Acquisition of a COTS-based Command and Control System for Legacy and New Satellites

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Command & Control System-Consolidated (CCS-C)

Mission
Develop, deploy and sustain an integrated MILSATCOM Satellite Control System

Capabilities
- Launch and S-band on-orbit command and control of MILSATCOM satellites
- Integrated satellite operations center
  - DSCS III, Milstar, WGS, AEHF
- Training systems same as operational systems
- Non-collocated backup
# Program Schedule

## Phase II

<table>
<thead>
<tr>
<th>Major Initial Reviews</th>
<th>FY02</th>
<th>FY03</th>
<th>FY04</th>
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## CCS-C

- Core SW/DB Development/Objective SW Development Lab
- Integrated System
  - 3SOPS (SOC 32 & 31)
  - 4SOPS (SOC 42/41)
  - Mission Trainer and Backup SOC

## DSCS III

- SV 1-13
- FDE

## Milstar

- SV 1-5
- MUS
- FDE

## Wideband Gapfiller System

- IOC
- L1
- L2
- L3

## Advanced EHF

- DB/MUS

## TCS

- DB/MUS

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As of Feb 03
Acquisition Strategy Development

First things first
Drivers

- Limited lifetime of legacy ground system
- Schedule for Wideband Gapfiller on-orbit support capability
- Advanced EHF (AEHF) launch support capability
- Development cost and schedule control
Market Survey – Early Industry Involvement

- Extensive research
  - Discussions with industry
  - Independent product surveys
  - Ground system marketplace analyses
- Determined the availability and capability of:
  - Current satellite ground system products
  - Typical commercial practices for:
    - Contract type/terms and conditions
    - Testing/Maintenance/Warranties
- Impacts
  - Identified a robust commercial market for Satellite Command and Control Systems
Multi-Phase Strategy

- Initial Competition
  - Multiple offerors
  - Analysis of system objectives and requirements
  - System design descriptions
  - Technical approach to mitigating government-identified technical, cost, and schedule risks.

- Cost proposals:
  - Demonstration Phase
  - Four-year Development Phase
    - FFP for COTS hardware/software/installation
    - CPAF for development
  - Five years of sustainment
Multi-Phase Strategy (cont’d)

- **Demonstration Phase**
  - Two contractors
  - Draft System/Subsystem Specifications, engineering studies, & system design documents
  - Prototype of initial CCS-C capabilities
    - Demonstration conducted at CERES, Schriever AFB, approximately 7 months after contract award (Oct 01)

- **Downselect**
  - CFI/downselect NOT full/open competition
  - Call For Improvement (CFI) to Demo Phase contractors
    - Release Nov 01
  - Downselect to one contractor
  - Development/Sustainment Options award Mar 02
“Fly Before You Buy”

What really happened in the Demonstration Phase
Objectives

- Downselect between two contractors to award development/sustainment options
- Reduce development risk and uncertainty
  - Overcome history of COTS integration development overruns
  - Assess impact of program-unique requirements on COTS-based system architectures
- Validate contractors’ system and proposal claims
  - Demonstrated ability to interface with MILSATCOM-unique vehicles
- Hands-on operator feedback in a “real world” environment
  - “Fly Before You Buy” - Software Engineering Institute (SEI) and Industry Best Practice
- Forum for interaction and technical interchange among operators and contractors
Programmatic Challenges

- Personnel constraints
  - Shortages and Transitions
  - Involving other program stakeholders
- Fiscal Constraints due to budget reductions
- Managing two (competing) contractor teams
  - Information Separation
  - Workload and division of labor
  - GFP delivery
Maintaining Fair Competition

- Managed two unique contractor approaches and organizational structures
- Prevented technical transfer
  - Ideas from KTR A getting to KTR B, vice versa
- Prevented unfair competitive advantage
  - Contractor with access to useful information and resources
- Briefed Rules of Engagement to government stakeholders and contractors early
Minimizing Requirements Creep

- Demo actually provided a mechanism for managing requirements creep
  - Contract structured to allowed for some, but not significant, changes to requirements
  - Became a powerful control on new requirements
- Still had numerous stakeholders who wanted to add “new” requirements
- Strong leadership at AFSPC significantly contributed to minimized requirements creep
- A handful of critical new requirements and fact-of-life changes were incorporated, but “creep” was controlled
Demonstration Phase Results

- Competition provided increased capability at lower cost
- Government input (both user and acquirer) improved Contractor’s:
  - Understanding of requirements
  - Final design
  - Operations and sustainment concepts
- Legacy transition schedule refined
- Key system capabilities validated
  - Technical risk baseline updated
- Strong government/contractor IPT involvement
  - AFSPC users/staff were integrated into all aspects of program development
  - Foundation for continued participation in Development Phase
Program Risk Mitigation

Probability of Occurrence

Post Demo/Pre-CFI

Prior to Demo Phase

Development Phase Start

Impact

Low Med High

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Lessons Learned

- Ensure balance of competition & fairness in downselect process
- Extend competitive phase timeline
  - Requirements refinement
  - Development of preliminary designs
- Increase support from legacy satellite and ground system contractors
  - Explanation of operations plans and satellite constraints
  - Analysis of satellite databases
Integrated Product Development Organization

Program Management

**System Engineering**
- Requirements Analysis
- Test
- Risk Mitigation

**System Development**
- Telemetry & Commanding
- Orbit & Attitude
- Mission Planning
- Simulation
- Security

**Operations/Logistics**
- Operations Concepts
- Facility Activation
- Transition
- Training
- Support & Sustainment

Satellite-Specific Development
- Functional & Interface Requirements
- Memory Management
- Maneuver Planning

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Development Approach

- High degree of operator involvement
  - Guaranteed availability of key personnel throughout transition period
- Operators integrated into IPTs
  - Explain current operational procedures and satellite constraints
- Refine development requirements
  - Satellite operations
  - HMI design
  - Documentation of procedures
Positive control of requirements change
- Approval hierarchy: Squadron-Wing-Headquarters
- Program Configuration Control Board
  - Review/approval of DOORS change proposals

Extensive IPT Coordination
- Issues worked at lowest level IPT
- Integration of issues at higher-level IPTs
Conclusions

- CCS-C acquisition strategy was a success
  - Competition resulted in greater capability at lower cost
- Operator involvement at all steps is an essential factor for system buy-in
  - Understanding how acquisition process affects outcome
  - Being flexible in requirements definition and change
  - Actively supporting system development and transition
Backup Charts
### Risk Baseline

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<th>Probability of Occurrence</th>
<th>Impact</th>
<th>T9</th>
<th>C1</th>
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- **T1** - Milstar MUS Functions/Core Interfaces
- **T2** - Correct Vehicle Modeling
- **T3** - Legacy SV Telemetry Databases
- **T4** - Incorrect SV Command Data
- **T5** - Orbit Accuracy
- **T6** - Attitude Sensors
- **T7** - SV Simulation
- **T8** - Expandable System Architecture
- **T9** - COTS Management
- **T10** - DII/COE Compliance
- **T11** - Scheduler Modifications
- **T12** - Engineering Analysis Capability
- **T13** - AFSCN Ground Simulation
- **T14** - Integrated System Monitoring
- **T15** - Satellite Support Plans
- **T16** - External Interfaces with MUE
- **T18** - AFSCN RGF Interface
- **T20** - Operational Validation
- **T21** - Interfacing with SV Developers/Legacy System Contractors

- **S1** - Meeting Test Objectives
- **C1** – New Satellite Requirements
- **C2** - Core Cost Overrun
- **C3** - Budget Cut Impacts
System Architecture

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Key:
- COTS
- New
- Reuse/NDI

T&C
- OPS Mon & Control
- Crew Support
- Procedure Builder
- T&C Server Utilities
- T&C Client Utilities
- T&C Processing
- T&C Database
- Schedule Exec. Server
- Schedule Exec. Viewer
- Procedure Auto. Server
- Procedure Auto. Client
- FEP

MPS
- Schedule Generation
- Resource Config. Mgmt
- DB Initialization Util.
- MPS Database
- AFSCN Interface
- OAA Interface
- T&C Interface

OAA
- OAA Batch/Core
- OAA Utilities
- OAA GUI/Core
- OAA External Interfaces

AT
- Archive
- Trending

SIM
- SV Simulator
- GS Simulator
- Simulation Executive
- Instructor User Interface
- Database Utility

DSCS MUS
- Ex. Data Conversion
- DB Ingest Script

AEHF MUS
- Ex. Data Conversion
- UEM Generator
- MIM
- DB Ingest Script

Milstar MUS
- Ex. Data Conversion
- UEM Generator
- MIM
- DB Ingest Script

NATO MUS
- Ex. Data Conversion
- DB Ingest Script

WGS MUS
- WGS MUS
- Ex. Data Conversion

Note: Color coding assignments reflect the majority of the code per component. An orange color code does not necessarily imply no new code will be developed.