



# ***Advanced EHF Systems Engineering***

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Protected SATCOM Div***



# Advanced Extremely High Frequency (AEHF)



## Specifics

- Requirements Basis: ORD – Oct 2000
- Major Customers: POTUS, COCOMS, International Partners
- Contractor: Lockheed Martin (Prime) and Northrop Grumman (Sub)
- Acquisition Priority: ACAT 1D
- External AF Interest: DOT&E Oversight

## Mission Description

- Provides DoD Global, Secure, Protected Jam-Resistant Comm for High Priority Military Ground, Sea, Air Assets
- Survivable Strategic Comm (19.2 Kbps)
- Protected Tactical Comm (Anti-Jam) Up to 8 Mbps
- Capacity: 430 Mbps per Satellite
- Data & Voice Net: Broadcast, Conference, Report Back
- Coverage: Global +/- 65 degree Latitude
- Backward Compatible with Milstar I/II
- Allows Nat'l Security Council & Unified Combatant CDRs to Control Tactical/Strategic Forces at all Levels of Conflict & Supports Attainment of Info Superiority
- International Partners: CA, UK, NL

## Program Status

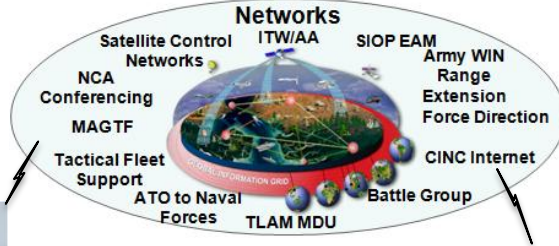
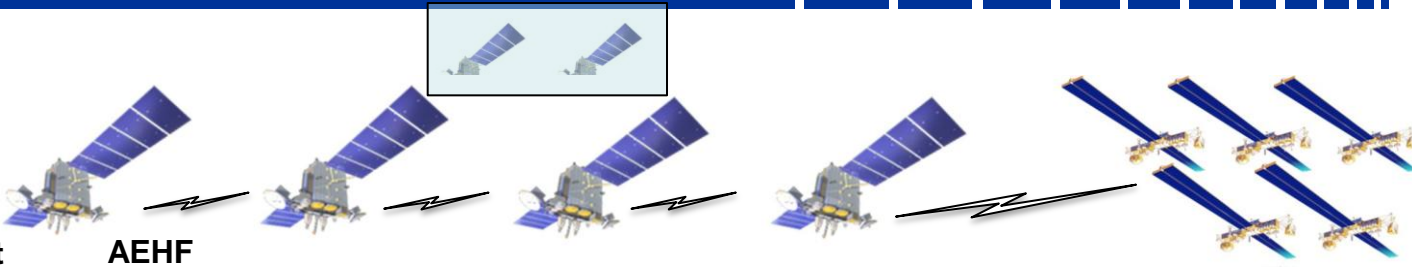
- Production and Deployment Phase
- SV-1: SCA - Control Transferred to 14<sup>th</sup> AF Ops – Mar 12
- SV-2: Completed On-Orbit Testing – Oct 12
- SV-3: Preparing for Launch – Projected Launch Sep 13
- SV-4: Bus and Payload in development and integration phase; estimated launch is 2017
- MCS: Inc 5 Operational Evaluation (OUE) Oct-Dec 2012;
  - Projected Ops acceptance Mar 13
- SV-5/6: LM proposal delivered Jul 12 ; ECD award: Dec 12
- IOC : APB Threshold: Dec 14



# AEHF Functional System Overview

## Space Segment

- Comm routing
- Maintains protected comm between +/-65°
- Constellation management
- Status and control
- System timing
- Over-the-air rekey



## Baseband Equipment

- Direct interface to system user
- User interoperability
- End-to-end services



## Terminals

- Interface to user equipment
- User comm services
- Orderwire coordination
- Interoperability



## Legacy Terminal Data Nodes (TDN)

- Formats strategic terminal data for terminal load



## Comm Planning (MPE)

- Payload configuration
- Terminal configuration
- Comm resource loading
- Resource utilization
- Apportionment planning
- Comm link utilization



## Satellite Control (MOPS)

- Status and control
- Stationkeeping
- Orbit management
- Repositioning
- System time mgmt
- Mission operations

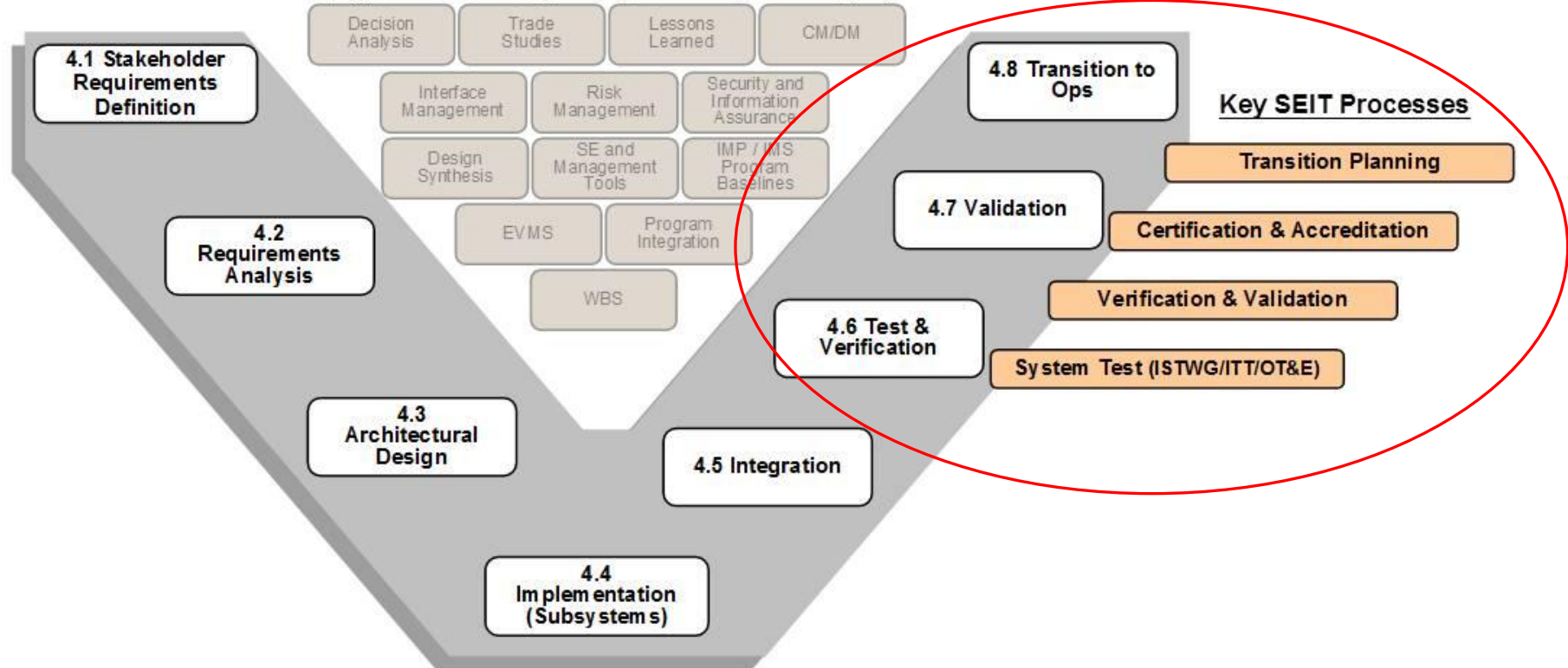
**Complex System Architecture Enabled by Software and Interface Control**



# AEHF Systems Engineering Overview

## SE Management, Control & Analysis Processes

*(applied continuously throughout the system lifecycle)*



## Specialty Engineering Disciplines

*(applied continuously throughout the system lifecycle)*

Reliability	Maintainability	Survivability	Modeling and Simulation	Logistics	Resource Allocation	Human Factors	Parts, Materials, and Processes	Electromagnetic Control	Hazardous Materials Management
Inspection and Maintenance	System Safety	OSSE	Quality and Mission Assurance	Operational Risk Management	Mishap Prevention	Discrepancy Reporting and Disposition	Misc. Analyses and Assessment	Environmental	Life Cycle Cost Analysis

**Disciplined Systems Engineering Processes Ensures Program Technical Baseline**



# ***AEHF Systems Engineering Successes and Challenges***

## **• Successes**

- Compatibility demonstrated with legacy system**
- Extensive insightful system test program**
- On-orbit mission assurance and anomaly resolution**
- Inclusive and transparent change control**
- Strong interface and change control process at architecture level**

## **• Challenges**

- Mission Planning Software Development**
  - Complexity drives a Wicked Problem**
  - Human Factors**
  - CONOPS for transformational capabilities**
- Evolving Architecture**
  - Adding new missions & capabilities challenging**
  - Encryption**

**Systems Engineering Informs PM and Warfighter Decisions!**



# Summary

- **The AEHF System is highly complex and significantly more capable than previous protected SATCOM systems**
  - **Expands significantly upon previous Milstar program**
  - **System performance is strongly dependent upon architecture**
  - **Many more user constituencies/requirements**
  - **Software a major system enabler, complexity driver**
- **Systems Engineering processes are core to the success of AEHF**
  - **Key to managing risk and delivering integrated capability**
  - **Enable effective program execution, coordination with stakeholders, and program baseline control**

**Systems Engineering Critical to AEHF Success!!!**