Session 10B: Ground Systems Standardization and Commonality

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WG Description

- Some standardization of spacecraft ground systems can reduce the cost of both development and operations.

Standards Need to Provide Real Benefits

- Standards need to solve an actual problem and provide COST benefits to the customer or vendor
  - Benefits of reliability, knowledge management, facilitating competition, really come down to reduced acquisition costs
  - For the vendor, standards reduce dev costs which reduce product costs which lower customer costs and/or increase market potential as customers with fewer dollars can contract for the systems
  - Vendors must meet established standards to compete in certain markets (e.g. Ethernet LAN standards)

Implement Standards at Initial Development

- To be cost effective standards must be implemented during initial development
  - In general, cost of implementing new systems with standards during development are equal to those not implementing standards.
  - Not cost effective to retrofit working systems solely for sake of standardization
  - Because software can be (relatively) easily modified, applications are rarely re-written in entirety except when driven by hardware/OS upgrades or something like Y2K

Overcoming Obstacles to Standardization

- Up-Front Development and Implementation Costs
  - Contractors demand return on investment
  - Customers are reluctance to pay up front costs which will benefit others
- Time to generate consensus/standards is normal in any domain
- Pattern of standards development
  - Initially proprietary de facto standards (e.g. Microsoft Windows)
  - Users converge on 1 or 2 solutions (e.g. VHS vs. Betamax)
  - Finally creation of formal standards (e.g. 802.x LAN standards)
- Best Approach for implementing Space Standards is for Gov't to Mandate them
  - US Gov't is the largest customer in space systems
  - Gov't had funds and market share to encourage standards by mandating in their NEW contracts
  - By mandating standards and paying for their development/implementation the gov't can reduce the time that industry congregates on a standard
  - But Space Standards must be ready for implementation at contract award

Limit Standards to minimal, specific interfaces

- Standardize at the lowest interface level that allows for vendor product enhancement
- Standards must allow proprietary improvements and brand distinction, e.g. Ethernet LAN switches are a good best example of successful standards
- Suggested Targets for Space Ground System Standards:
  - Space/Ground Data Link Standards at physical, link, and transport layers, e.g. CCSDS
  - Remote Ground Station/Antenna Control/Status, e.g. the CCSDS and SLE
  - Ground System Component Status/Monitoring e.g. SNMP
  - Telemetry / Command Database Exchange (XML Telemetry Command Exchange (XTCE)
  - Satellite Control Procedure Languages (Chaudhri's suggested OMG Standard)
  - Orbit data Input/Report Formats (e.g. PPUNCH, CPUNCH for 2LMES)
  - Orbit Models and Astrodynamic Constants/Parameter sets
  - Standard Encryption and Authentication algorithms e.g. from NSA
  - Telemetry Processing Frame/Packet Input Formats
  - On-Board Computer Management Dump and Upload Formats
  - Satellite Command Formats, e.g. like standard computer machine language
  - Time-Tagged, Processed Telemetry History Formats that would interface with common data analysis tools like PV Wave and MATLAB
  - Real-time Telemetry Distribution to HMI Display Interfaces
  - Standard Nomenclature and Subsystem Hierarchy for Telemetry Display Design

Engineering & Mgmt Processes for Standards Similar to COTS

- Engineering processes for commonality and standards reuse are no different than those for using COTS products, which are in essence a de facto standard.
- Estimate cost and schedule for standards-based development similar to use of COTS products
  - Immature standards should be estimated like new development with margin for implementing multiple versions as standard mature
- Standards-based Development pose no special pitfalls if standards are mandated at program inception
  - Should plan for rigorously testing interfaces against published standards

Panel Questions

- 1) What cost sharing or other efforts have you used to achieve commonality with other programs?
- 2) What regulatory or policy obstacles to achieving commonality have you experienced and how have you addressed those obstacles? Are there policy changes that could help enable standardization and reuse?
- 3) How have you obtained buy-in on use of standards and overcome resistance and skepticism?
- 4) What are the implications of trying to achieve commonality at different stages of development maturity? Does commonality always have to be planned for in the initial development or are there ways to leverage reuse for systems that are further along?
- 5) Does planning for commonality and reuse require different systems engineering processes?
- 6) How can costs and schedules for projects involving commonality and reuse be estimated accurately?
- 7) Are there management best practices that allow for successful use of commonality, standardization, and reuse in ground system projects? Are there specific pitfalls associated with management of vendors and subcontractors?