Space Acquisition Strategy – Just How Important is the Ground Segment?

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Agenda

- Overview
- Differences Between Ground and Space Software
- Ground System Risks
- Ground-Centric Acquisition Strategies
  - Options to Mitigate Risks
  - Evolutionary Acquisition Lessons
- Recommendations
Overview

Space segment - exciting!
- Drives acquisition strategy
  - You used to only get one chance
  - It’s Hardware (we understand that)
  - Highest instant cost item

Ground segment – who cares?
- Secondary consideration in acquisition strategy
  - You can always change it
  - It’s Software – (I can’t see it)
  - Higher Total Ownership Cost (TOC)
Ground System Risks (1)

Technical Risks
- Large, complex software intensive system
- COTS use and integration not adequately planned
- Many and complex interfaces
- Lack of architecture requirements and definition
- Lack of architecture evaluation
  - Source selection and after contract award
  - Products and processes
Ground System Risks (2)

Technical Risks continued

- Lack of complete and stable requirements
  - Operations concept space-centric
    - Vague or lacking Ground operational requirements
    - No user involvement nor prioritization
    - Transition schedule requirements unclear
    - No sustainment concept
  - Space/Ground trades still in work
  - Incomplete security requirements
    - Old security classification guide
    - Lack of program protection plan
  - Detailed legacy requirements not used
  - Lack of flexibility in capabilities/requirements
Ground System Risks (3)

Programmatic Risks

- Lack of focus on ground
  - Government and Contractors
  - Acquisition strategy and RFP
- Acquisition schedule & strategy often dependent on others
  - Integration with legacy and other components
  - Concurrent developments
- Lack of bottom-up government cost and schedule estimates lead to inaccurate
  - Program Office Estimate (POE)/Basis of Estimate (BOE)
  - Reuse potential of legacy components
- Budget and POE disconnects
- Government budget volatility
- Sustainment of ground element(s) not planned
Software Differences

- **Ground**
  - More Complex
    - Requirements
      + Functionality
      + Interoperability
      + Autonomy
    - Architecture
      + Distributed network
    - Integration
      + More COTS
      + More external interfaces
    - Team
      + Dispersed
      + Different Processes
  - Large
    + 2.0 – 4.0 M SLOC

- **Space**
  - Less Complex
    - Requirements
      + Real-time embedded
      - Payload Specific
      - Reuse bus
    - Architecture
      + Processor constrained
    - Integration
      - Standard Bus interfaces
    - Team
      - Typically only 1 or 2 teams
  - Significantly smaller
    - 0.01-0.5 M SLOC

Ground Software is Highest Risk!
Acquisition Strategies – Options to Mitigate Risk

- Sustainment of ground element(s) not planned
- Single full contract for ground and space
- Two parallel contracts: one for space & integration and one for ground
- Single contract for space and add modernized ground to legacy ground sustainment contract
- Three contracts – One for space and integration and two for ground: ground contract will have requirements and architecture definition study phase then downselect
- Study contracts to refine and allocate requirements followed by full/open competition
- Two full contracts – first phase for requirements and architecture definition and then CFI downselect
- Four full contracts – two for space and two for ground. First phase for requirements and architecture definition and then downselect
Acquisition Strategies – When Evolutionary Acquisition Works

- Large proportion of commercial technology or reuse
- Need to shorten technology insertion life cycles
- Schedule urgency
- User is flexible when requirements are delivered
- Budget uncertainty

Appropriate for Most Space Ground Systems - Spreads Risks and Development Costs
Single KTR for both space and ground

Combined arch baseline and development

Arch baseline followed by downselect - development

Separate KTRs for space and ground

Combined arch baseline and development

Arch baseline followed by full and open development

Two ground KTRs for arch baseline followed by downselect

Two ground KTRs for arch baseline followed by full & open

KTR = Contractor
Arch = Architecture
Two parallel contracts: one for ground & one for space and integration

**PROS**
- Use contractors respective strengths
- Increased competition
- Reduced ground risks: awards to most capable contractor
- Incentivizes space/ground contractors appropriately
- Model successfully used by commercial space

**CONS**
- Increased SPO requirements
  - PM & integration roles
  - Ground/space allocation
- Increased potential for space/ground contractor misalignment
  - RFP/contracts need to be well defined and flexible
    - Ensure cooperation in Interface definition, design, test, database calibration, etc
  - High potential for ECP to ground after contract award
- Reduced cost/schedule confidence
- Space contractor may lack integration capability
Two full contracts – first phase for requirements and architecture definition, then downselect

**PROS**
- Design before you buy
- Prolonged competitive phase will result in contractors ‘best’ ideas
- Requirements on contract
  - High cost/schedule confidence
- Reduced cost risk
- Better ground space trades

**CONS**
- 2 Source Selections (1 mini)
- ~1 year added to schedule
- Added SPO resources
- Best value determination process needs to be clearly defined during competition
- Additional cost for second phase 1 contractor

GSAW 2003  05 March 2003  Space Acquisition Strategy – Just how important is the Ground-Segment?
Impacts of Evolutionary Acquisition

- Complete, up-front program plan not possible
  - User willing to accept system installments
  - Acquirers/Budgeters accept ambiguity
- Significant User involvement in all phases
  - User must lead formalized spiral definition process
  - Continuous management of user expectations
- Evolutions will not be totally defined by prioritized requirements
  - Minimal interdependencies
- Flexible requirements process
- Program documentation structured to support spiral definitions
  - especially requirements, test, and training
- Modifiable, extensible architecture
Recommendations

Every Acquisition Team Must

Thoroughly Define All Risks
- Ground AND Space for Government/User AND Contractor
- **Ground is Highest Risk!**

Minimize Risks Through Acquisition Strategy
- Detailed Pro and Con for Option Selection
- **Implement Lessons Learned from Evolutionary Acquisitions**
- Have Accurate and Flexible Cost and Schedule Baselines
- Select Best Software Contractor Team
- Have Effective Architecture Requirements
  - Definition through Evolution
- Emphasize architecture in RFP Section L, Section M, and include architecture related documents in CDRL

Continue to Manage Risks after contract award