FEDERAL GOVERNMENT

A newly formed business can access the Small Business Administration and various U.S. Army websites for information about the basic requirements that must be in place before competing for government contracts. Another source of information for new businesses is the Procurement Technical Assistance Center: <http://www.aptac-us.org>.

The following information can be used as a guide to doing business with USASMDC:

1. Research USASMDC before making contact. The command, like many Army activities, maintains its own website: <http://www.smdc.army.mil>. The USASMDC Small Business Program, found under the Resources tab, contains a Business Opportunity link with forecasting/planning information.
2. Ensure profile information is current and accurate in the System for Award Management <https://www.sam.gov/SAM/> and verify registration has not expired. Verify all relevant North American Industry

Classification System, commonly referred to as NAICS, codes, business size/revenue representation and socioeconomic status are correct.

3. Review the business profile in the Small Business Administration Dynamic Small Business Search: [http://dsbs.sba.gov/dsbs/search/dsp\\_dsbs.cfm](http://dsbs.sba.gov/dsbs/search/dsp_dsbs.cfm). Ensure this information is consistent with what is in the System for Award Management. Fields in this database that assist in market research include keywords, capabilities narrative, special equipment/materials and performance history.
4. Confirm the business website for public access is consistent with information posted in System for Award Management and Dynamic Small Business Search.
5. Prepare to meet with the USASMDC Small Business Office. Meetings can be either in person or by phone. Have business capabilities that are in line with USASMDC requirements ready for discussion. Be prepared with business history, prime and/or subcontractor interests, and any unique capabilities. Ask about current contracting vehicles and how to locate upcoming opportunities.
6. Monitor federal business opportunities. Use the website <https://beta.sam.gov/> to monitor sources sought, request for information, and synopsis for upcoming requirements and solicitations notices. This is the single point of entry for the federal government and should be monitored daily. This website is used to publish other events, such as industry day briefings, Advance Planning Briefings to Industry and Procurement Technical Assistance Center events.
7. Seek additional assistance in the defense marketplace. Procurement Technical Assistance Centers: <https://www.aptac-us.org/> are located in most states and are partially funded by the Department of Defense to provide small businesses with information on how to do business with DOD. They provide in-depth counseling on marketing, financial and contracting issues to small business concerns at minimal cost.

Small businesses provide support to the fielding of the Army's 50 kW-class lasers on a platoon of Stryker vehicles. (U.S. Army photo)



8. The Small Business Administration offers assistance through their Small Business Development Centers: <http://www.sba.gov/tools/local-assistance/sbdc>, which can provide aspiring and current small business owners a variety of free business consulting and low-cost training services including: business plan development, manufacturing assistance, financial packaging and lending assistance, exporting and importing support, disaster recovery assistance, procurement and contracting aid, market research help, 8(a) program support and healthcare guidance. Also, get to know the local SBA Procurement Center Representative. He or she can be a valuable resource for staying on top of regulatory updates/changes (such as limitations on subcontracting) and program guidance (such as the SBA All Small Mentor-Protégé Program).
9. Prepare a proposal. Read the solicitation and the performance statement of work carefully. Pay

particular attention to sections L and M of the solicitation. Section L provides instructions, conditions and notices to offerors or respondents. Section M lists the evaluation factors for award. Ensure the submitted proposal meets all of the requirements of the solicitation.

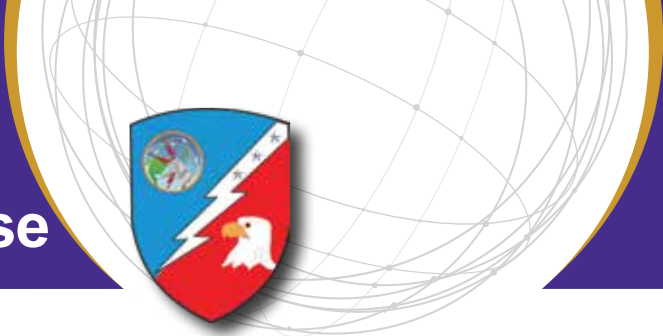
10. Lastly, win a contract....PERFORM....and earn excellent experience.

For more information contact the USASMDC Office of Small Business Programs

ATTN: SMDC-SB  
P.O. Box 1500  
Huntsville, AL 35807-3801  
Phone: (256) 955-3412  
Email: [usarmy.redstone.smdc.mbx.small-business-office@mail.mil](mailto:usarmy.redstone.smdc.mbx.small-business-office@mail.mil)



# Joint Functional Component Command for Integrated Missile Defense



**COL Geoffrey Adams**  
Deputy Commander



**SMSgt Michael List**  
Senior Enlisted Advisor

## PURPOSE

In addition to his U.S. Army Space and Missile Defense Command service component role, Lt. Gen. Daniel Karbler is also the commander of U.S. Strategic Command's Joint Functional Component Command for Integrated Missile Defense.

JFCC IMD synchronizes planning in support of the USSTRATCOM responsibility as the global missile defense coordinating authority. JFCC IMD conducts global missile defense operations support, advocates for and recommends acceptance of missile defense capabilities, and executes joint and combined global missile defense training and education for the USSTRATCOM commander in support of combatant commands, the services and appropriate U.S. government agencies. These efforts deter adversaries, assure allies and defend U.S. deployed forces, allies and partners against missile attacks.

## IMPACT

The command is the recognized subject matter expert across the missile defense enterprise in matters of operational support, policy, strategy, training and education. It anticipates and forcefully advocates for the warfighter's global missile defense requirements through engagement and partnering with the Missile Defense Agency, other governmental agencies, the services, geographic combatant commands, and U.S. allies and partners.

Missile defense is a key part of America's national defense strategy to deter threats; assure allies and partners of its commitment to established security frameworks; and to defend the homeland, deployed forces, friends and allies. It becomes even more important in an environment in which

missile threats continue to proliferate and expand in range and lethality.

As a mission area, global missile defense encompasses missile defense operations, actions and activities that affect more than one geographic combatant commander. This requires synchronization of the affected commands to coordinate effective allocation, deployment and employment of the capabilities necessary to deter, prevent or respond to attacks and to nullify or reduce the effectiveness of a threat.

Given the transregional nature of the threat and the low-density, high-demand nature of missile defense platforms and complex architecture of sensors, shooters, and command and control nodes spanning multiple areas of responsibility, combatant commands designated with responsibility for an adversary problem set must approach missile defense from a global perspective. JFCC IMD provides direct support to these efforts.

The president assigned USSTRATCOM six missile defense-related responsibilities, which are delegated to JFCC IMD. JFCC IMD translates these delegated responsibilities into lines of effort which include:

- Synchronize global missile defense planning, global force management and missile defense security cooperation activities.
- Conduct global missile defense operations support, to include asset management, alternate execution authority, federated intelligence support and network monitoring and protection.
- Execute above element joint and combined global missile defense training, exercises and experimentation.



*A threat-representative intercontinental ballistic missile target launches from the Ronald Reagan Ballistic Missile Defense Test Site on Kwajalein Atoll in the Republic of the Marshall Islands March 25, 2019. It was successfully intercepted by two long-range ground-based interceptors launched from Vandenberg Air Force Base, California, in the first salvo test of GBIs. (U.S. Army photo)*

- Advocate for and recommend acceptance of global missile defense capabilities, conduct analysis and assessments of current and future capabilities, and support tests.

A strong partnership with the services and the material developers ensure advocacy for future requirements, delivery of tested capabilities and informs decision makers during operational acceptance of those capabilities into the architecture. In partnership with geographic combatant commands, JFCC IMD provides expertise to support planning, joint and combined training, resource allocation recommendations and asset management. All of these are key in supporting

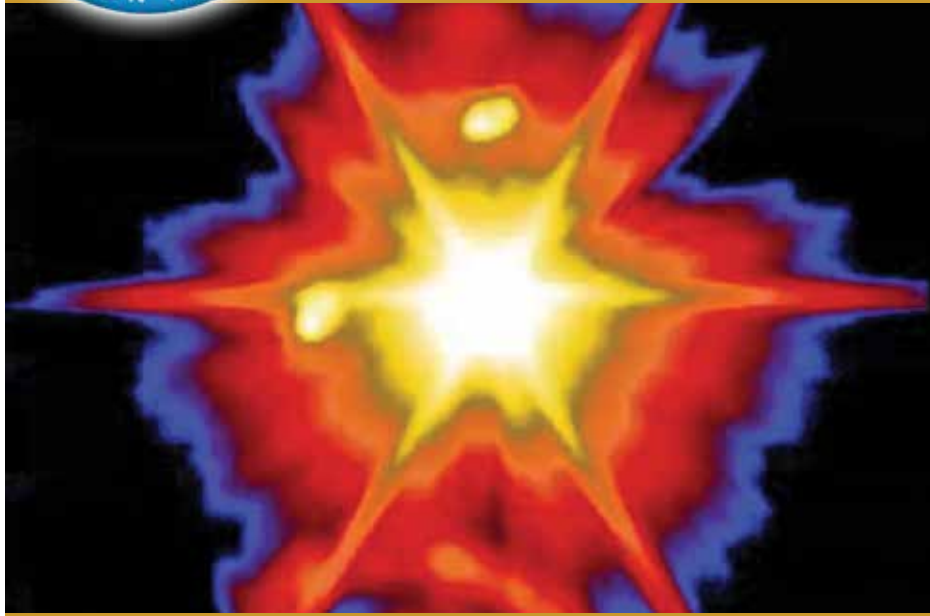
the goal of ensuring U.S. global missile defenses are postured to support U.S. critical defense objectives.

JFCC IMD began operations in January 2005 as one of five original Joint Functional Component Commands. The command includes Army, Navy, Marine Corps and Air Force personnel, as well as U.S. government civilians and contractors. The headquarters is co-located with the Missile Defense Agency in the Missile Defense Integration and Operations Center at Schriever Air Force Base, Colorado. The command's location allows JFCC IMD to leverage MDA's existing infrastructure and ensures a strong partnership with the materiel developer in execution of the command's assigned responsibilities.





## Missile defense flight test makes history



*A threat-representative intercontinental ballistic missile and a ground-based interceptor collide during the first-ever salvo test of the GBIs, March 25, 2019. The ICBM launched from the Ronald Reagan Ballistic Missile Defense Test Site on Kwajalein Atoll in the Republic of the Marshall Islands, and the GBIs launched from Vandenberg Air Force Base, California. (U.S. Army photo)*

The ground-based midcourse defense elements of the ballistic missile defense system provide combatant commanders the capability to engage and destroy intermediate- and long-range ballistic missile threats to protect the United States.

The U.S. Missile Defense Agency in cooperation with the Joint Functional Component Command for Integrated Missile Defense, U.S. Northern Command, and elements of the U.S. Air Force Space Command's 30<sup>th</sup>, 50<sup>th</sup> and 460<sup>th</sup> Space Wings, successfully conducted a live test event of the system against an intercontinental ballistic missile-class target in March 2019, called Flight Test Ground Based Midcourse Defense System-11, or FTG-11. This operational test was the first salvo engagement of a threat-representative ICBM target by two ground-based interceptors.

The threat-representative ICBM target was launched from the Ronald Reagan Ballistic Missile Defense Test Site on Kwajalein Atoll in the Republic of the Marshall Islands, more than 4,000 miles from the two GBIs, which were siloed at Vandenberg Air Force Base, California. During the test, space-, ground- and sea-based BMDS sensors provided real-time target acquisition and tracking data to the command, control, battle management and communication system.

National Guard Soldiers on crew at the 49<sup>th</sup> Missile Defense Battalion at Fort Greely, Alaska, performed the tactical level of the engagement, while the 100<sup>th</sup> Missile Defense Brigade crew at the Missile Defense Element at Schriever Air Force Base, Colorado, provided operational overwatch.

The two GBIs were then launched. The first GBI and the Exoatmospheric Kill Vehicles successfully engaged the target complex then correctly identified and destroyed the lethal reentry vehicle. The second GBI then looked at the resulting debris and remaining objects. Not finding another lethal reentry vehicle, GBI #2 EKV selected the next 'most lethal object' and struck that, precisely as designed.

"This was the first GBI salvo intercept of a complex, threat-representative ICBM target, and it was a critical milestone," said Lt. Gen. Samuel Greaves, former MDA director. "The system worked exactly as it was designed to do, and the results of this test provide evidence of the practicable use of the salvo doctrine within missile defense. The Ground-based Midcourse Defense System is vitally important to the defense of our homeland, and this test demonstrates that we have a capable, credible deterrent against a very real threat."



## U.S. Army Space and Missile Defense Command

### KEY CONTACTS

#### REDSTONE ARSENAL

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