

# Navy Communications Satellite Program Office (PMW 146)



## Mobile User Objective System (MUOS)

Statement A: Approved for public release;  
distribution is unlimited (8 February 2012)

PMW-146-D-12-0011

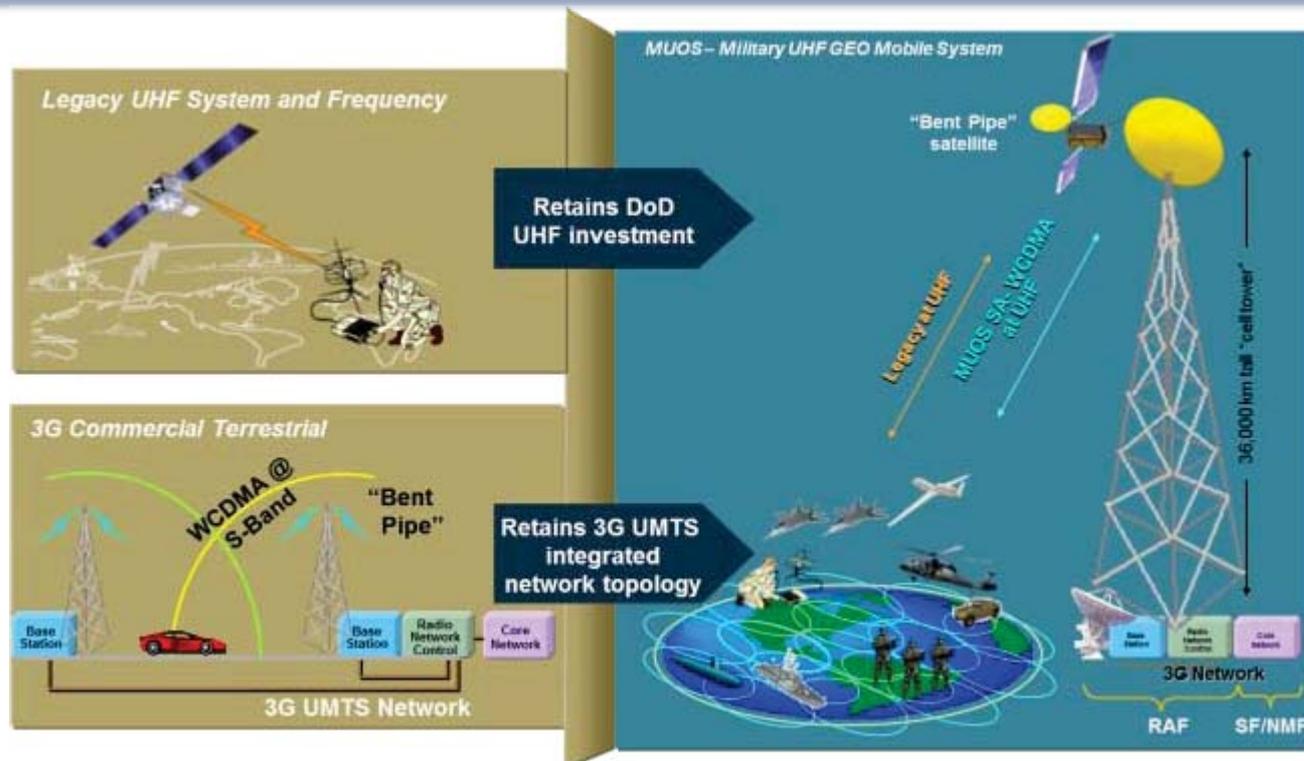
CAPT Paul Ghysel  
Program Manager

# What is MUOS?

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MUOS

- **Worldwide communications service provider 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 GIG and Transformational Communications Architecture**

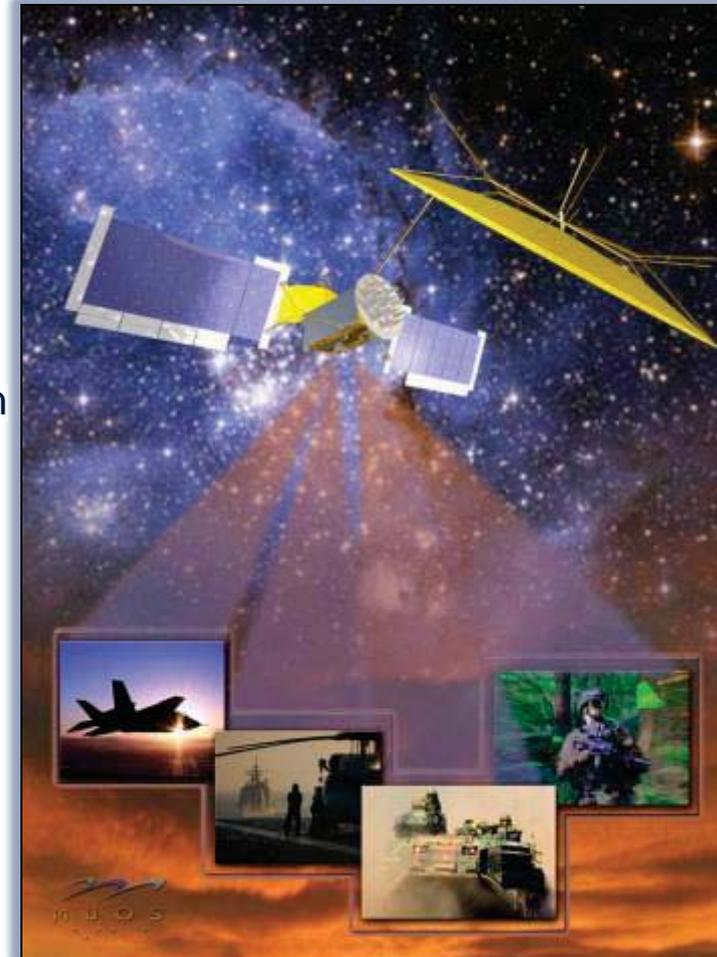


# MUOS – Enabling Capabilities

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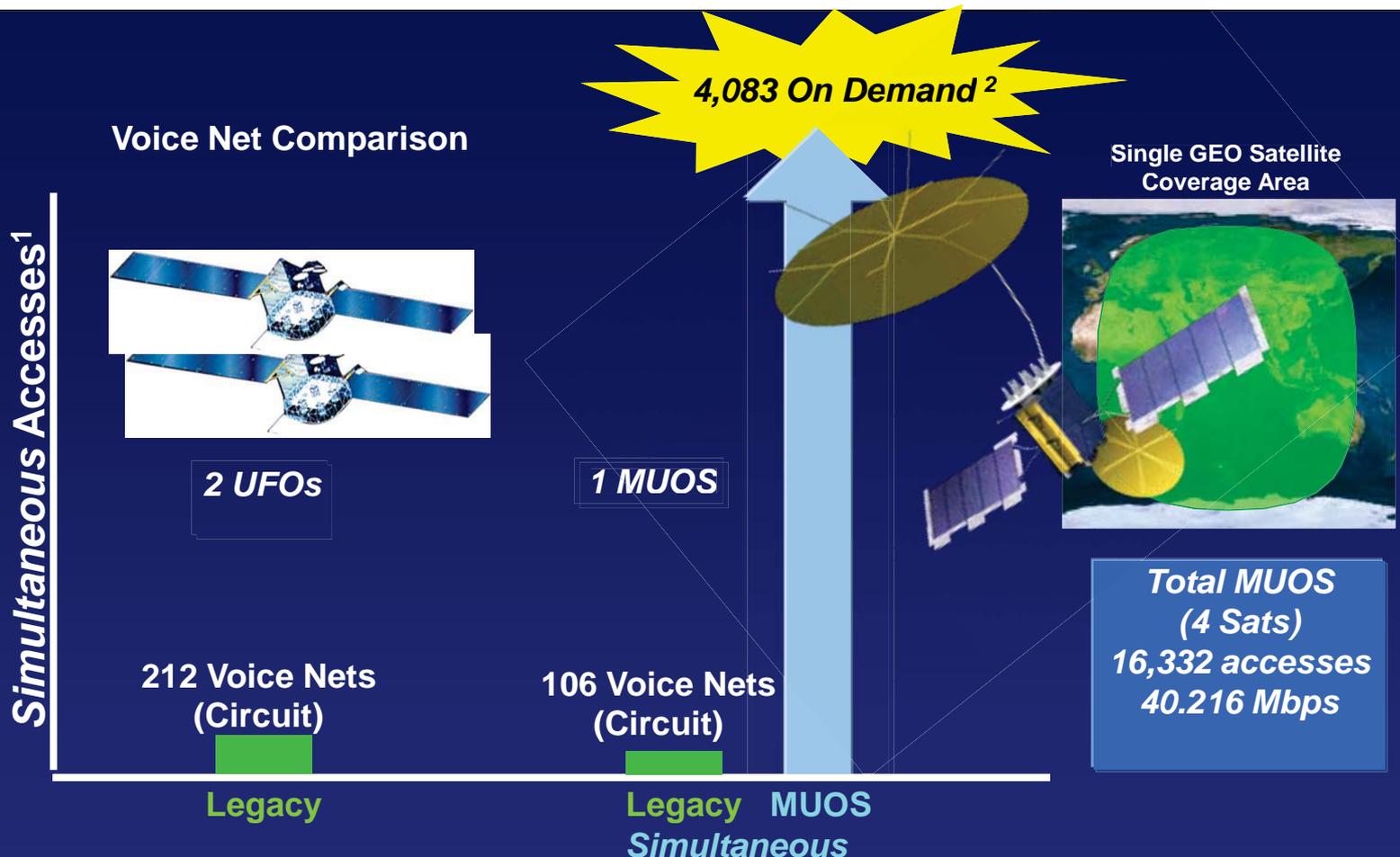
MUOS

- **Beyond-Line-of-Site, Communications-On-the-Move to the soldier on the ground**
  - Focus on usability
  - >10X current UHF SATCOM capacity
- **Global communications**
  - Connect any set of users, regardless of location
  - Priority-based access to voice, data, and video, on demand
- **Improved Connectivity in stressed environments**
  - Urban Canyon, Mountain, Jungle, Weather, Scintillation
- **“Bandwidth on Demand” architecture**
  - Future upgradeable, “smarts” are on the ground
  - GIG Accessibility (NIPR, SIPR, DISN)



***MUOS will enable Net-Centric use of UHF SATCOM***

# Transforming Narrowband SATCOM



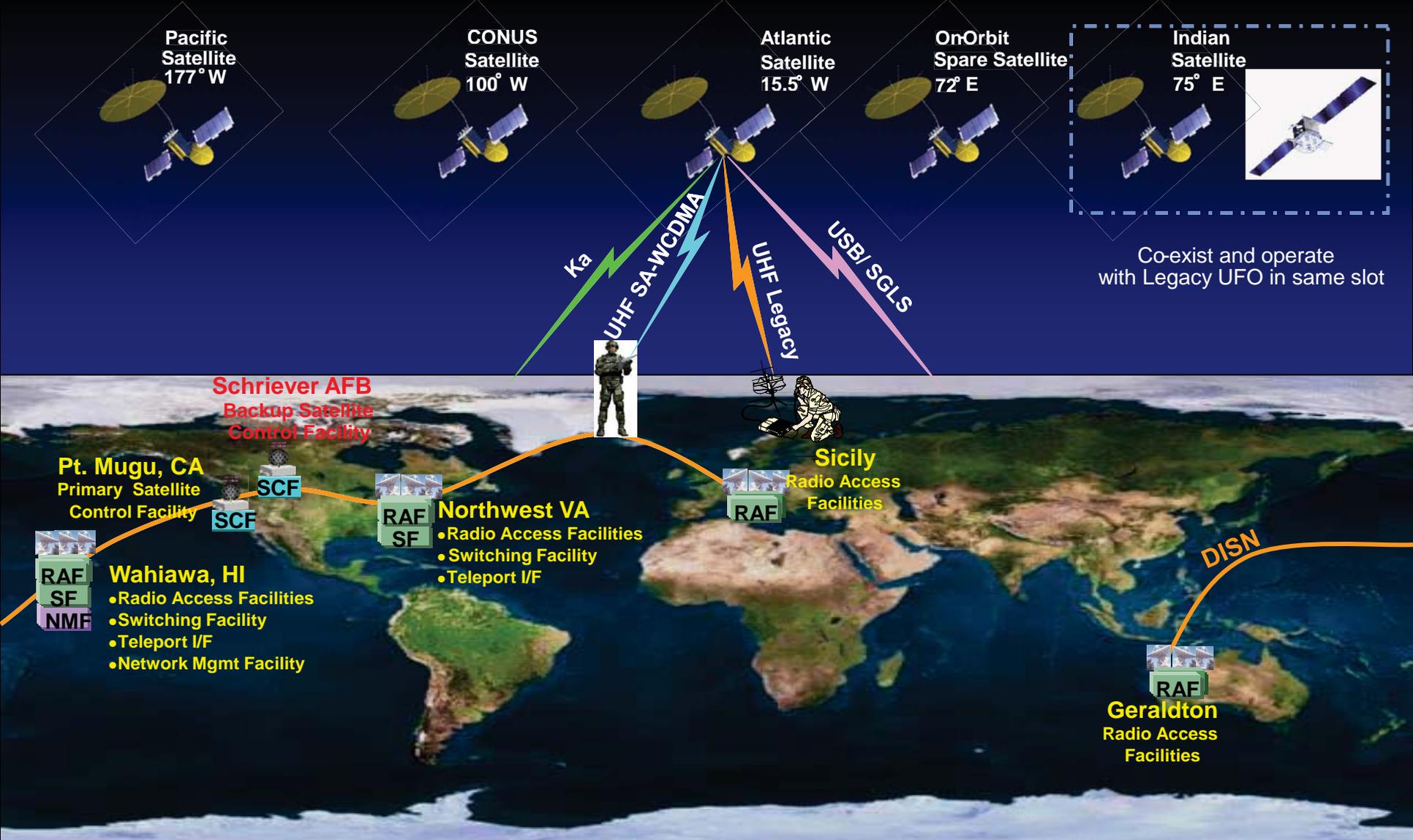
<sup>1</sup>Normalized to 2.4 kbps voice accesses for comparison. Fewer accesses at higher data rates  
<sup>2</sup>Netted Voice, point to point, broadcast, or data

**Leap Forward.....By leveraging 3G cellular technology!**

# MUOS Architecture

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# Spacecraft Status

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- **Satellite #1**
  - Final launch preps in progress
  - Scheduled for launch Feb 2012



Payload Encapsulation

- **Satellite #2**
  - Thermal Vacuum (TVAC) testing in progress
  - Launch slot projection July 2013



TVAC Preparation

- **Satellites #3, #4, and #5 on track for deliveries in FYs 13, 14, and 15**

# Ground Status

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- **Ground System**

- Build 1: Satellite command and control completed
  - Used for Satellite #1 launch
- Build 2: WCDMA code and unit test completed, made first end-to-end call; Factory Acceptance Testing complete
- Build 3: Completed Factory Acceptance Testing in Sept 2011

- **Software Build Descriptions**

- **Build 1:** Satellite control, Legacy point-to-point and netted communications, minor network management functionality (ET failover and hardware fault connection/reporting)
- **Build 2:** Complete Satellite control, Legacy point-to-point and netted comms
- **Build 3:** Full MUOS point-to-point and group communications with cover, spectrum adaptation, geolocation, comm planning, key management, full network and operations management, congestion management, and access to DSN/SIPRNET



**Successful N2N2 Test**



**MUOS Ground Site Wahiawa, Hawaii**

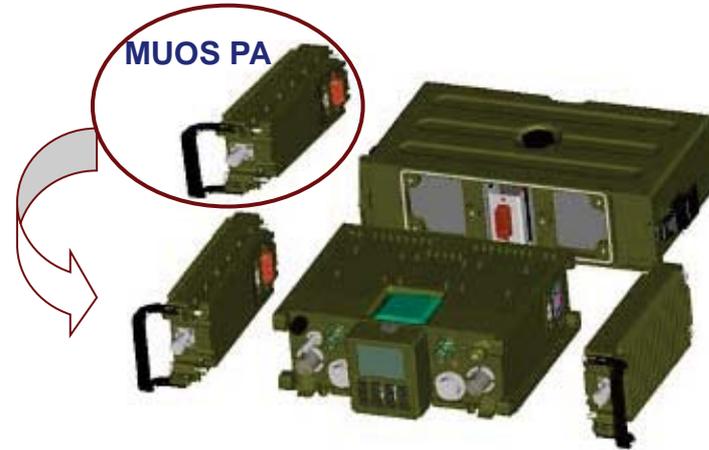
# Waveform Status

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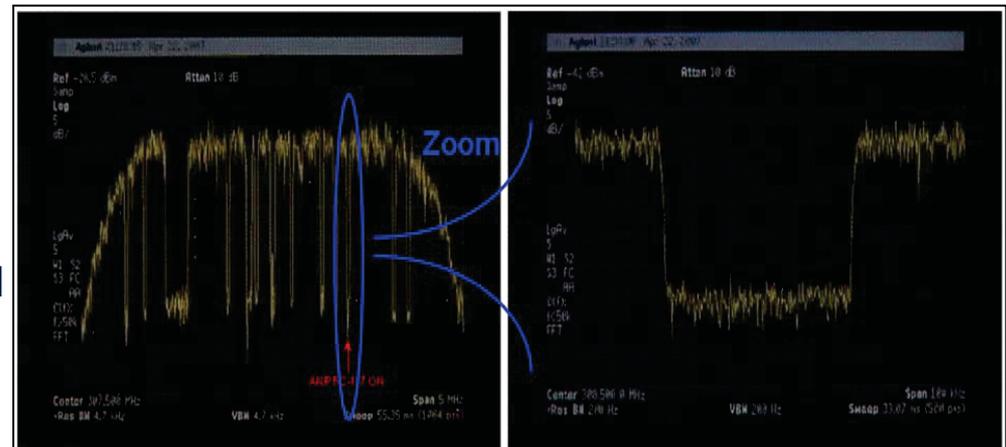
- **Waveforms**

- Waveform initial integration with ground complete, v1.2 delivered to JTRS Information Repository (IR) May 2009
- WF v1.3 FQT completed May 2011 and delivered to IR (Black only) in Jan 2012
- WF v3.1 FQT schedule under review



- **Spectrum Certification Status**

- Obtained Stage 3 certification for MUOS SA-WCDMA in Sep 2007
- Satellite Stage 4 Frequency Allocation preliminary approval
- JTRS Stage 3 requests submitted Spring 2011



# Launch Vehicles

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- **MUOS will use United Launch Alliance (ULA) Atlas V rocket procured through USAF as part of the Evolved Expendable Launch Vehicle (EELV) Program**
  - Atlas V combines best practices from Atlas and Titan programs
  - Single-stage main engine (Russian RD-180, and Common Core Booster with five strap-on solid rocket boosters)
    - CCB is 12.5 ft. in diameter by 106.6 ft. long and uses 627,105 lbs. of liquid oxygen and RP-1 rocket fuel propellants
    - 5.4-meter diameter payload fairing

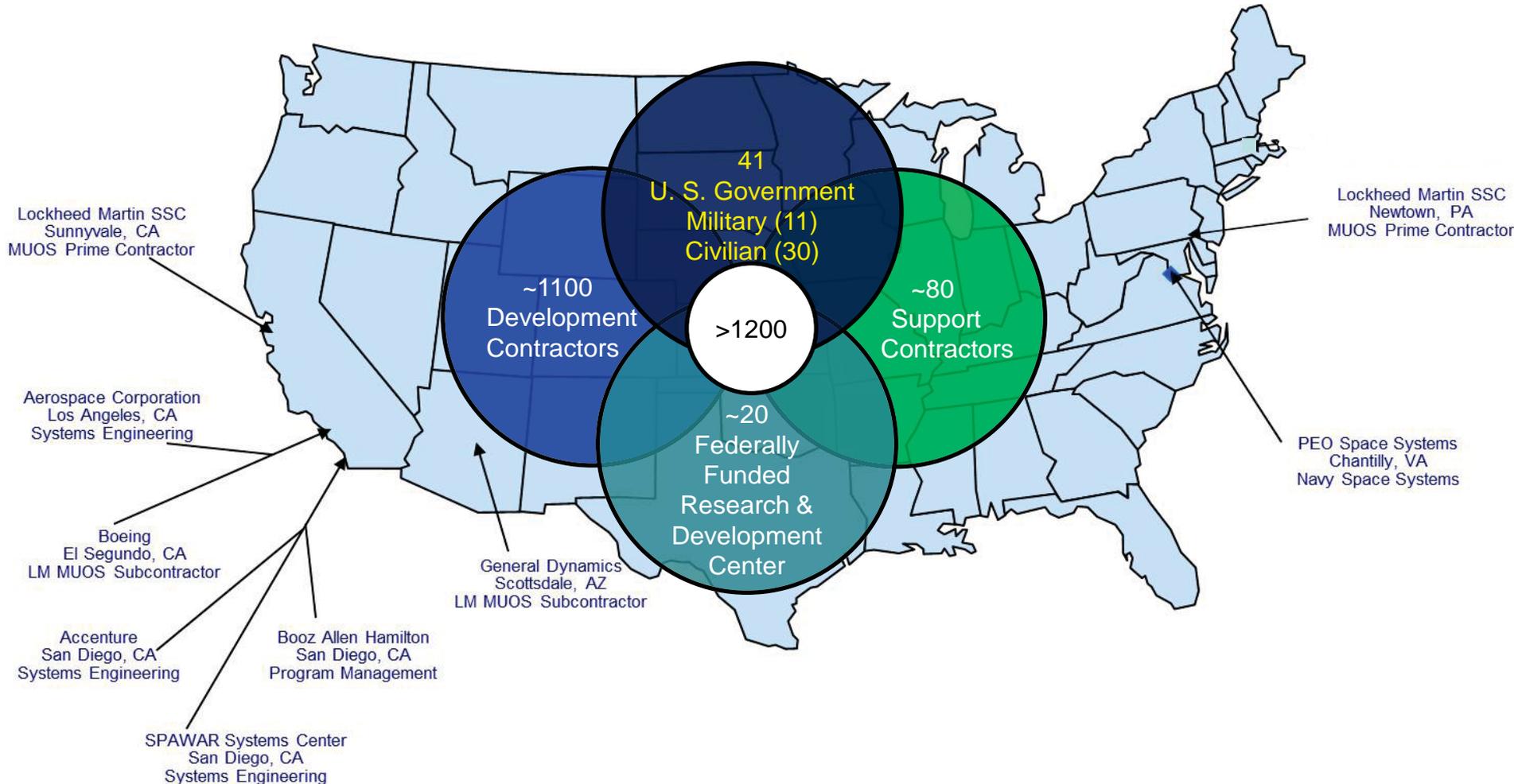
- **Weight: 734,850 lbs**
- **Height: 191 feet (Centaur Upper Stage + 4m extended PLF)**
- **Thrust at liftoff: 860,400 lbs (+ 255,405 lbs/SRM)**
- **Maximum payload weight: 6,000-14,000 lbs to Geostationary Orbit**



# How Many People Did it Take to Make MUOS?

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# MUOS Fun Facts

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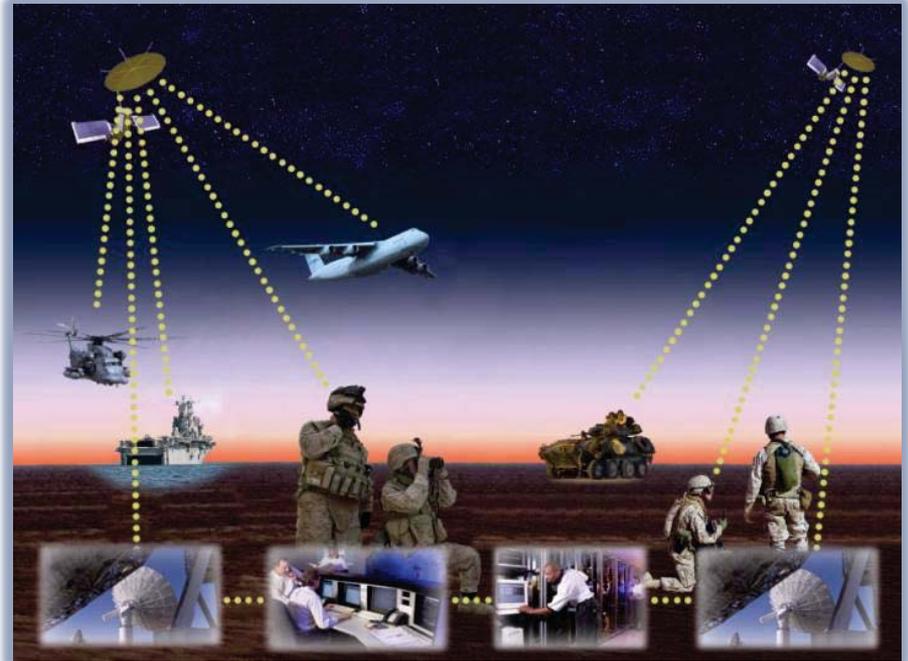
- **MUOS satellites weigh 8,405 pounds (more than 3 Honda Civics)**
- **MUOS carries more than 6450 pounds of fuel (weighs more than 1000 gallons of gasoline)**
- **MUOS deployed solar arrays span more than 94 feet (same length as a basketball court)**
- **MUOS solar arrays produce 15.4 kilo watts of power (enough to light 154 100W light bulbs)**
- **MUOS satellites fly 22,236 miles above the earth (100 times higher than the Space Shuttle!)**
- **MUOS satellites on orbit fly at more than 6,850 miles per hour (9 times the speed of sound!)**
- **MUOS has about 13,000,000 lines of software code (more that 1 line for every person living in either Illinois or in Pennsylvania!)**
- **MUOS uses more than 18,000 miles of fiber optics cable across the globe (more than 316,000 football fields in length!)**
- **MUOS earth terminal antennas are more than 80 feet high (higher than a 7 story building)**
- **MUOS earth terminal antennas are more than 60 feet in diameter (distance from pitcher's mound to home plate)**
- **MUOS earth terminal antennas weigh 250 tons (the weight of more than 20 school buses!)**
- **MUOS earth terminal antennas are mounted on 1000 tons of concrete (the weight of more than 5 747 jetliners)**
- **MUOS will launch on the Atlas 551 rocket that will produce more than 1,000,000 pounds of thrust and reach a speed up to 22,000 mph (the equivalent power generated by 13 Hoover dams carrying the weight of 8 horses at speeds 15 times faster than a speeding bullet!)**
- **MUOS and its Atlas 551 rocket stand 206 feet tall on the launch pad (same as a 19 story building)**

# Summary

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- **Current UHF SATCOM systems are reaching end of life**
- **MUOS will replace UFO constellation**
  - Satellite #1 ready for launch
  - Ground & Waveform development ready to support first launch
    - MUOS Waveform being distributed to developers to expand long term terminal population
- **MUOS will provide a significant increase in narrowband communication capability**



***MUOS is vital to future UHF SATCOM operations and will change the way services are delivered!***

# PEO SPACE SYSTEMS PMW 146



NARROWBAND SATCOM TO THE WARFIGHTER