Beyond the First Generation: Trends in Evolving and Sustaining a COTS Based Satellite Ground System

Presented by:
Frederick C. Karres
GeoSpace, Inc.

Co-author:
Thomas D. Rivers
Integral Systems, Inc.

Presented:
February 23, 2000
Ground Systems Architecture Workshop 2000
Focus Issues

- Satellite Operations Centers are specialized IT systems controlling mission critical assets and operations
  • In today’s modern IT environment, how are operators managing and evolving these systems? What are their decision drivers?
  • What is the current and future role of COTS in these systems?
  • From the operators viewpoint, how can the satellite ground system (SGS) providers help them field evolve-able and sustainable ground systems?

- What lessons can be learned from other modern IT systems to improve the way our industry builds, sustains, and evolves ground systems?
Starting Hypothesis

- The satellite industry’s ground environment sustainment and evolution methodology is lagging behind advances in comparable IT systems.
- Adopting modern IT system sustainment and evolution approaches will allow our industry to be more competitive and flexible to take advantage of rapidly evolving information technology.
Satellite Ground System History

• The basic architectures (and S/W components) of most SGS’s were developed prior to the IT revolution of the later 1990’s
• Most systems were developed by aerospace companies, often “bundled” with satellite purchase
  - Lack of industry wide interface standards (Proprietary interfaces)
  - Basic building blocks often called “COTS” but only a few can be compared to products found in the commercial IT industry
• Some COTS products have emerged in the SGS arena during the 1990’s
  - These products must be “configured” to varying degrees in order to meet the satellite interfaces of different manufacturers and have different degrees of convenience in integrating with other system components
• As COTS based SGS’s become the norm, traditional methods of acquisition and sustainment may change to a more commercial IT system model
  - In the future, the satellite operators will be increasingly competing with other industries and must consider adopting these industries IT models to remain competitive
Research Scope

• Interviewed satellite operators that maintain significant C^2 ground infrastructure. Survey scoped the current state of their SGS’s as well as their current and future plans for sustainment
  - Contacted eight operators, four chose to participate in survey
  - Spectrum of COTS and Custom ground systems employed

• Researched the current architectures, COTS usage, and sustainment/evolution approaches for major commercial IT systems
  - In depth interview with Managing Consultant for HP’s Telecom Practice
Survey Results

- A total of 39 commercial satellites controlled across 4 fleet operators
- About half are controlled by COTS TT&C products
  - The remainder by legacy software products supplied originally by the satellite providers
- Two newer systems (fielded since 1995) tended to be nearly 100% COTS
  - One operator of older satellites (3-15 years) had completely transitioned his C^2 system to a COTS based architecture
  - Another similar operator had a system that was essentially 0% COTS; system is a “glued” together assortment of non-commercial products originally supplied by the satellite manufacturer
- Operators using COTS based systems have a much smaller internal maintenance staff, different expertise (i.e. more operationally oriented)
  - Maintenance typically consists of system & S/ W problem detection, LRU replacement
  - Very little internal development --- SPR’s and new feature development are performed by the product vendor/ system integrator
  - Operators with COTS based systems have a much lower on-site SGS maintenance & sustainment staff (e.g. fractional heads per satellite, day shift only)
Survey Results (cont.)

• Very little sustainment and evolution planning going on -- ad hoc process
  - None of the operators had long term (3 to 5 year) sustainment plans
  - Two operators were starting to develop short term (0 to 2 year) plans
  - Majority acknowledged that they need to become proactive and start doing this
  - Major Risk: They are currently “at the mercy” of the COTS suppliers or the satellite suppliers (or both) at present

• Operators that have implemented a COTS based system believe that they are minimizing cost by relying on the COTS supplier/system integrator to provide maintenance and system sustainment/evolution
  - Enables operator to maintain a very lean personnel infrastructure

• Operator that has a “glued together” architecture plans on taking significant steps to implement a modern C² architecture this year. Goals are to:
  - Ensure a system that supports a universal ops concept across satellite fleet
  - Puts the operator in the “driver’s seat” for future system sustainment & evolution
Industry Status, Future Trends

• On-going consolidation in the commercial satellite industry, along with recently established systems, has lead to a variety of SGS architectures and attendant sustainment methodologies
  - Loosely analogous to the the situation in the telephony/data networks industry

• COTS to play an increasing role in SGS’s; suppliers also tend to be the system integrators

• COTS based systems allows for outsourcing of most of maintenance and sustainment functions, allowing operators to focus on operations
  - Operators or third party system integrator plan and manage the system evolution at a top level
Sustainment and Evolution Model for Commercial IT System

• Commercial IT communications systems have many parallels to SGS’s
  - Control mission critical functions
  - Industry has a wide array of architectures: RBOC’s maintain significant legacy assets, must compete with newer wide-band companies with very modern IT architectures

• Commercial IT industry is much more standards based
  - A wide variety of different vendor’s COTS can be very easily integrated
  - COTS products don’t drive the architecture - the operator can control it as a fundamental enabler of his operations concept and business model

• Architectures freed from constraining custom code or system defining COTS can easily evolve to meet the fast changing business realities of the market
  - Easy to add new technology COTS into architecture (plug & play)
Conclusions

• Recent expansion and consolidation has led to SGS’s with multiple legacy systems which are not easily or efficiently interoperable

• Satellite operators have not been proactive in the area of system sustainment
  - Little formal planning occurring
  - No longer term plans
  - Not looking at what other similar (and possibly competing) industries are doing

• Sustainment entirely driven by mission needs and business plans
  - Business plans considering satellite revenue (therefore mission need driving sustainment and evolution), but NOT looking at profit margin increase from cost savings associated with more efficient sustainment and evolution methodology
Conclusions (cont.)

- The satellite industry has 3 possible models for sustainment/standardization
  - Maintain consolidated legacy systems -- satellite suppliers drive sustainment
    - This would be a standardization on a per satellite basis
  - Switch entire fleet operations over to core set of COTS products -- let the COTS supplier drive sustainment
    - This would be a standardization on a per vendor basis
  - Industry standard COTS products -- allows the satellite operator or his system integrator to drive the sustainment process
    - This would be a standardization on a per industry basis

- The results of our survey clearly indicate that the industry is at the per satellite standardization and is moving towards the per vendor basis

- Industry standards for COTS and architectural interfaces would be a powerful help toward allowing satellite operators to evolve their systems in response to their business needs and technology advancements, but much progress is still required in this area
Recommendations

• Satellite operators must become more proactive in driving the sustainment process
  - They need to understand their drivers and risks
    • Business
    • Mission Risk
    • Sustainment Cost

• The SGS community should charter an industry group to develop the “right level” of standards that would promote a more IT style sustainment and system evolution methodology
  - Standards group must be inclusive of operators, satellite manufacturers, COTS SGS vendors