

## The Mobile User Objective System

Since the launch of the first Ultra High Frequency satellite in 1978, several replacement UHF satellite constellations have been launched as satellites neared the end of their life cycle and to support an increasing demand in UHF tactical communications.

The UHF Follow-On Constellation is the predominant constellation used by our joint warfighters around the globe today. From dismantled Special Operations Forces to the White House Communications Agency, UFO is used to provide reliable beyond line of sight connectivity in support of operations. Even though newer more capable satellites and waveforms improvements have been fielded, the overall narrowband (UHF) satellite architecture has not significantly changed in the past three decades of service.

Over the next few years, we will begin to transition to a truly new and revolutionary UHF waveform and SATCOM architecture called Mobile User Objective System. MUOS will transform the way the Department of Defense, especially the Army, uses the UHF spectrum to support military operations. MUOS is the DoD's next-generation UHF Satellite Communications system. MUOS is a next-generation narrowband tactical satellite communications system designed to significantly improve ground communications for U.S. forces on the move.

When fully deployed, MUOS will consist of four geosynchronous satellites plus an on orbit spare. These four geosynchronous satellites will provide global coverage from 65 Deg N Latitude to 65 Deg S Latitude and their orbits will provide overlapping coverage for more than seventy percent of the area. MUOS is based on a modified 3G cellular technology widely used in our



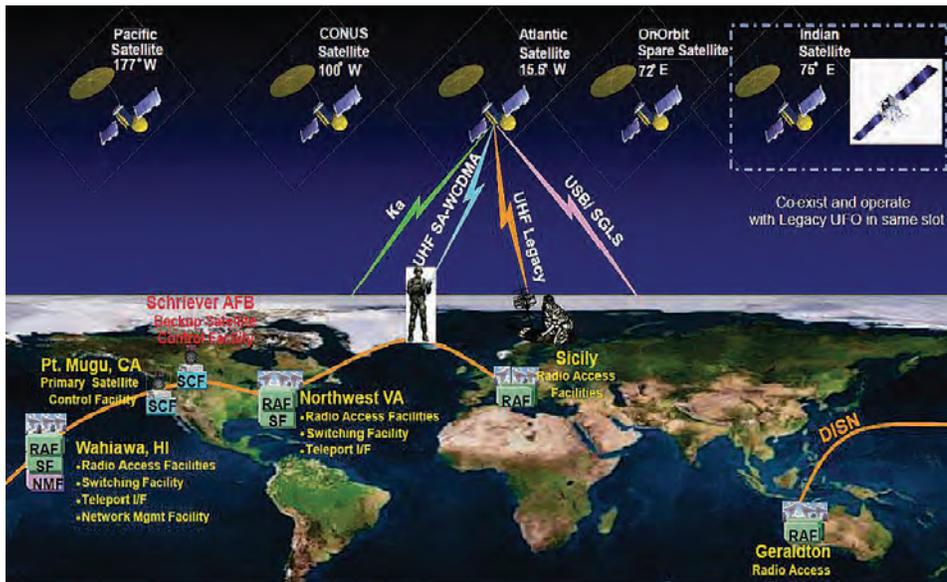
**Atlas V Mobile User Objective System-1 launch, 24 February 2012**

cellular phone systems of today.

There will be four ground stations to control and provision the MUOS system. MUOS operates like a global cellular service provider to support the warfighter with netted communications, cell phone-like capabilities with access to voice and data services provided by Defense Information System Network Internet Protocol based networks. It does this by adapting a Wideband Code Division Multiple Access cellular technology for

use over military UHF spectrum utilizing manpack satellite radio terminals instead of cell phones and geosynchronous satellites in place of cell towers. By operating in this portion of the spectrum, a lower frequency band than that used by conventional terrestrial cellular networks, MUOS provides warfighters the ability to operate in challenging communication environments like forested and urban areas. Users gain access to DISN provided services via gateways at the ground stations. On February 24, 2012 – The MUOS satellite was successfully launched from Cape Canaveral Air Force Station, FL, aboard a United Launch Alliance Atlas V rocket. This first MUOS satellite and associated ground system will provide initial on-orbit capability this year. The second MUOS satellite is scheduled to launch the summer of 2013, with the four-satellite global constellation achieving full operational capability by 2016. In addition to the new capabilities provided by MUOS, each satellite also has a separate legacy UHF communications payload on board to replenish and then extend the life of our current UHF narrowband communications capability until sometime past 2025. The Space and Naval Warfare Systems Command, Program Executive Office Space Systems, Communications Satellite Program Office is the program manager for MUOS.

As shown in the system architecture, there will be four active satellites on orbit around the earth, four Radio Access Facilities, two Switching Facilities – each with connectivity to a teleport, two Satellite Control Facilities and a network management facility positioned to globally support MUOS terminal users. Each MUOS satellite can view two RAFs.



### MUOS Architecture

Each RAF can view two MUOS satellites via Line-of-Sight. All facilities are connected together with high-capacity terrestrial fiber. The two switching facilities route traffic through Defense Information System Agency provided teleport sites to gain access to the Global Information Grid or to the appropriate RAF facility supporting the destination terminal. The RAFs communicate the routed voice and data traffic over Ka frequency band links to the satellites. The satellites then down-convert the signals to the UHF band and transmit them to MUOS-enabled terminals via the UHF downlink.

The Signal Center of Excellence TRADOC Capability Manager for

Tactical Radios is working to bring the first MUOS-enabled terminal to our warfighters. The Joint Tactical Radio System Manpack, the AN/PRC-155, 2-channel man-packable radio will be the first ground terminal to port the MUOS waveform later this year. End-to-End MUOS testing is scheduled to begin in 2014 once the second satellite is launched and operational.

The AN/PRC-155 radio with MUOS will provide mounted and dismounted Soldiers the ability to extend operations to beyond LOS ranges while maintaining communications and situational awareness with their higher headquarters. Terminal is designed to support voice

and data rates up to 64kbps.

The MUOS-enabled tactical radio will support traditional combat nets, point-to-point communication, and point-to-network voice and data services. COL Ralph "Tripp" Higgins, TCM-TR, said "MUOS will be a game changer in terms of narrowband SATCOM capability and capacity for our Soldiers." MUOS will provide ten times the current UHF SATCOM capacity.

It is truly a global system capable of connecting any set of users regardless of their location. MUOS will offer priority-based access for assured voice and data on demand and will improve connectivity in stressed environments such as urban canyons, mountainous, jungle, weather scintillation, and provides Non-Classified Internet Protocol Router, Secret Internet Protocol Router, and Defense Switched Network access to previously disadvantaged users.

As we begin the transition from current UHF SATCOM to MUOS by deploying the system architecture and fielding our first terminal, we will expect other terminals types will certainly emerge so U.S. forces can fully leverage the potential of the game changing tactical satellite communications system known as MUOS.

*Charles Schrader*  
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MUOS Lead

### ACRONYM QuickScan

DISA - Defense Information System Agency  
DISN - Defense Information System Network  
DoD - Department of Defense  
DSN - Defense Switched Network  
GIG - Global Information Grid  
IP - Internet protocol  
JTRS - Joint Tactical Radio System  
LOS - Line of Sight  
MP - Manpack  
MUOS - Mobile User Objective System  
NIPR - Non-Classified Internet Protocol Router  
PEO-Space Systems - Program Executive Office for Space Systems  
RAF - Radio Access Facilities

SATCOM - Satellite Communications  
SCF - Satellite Control Facilities  
SF - Switching Facilities  
SigCoE - U. S. Army Signal Center of Excellence  
SIPR - Secret Internet Protocol Router  
SPAWAR - Space and Naval Warfare Systems Command  
TCM-TR - Capability Manager for Tactical Radios  
TRADOC - U.S. Army Training and Doctrine Command  
UHF - Ultra High Frequency  
UFO - UHF Follow-On Constellation  
WCDMA - Wideband Code Division Multiple Access

## Joint Tactical Radio System Handheld – Manpack – Small Form Fit

The delivery of the JTRS Rifleman and Manpack Radios to the force represents the initial move to connect dismounted Soldiers on the battlefield in a net-centric way that supports the Department of Defense's movement toward network-centric operations and warfare at all tactical levels. It also signifies DOD's continued commitment to support disadvantaged warfighters.

### Rifleman Radio (AN/PRC-154)

The JTRS HMS program's Milestone C Decision held on 17 June 2011 authorized an initial Low Rate Initial Production of 6,250 AN/PRC-154 Rifleman Radios and 100 AN/PRC-155 Manpack radios. On 11 July 2012, the Defense Acquisition Board chaired by Mr. Frank Kendall, Under Secretary of Defense for Acquisition, Technology and Logistics, authorized an additional LRIP of 13,077 AN/PRC-154 Rifleman Radios. It was necessary to approve an additional LRIP to allow time to review the HMS Rifleman Radio Acquisition Strategy and competition plan for Full Rate Production currently planned for 1st Quarter, Fiscal Year 2014. The DAB decision brought the total LRIP to 10% of the total planned procurement of 193,279 Rifleman Radios.

The Army's Capability Set 13

and 14 Infantry Brigade Combat Teams will start receiving Rifleman Radios in October 2012.

### JTRS HMS Manpack Radio (AN/PRC-155)

The JTRS HMS MP Capability Production Document, version 2.4, was approved on 10 May 2012 via Joint Requirements Oversight Council Memorandum 067-12. The approved MP CPD supports test and evaluations and program decisions. In May 2012, the JTRS HMS Manpack Multi-Service Operational Test and Evaluation was conducted as part of the Army's Network Integration Evaluation 12.2 in White Sands Missile Range, NM. Although the HMS Manpack radio provided an operational value as a battalion and below asset capable of providing networked transport capability for Line-Of-Sight and Beyond Line-Of-Sight mission command communications, it failed to demonstrate adequate performance running the Single Channel Ground and Airborne Radio System waveform and fell short of the Manpack CPD reliability requirements. The SINCGARS waveform underwent several software updates immediately following the completion of MOT&E and a Customer Test was held 18-25 June 2012 at WSMR to characterize the SINCGARS range performance.

During the CT the Manpack radio demonstrated its ability to meet the threshold and objective SINCGARS performance requirements and showed significant improvement since MOT&E.

On 26 July 2012, an In-Progress Review DAB was conducted and chaired by USD (AT&L). The purpose of the IPR was to obtain authorization to award a contract for an additional LRIP of 3,984 AN/PRC-155 Manpack radios. The LRIPs will support Follow-on Operational Test and Evaluations and establish an initial production base to enable an orderly ramp to FRP. The DAB did not support the request for additional LRIPs. The DAB requested the Program Manager for HMS (PM-HMS) conduct a third Government Developmental Test and to return to the DAB in October 2012 with the emerging test results. The purpose of GDT 3 is to further prove out the SINCGARS' fixes and establish a greater level of confidence that a large number of the reliability challenges have been addressed appropriately. The GDT 3 will be conducted at the Electronic Proving Ground, Fort Huachuca, Ariz., 17-28 September 2012.

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## ACRONYM QuickScan

<b>AS</b> - Acquisition Strategy	Memorandum
<b>BLOS</b> - Beyond Line of sight	<b>JTRS</b> - Joint Tactical Radio System
<b>CPD</b> - Capability Production Document	<b>LOS</b> - Line of Sight
<b>CS</b> - Capability Set	<b>LRIP</b> - Low Rate Initial Production
<b>CT</b> - Customer Test	<b>MOT&amp;E</b> - Multi-Service Operational Test and Evaluation
<b>DAB</b> - Defense Acquisition Board	<b>RR</b> - Rifleman Radios
<b>FOT&amp;E</b> - Follow-on Operational Test and Evaluations	<b>SINCGARS</b> - Single Channel Ground and Airborne Radio System
<b>FRP</b> - Full Rate Production	<b>USD AT&amp;L</b> - Under Secretary of Defense for Acquisition, Technology and Logistics
<b>GDT3</b> - Government Developmental Test	<b>WSMR</b> - White Sands Missile Range
<b>IBCT</b> - Infantry Brigade Combat Teams	
<b>IPR</b> - In Progress Review	
<b>JROCM</b> - Joint Requirements Oversight Council	