



Program Executive Office
Space Systems (PEO SS)
Navy Communications Satellite Program Office
PMW 146

MUOS Program Update

28 October 2015
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Statement A: Approved for public release, distribution is unlimited (21 October 2015)

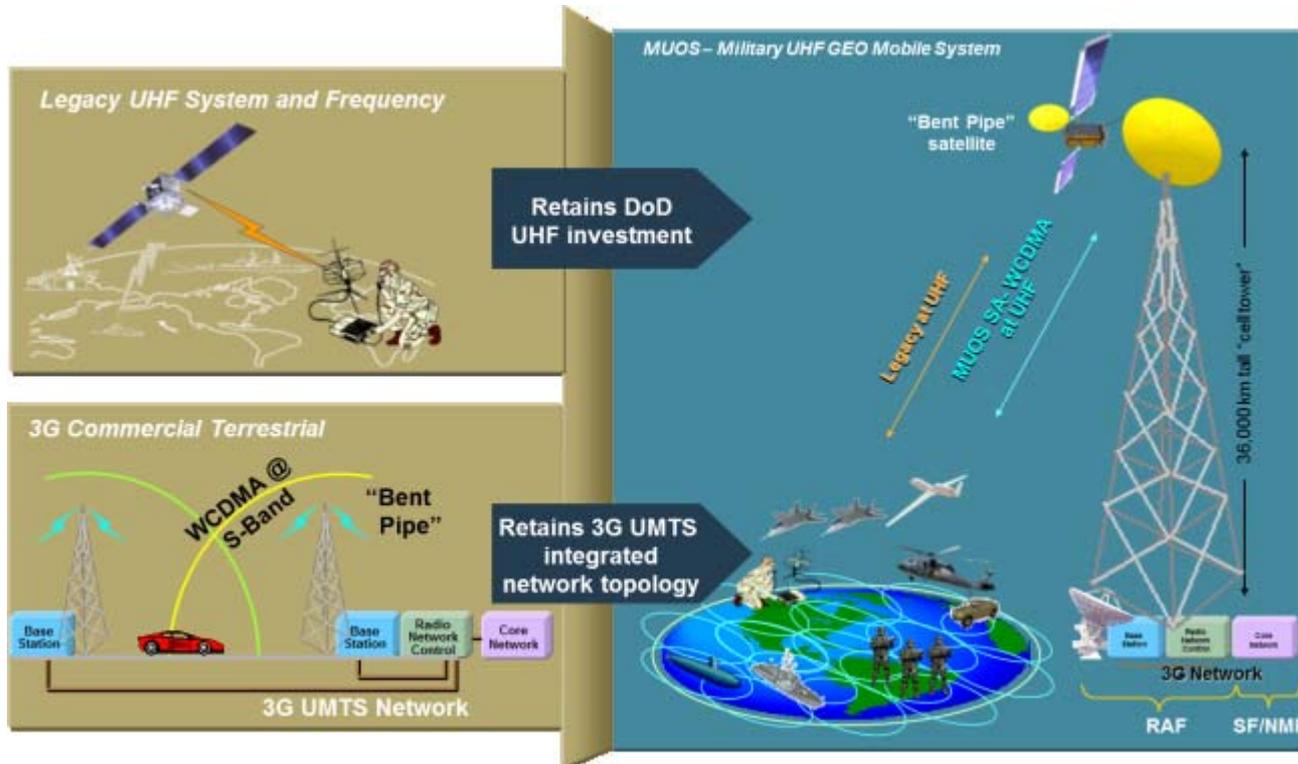
*Space-enabled capabilities for
Naval, Joint and Allied Operations*





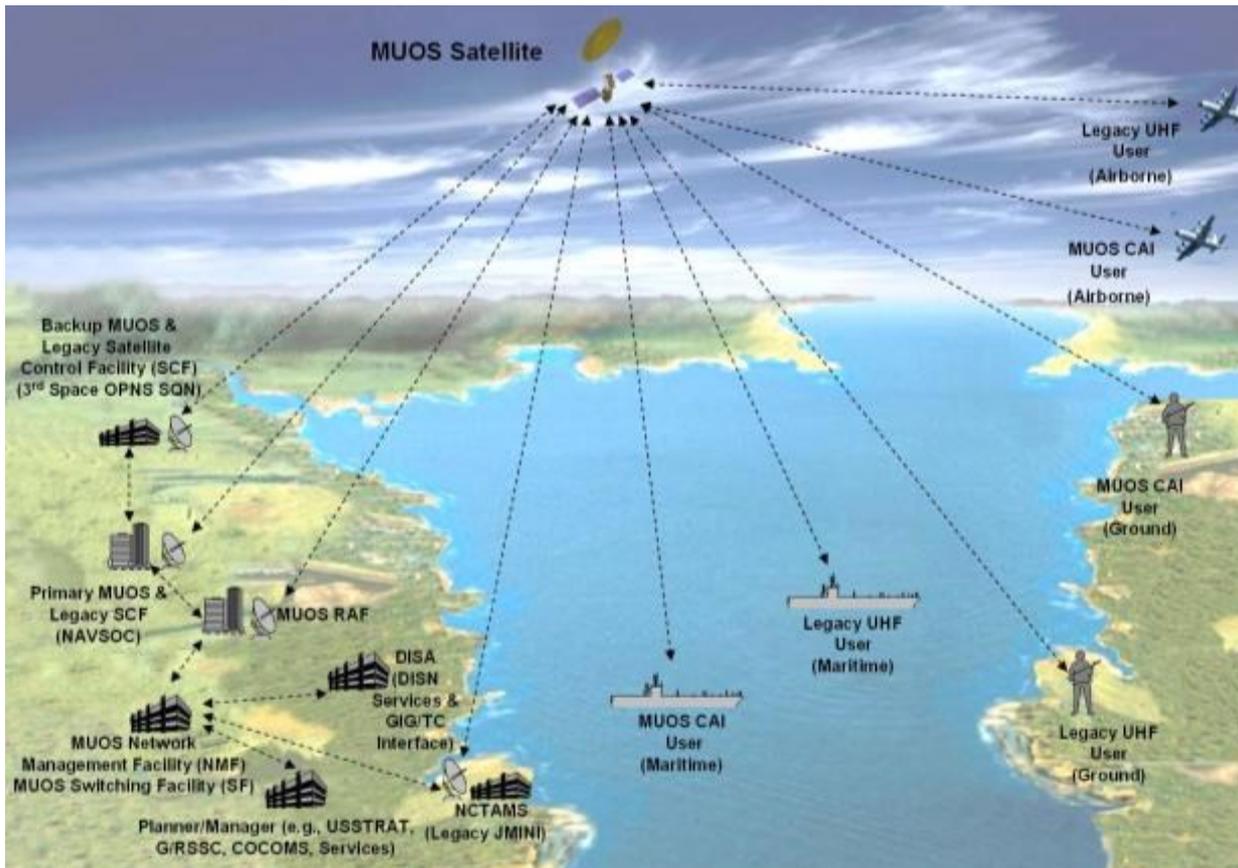
What is MUOS?

- Worldwide communications service with modern cellular-based service capabilities
 - Uses commercial 3G Spectrally Adaptive Wideband Code Division Multiple Access (SA-WCDMA) cellular phone technology with geosynchronous satellites replacing cell towers
 - Interfaces with a DISN via DoD Teleports to provide access to DISN services and integrate with the Global Information Grid (GIG)





MUOS Capabilities

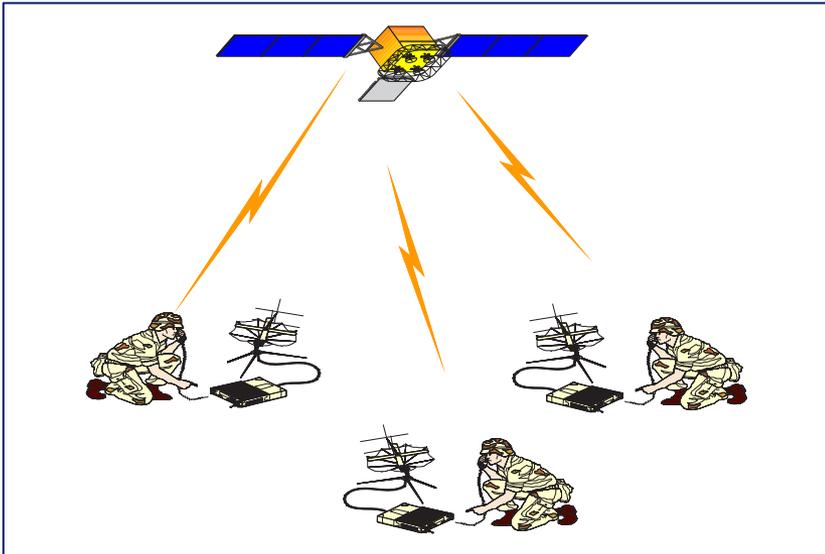


- WCDMA 3G cell phone-like features
- Increased capacity; more than 10X that of UFO
- 24/7 worldwide coverage (65N-65S) Latitude
- All IP architecture
- Priority based access
- Direct access to NIPRNET, SIPRNET and DSN (Internet and Phone)
- Legacy Payload on each satellite

MUOS is the next generation of UHF Tactical SATCOM System

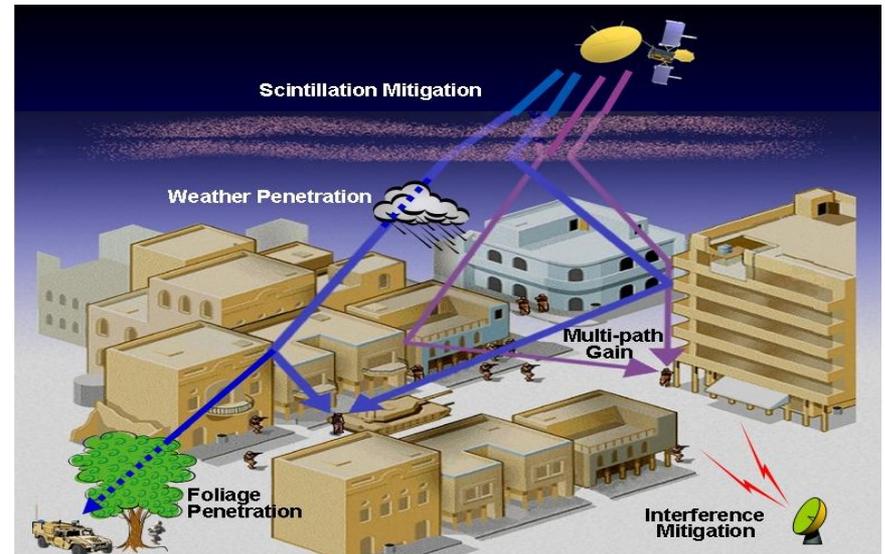


UFO – MUOS Capability Comparison



Legacy UHF SATCOM

1304 2.4kbps accesses,
3.130 Mbps capacity



MUOS

16,332 2.4kbps accesses + 424 Legacy Accesses,
40.216 Mbps capacity

UHF SATCOM Attributes

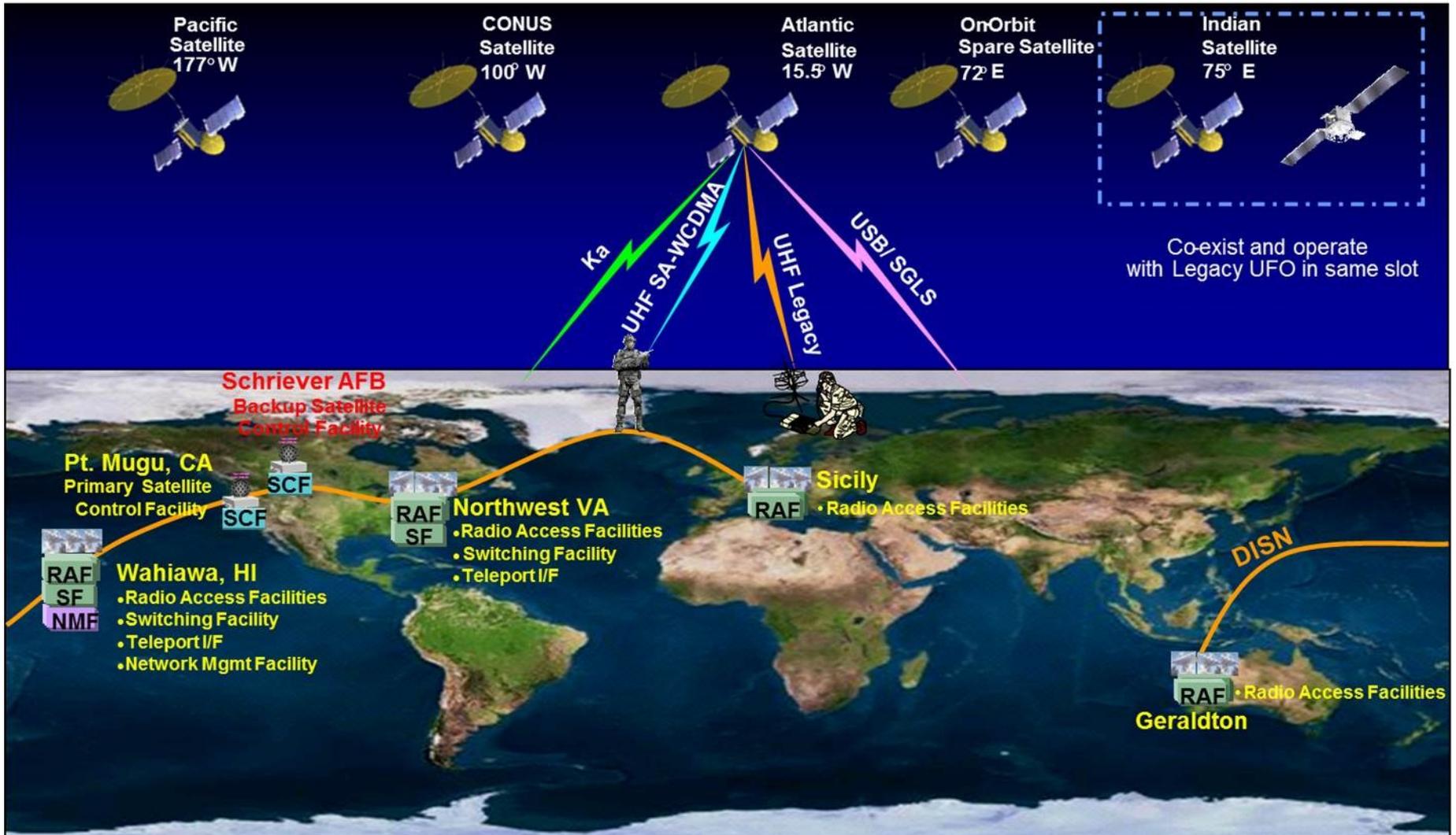
- Small, inexpensive terminals
- Low profile communications footprint
- Weather tolerant

MUOS improvements to legacy

- Increased capacity (spot beams, frequency reuse, spectrally-adaptive waveform)
- Improved comms on the move (link budget)
- Higher Data Rates (2.4 – 384 kbps)
- More resistant to interference
- DSN, SIPRNET, and NIPRNET services
- Supports IP applications



MUOS Architecture





MUOS Spacecraft

MUOS-1 Launched Feb 2012



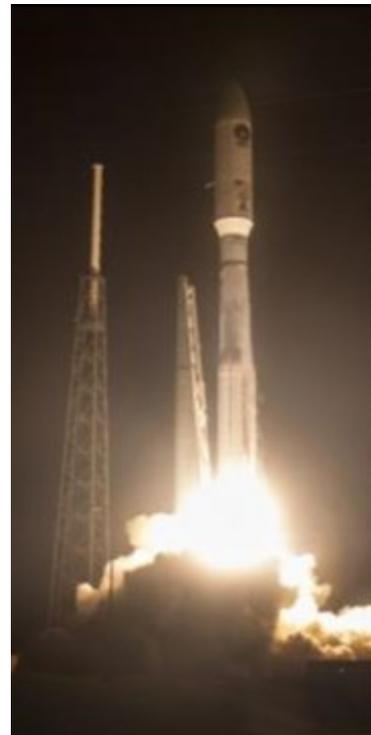
- ✓ Turned over to Navy control in May 2012
- ✓ Supporting Legacy operations in Pacific Slot since Nov 2012

MUOS-2 Launched Jul 2013



- ✓ Turned over to Navy control in Nov 2013
- ✓ Supporting Legacy operations in CONUS Slot since Jul 2014

MUOS-3 Launched Jan 2015



- ✓ On-orbit testing
- ✓ In operational slot over the Atlantic
- Early Legacy Operational use (Jan 2016)

MUOS-4 Launched Sep 2015



- On-orbit testing in progress
- Handover Satellite Control to NAVSOC
- Transit to operational slot over Indian Ocean

MUOS-5 Planned mid 2016



- MUOS-5 Integration & Testing in progress
- Ship to CCAFS in Mar 2016
- Launch planned for Spring 2016



Ground and Satellite Control Sites



Ground



✓ Wahiawa, HI



✓ Chesapeake, VA



✓ Geraldton, Australia



✓ Niscemi, Italy

Satellite Control



✓ NAVSOC HQ, Pt Mugu, CA



✓ NAVSOC Det Delta, CO

Ground Facilities Production is Complete



SoS E2E Integration



- PMW 146 is partnered with U.S. Army to facilitate SoS E2E integration
 - PM TR for MUOS waveform with HMS terminal
 - PM WIN-T for JENM coordination
 - ARSTRAT Narrowband Office for:
 - Terminal Provisioning
 - MIL-STD Conformance Testing
 - Planning MUOS Operational Transition



Terminal Integration & Test

- **MUOS waveform in JTN Information Repository (IR)**
 - Enables radio vendors to develop MUOS capable terminals
 - Available to terminal vendors since Jan 2013
 - 34 organizations have accessed MUOS IR
 - Latest update posted August 2015 (v3.1.4)
 - Engineering release post MOT&E; full update (v3.1.4) Apr 2016
- **MUOS labs are open and hosting terminal vendors**
 - MUOS Ground equipment is government owned in Sunnyvale and Scottsdale contractor lab facilities
 - Consistent industry activity since Spring 2014
- **MUOS MIL-STD (188-187) published Jan 2015**
 - Facilitates MUOS Terminal Certification (ARSTRAT purview)
 - Navy is the MIL-STD Conformance Test Agent
 - Certification procedures are in development with terminal industry input
- **Over-The-Air Testing**
 - Supporting vendor terminal development by testing in realistic operational environment
 - Demonstrations performed for military sponsors
 - US NORTHERN Command: Arctic Shield 2014
 - USAF: C-17, Operation Deep Freeze
 - NSWC Operational Scenario Test
 - PACOM Operation Deep Freeze (Antarctica)
 - IBS Demos (1 & 2)
 - NDI Demo (PRC 117G SOCOM, NECC, ACC)
 - USCGC HEALEY Demo 2015

Manpacks



General Dynamics
AN/PRC 155



Harris
AN/PRC-117G

Ship/Sub/Fixed Site



General Dynamics
AN/USC-61C (DMR)

Airborne

Helos



Raytheon
AN/ARC-231

Fixed Wing



Rockwell Collins
AN/ARC 210



Northrop Grumman
Freedom 450



MUOS Demonstrations



NORTHCOM 2014/2015

- Exercised MUOS services beyond 65° N&S design specification (85°09"N) across geographically disparate locations: Arctic Ocean, Alert Canada, JTF-AK, NORTHCOM HQ & San Diego, CA.



Air Force C-17 MUOS Risk Reduction

- Demonstrated interoperability between two different MUOS radios (PRC-155 & ARC-210)
- First continuous real-time aircraft mission data link to AMC HQ.



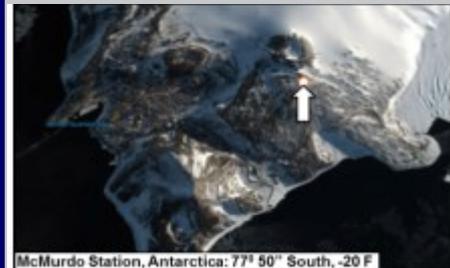
NSWC Operational Scenario Test

- Operational military personnel conducted planning, provisioning and executed operationally relevant scenarios utilizing MUOS radios.



PACOM Operation Deep Freeze

- Demonstrated simultaneous MUOS voice & data comms between McMurdo Station Antarctica 77°50"S, NSF HQ Christchurch NZ, SSC Lab, San Diego and in flight C-17 sorties.





Vision Going Forward



- Widespread availability of MUOS capable terminals
 - Multiple platforms (Handheld, Aircraft, etc.)
- Narrowband SATCOM interoperability between terminal types and warfighter partners
 - Legacy, WCDMA, and Coalition Partners
- Transition from legacy UHF SATCOM to MUOS WCDMA communications
 - Meeting warfighter needs into the future



How Can Industry Help?

- **End-User Applications for MUOS**
 - Develop, Integrate, and verify existing / new applications for MUOS capable terminals
 - Provide concepts for a “store-front” of authorized MUOS applications
- **Industry Use Consortia**
 - Share knowledge on MUOS use and CONOPS
 - Application developers, terminal makers, providers of ancillaries and tools
 - Information Assurance , key management, provisioning
 - Collaborate on guidelines for uniform terminal presentation (e.g. icons) for MUOS Human Machine Interface (HMI) indicators
 - Provide feedback on common solutions/enhancements to improve MUOS
- **Preparing Terminals for Operation**
 - Support technical needs for deploying terminals
 - Over-the-air terminal integration, testing, demos, and platform integration



Summary

- MUOS Program
 - MUOS-1 providing Legacy UHF SATCOM service since Nov 2012
 - MUOS-2 providing Legacy UHF SATCOM service since Jul 2014
 - MUOS-3 launched 20 Jan 2015; in operational position 1 Aug 2015
 - MUOS-4 launched 2 Sep 2015; On-Orbit testing in progress
 - MUOS-5 on track for launch in Spring 2016
 - Ground system and Waveform complete
 - Multi-Service Operational Test and Evaluation in progress
- End-to End (E2E) Integration in partnership with U.S. Army
 - MUOS waveform and HMS Terminal
 - Lab facilities for terminal development, test and certification
 - E2E capability demonstrations
- MUOS Operations
 - MUOS Legacy payloads are operational today
 - WCDMA operations planned to begin in 2016

MUOS will provide a significant increase in Narrowband communication capability



**We influence, develop,
integrate, and maintain
space-enabled capabilities
for Naval, Joint
and Allied operations.**