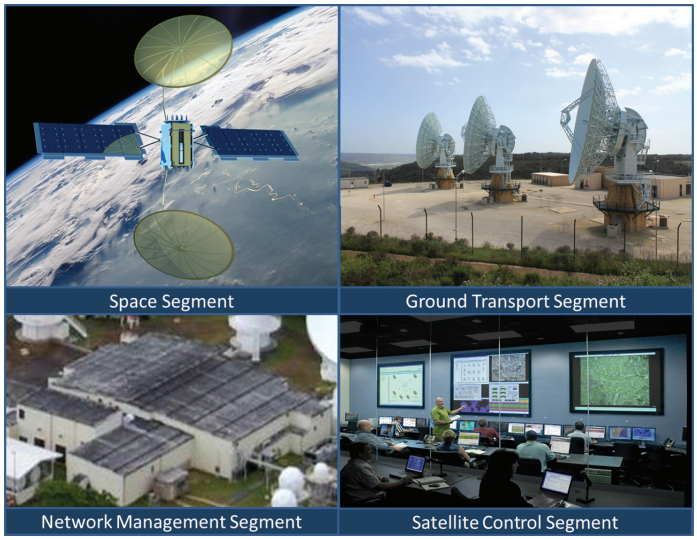
Mobile User Objective System (MUOS)

Executive Summary

- The Mobile User Objective System (MUOS) Program Office conducted five Developmental Test Assist (DTA) events with the Navy's Operational Test and Evaluation Force (OPTEVFOR) and DOT&E observation. The DTA events demonstrated new capability and system improvements made since the previous FY16 Multi-Service Operational Test and Evaluation (MOT&E-2), when DOT&E assessed MUOS as not effective, not suitable, and not cyber-secure.
- The U.S. Army Space and Missile Defense Command/ Army Forces Strategic Command (SMDC/ARSTRAT) conducted an operational management exercise from July 16 – 20, 2018, with geographically-dispersed Regional Satellite Communications (SATCOM) Support Centers (RSSC) planners and the MUOS Network Management Facility (NMF) managers in Wahiawa, Hawaii, that exercised and refined help desk operations and system restoral standing operations procedures to improve support for MUOS operational users.
- The Navy plans to conduct Developmental Test Technical Evaluation-3 (TECHEVAL-3) from November 26 through December 21, 2018, followed by an Integrated Test period from January 7 through May 1, 2019, to demonstrate readiness to enter into FOT&E.
- OPTEVFOR plans to conduct the MUOS FOT&E from June 3 through August 15, 2019 with operational users from the Army, Navy, and Marine Corps.

System

- MUOS is a satellite-based communications network designed to provide worldwide, narrowband, beyond line-of-sight, point-to-point, and netted communication services to multi-Service organizations of fixed and mobile terminal users. The Navy designed MUOS to provide 10 times the throughput capacity of the current narrowband satellite communications. The Navy intends for MUOS to provide increased levels of system availability over the current constellation of ultrahigh frequency (UHF) Follow-On satellites and to improve availability for small, disadvantaged terminals.
- MUOS consists of six segments:
  - The Space Segment consists of four operational satellites and one on-orbit spare. Each satellite hosts two payloads: a legacy communications payload that mimics the capabilities of a single UHF Follow-On satellite and a MUOS communications payload.
  - The Ground Transport Segment is designed to manage MUOS communication services and allocation of radio resources.
  - The Network Management Segment consists of a single NMF designed to manage MUOS ground resources and allow for government-controlled, precedence-based communication planning.
  - The Ground Infrastructure Segment is designed to provide transport of both communications and command and control traffic between MUOS facilities and other communication facilities.
  - The Satellite Control Segment consists of MUOS telemetry, tracking, and commanding facilities at the Naval Satellite Operations Center Headquarters and Detachment Delta.
  - The User Entry Segment provides a MUOS waveform hosted on MUOS-compatible terminals. The Army's Project Manager for Tactical Radios is responsible for developing and fielding MUOS-compatible radios. The Air Force, Navy, and Marine Corps are upgrading legacy UHF radios to be MUOS-compatible.



Mission

Combatant Commanders and U.S. military forces deployed worldwide will use the MUOS satellite communications system to accomplish operational missions, especially those involving highly mobile users. Such missions include major conventional war; regional conflicts; search and rescue; humanitarian or disaster relief; homeland security; and homeland defense.

Major Contractors

- Lockheed Martin Space Systems – Sunnyvale, California
- General Dynamics C4 Systems – Scottsdale, Arizona

Activity

- The MUOS Program Office conducted five DTA events in 2018, with OPTEVFOR and DOT&E observing. The purpose of the DTA events were to demonstrate to the MUOS community that the program has resolved problems found in MOT&E-2 and to build confidence in the system's readiness to enter TECHEVAL-3.
- The MUOS Program Office conducted DTA One (DTA-1) from January 29 through February 2, 2018, at SMDC/ARSTRAT and at RSSC-West on Peterson AFB, Colorado. DTA-1 focused on demonstrating improvements made to the MUOS communications planning and provisioning capability.
- The Navy conducted DTA-2 from March 26 – 28, 2018, at the NMF in Wahiawa, Hawaii. The purpose of DTA-2 was to demonstrate the new Bulk Key-loading Management capability. The Navy designed the capability to provide NMF managers the ability to load several thousand cryptographic keys concurrently from a compact disk, where previously the operator would have to load each key individually.
- The Navy conducted DTA-3 from May 15 – 16, 2018, to demonstrate the Automated Monitoring System – Geolocation Service capability. SMDC/ARSTRAT personnel used this capability to estimate the geographic location of an unknown emitter.
- SMDC/ARSTRAT conducted an Operational Management Exercise from July 16 – 20, 2018, with geographically-dispersed RSSCs and the MUOS NMF managers in Wahiawa, Hawaii, to exercise and refine standard operating procedures for help desk operations and resolving system outages.
- The Navy conducted DTA-4 from July 30 through August 8, 2018, at the MUOS NMF and at the RSSC – Pacific in Hawaii to demonstrate improvements made to the system situational awareness and fault management capabilities.
- The Navy conducted DTA-5 from September 10 – 21, 2018, at the Hawaii ground facility to demonstrate improvements to their cybersecurity posture and readiness to conduct the Cooperative Vulnerability and Penetration Assessment (CVPA).
- The Navy plans to conduct the developmental test TECHEVAL-3 from November 26 through December 21,2018, followed by an Integrated Test period from January 7 through May 1, 2019, to demonstrate readiness to enter into FOT&E.
- OPTEVFOR plans to conduct the MUOS FOT&E from June 3 through August 15, 2019, with operational users from the Army, Navy, and Marine Corps. The Navy cyber team plans to conduct a CVPA in January 2019 and an Adversarial Assessment (AA) in June 2019.
- The Navy conducted all testing in accordance with the DOT&E-approved test plans.

Assessment

- The Navy completed DTA-1 as planned. The system demonstrated improved capabilities compared to the FY16 MOT&E-2. ARSTRAT operators were able to accomplish initial and group provisioning successfully; however, the operators had to sometimes retry provisioning steps due to unexplained application error messages, or screens not fully displaying or properly updating.
- The MUOS NMF managers executed DTA-2 events and performed bulk key management per the program manager's test plan until the NMF managers discovered that the cryptographic key authority had issued them an incorrect version of cryptographic key. Due to the incorrect cryptographic keys, the test was terminated. The incorrect keys prevented the Program Office from being able to validate the cryptographic keys could be correctly sent to and loaded on remote MUOS radios. While the system appeared to work correctly, DOT&E cannot verify it did so without the remote radios communicating with MUOS using the new keys. OPTEVFOR plans to collect additional data during the integrated and operational test periods. The new bulk key-loading capability should reduce the time to load cryptographic keys into the MUOS system from days to minutes.
- The SMDC/ARSTRAT operators successfully completed DTA-3 on May 16, 2018. The testers met all test objectives and used the system to measure geolocation accuracy and timeliness of the system in locating a variety of reference emitters.
- The Navy successfully completed DTA-4 on August 3, 2018. The MUOS NMF managers and RSSC planners were able to demonstrate situational awareness and fault management capability improvements.
- Based on the Operations Management Exercise results, ARSTRAT made significant progress revising their standard operating procedures for help desk operations and resolving system outages. The improvements should result in support that is more responsive to MUOS operational users.
- During DTA-5 the Navy demonstrated an improved cybersecurity posture. The MUOS Program Office is working to mitigate remaining vulnerabilities in preparation for additional cyber testing during FY19 TECHEVAL-3 and the FOT&E.
- OPTEVFOR is on track in their planning to conduct the FY19 operational test. DOT&E approved their test concept on October 3, 2018. OPTEVFOR is developing their operational test plan in preparation for DOT&E approval.

Recommendation

1. The Navy should fix or mitigate cyber vulnerabilities found during DTA-5 and the CVPA in preparation for the AA in 3QFY19.