

Ground Systems Architectures Workshop

Ground System Acquisition Best Practices Panel

**JPL Ground System Acquisition
Best Practices and Future Trends**

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DISCLAIMER: All personal and professional opinions presented herein are my own and do not, in any way, represent the opinion or policy of JPL, NASA or Caltech.



Background

This presentation is based on my opinions and observations in working at JPL over the past two years.

I am drawing on a prior 25-year career working with Ground, Aircraft, and Spacecraft Systems for DoD, NRO, and Defense-related contractors focusing on data collection and analysis and cost estimation of software development and maintenance programs.

Discussion Topics

- JPL Ground Systems Description
- Multi-Mission Ground Systems & Services
 - Characteristics
 - Evolution
- Best Practices
- Future Trends
- Summary Conclusions

JPL Ground Systems Overview

- JPL Ground System supports
 - Interplanetary spacecraft missions
 - Radio and radar astronomy observations
 - Exploration of the solar system and universe
 - Earth-orbiting missions

Multi-Mission Ground Systems & Services

Multi-Mission Ground Systems and Service Office



MGSS Characteristics

- Provide operations support to Flight Projects
- Provide “One Stop” shopping for projects looking for effective, inexpensive, value-added services
- Develop and maintain an adaptable multi-mission operations infrastructure

MGSS Evolution

- **Current MGSS Architecture**
 - Well understood, long legacy
 - Used by more than 15 current missions
 - Heavyweight
- **Alternative Small Mission ‘low cost’ Architecture**
 - Lightweight
 - Greater reliance on commercial elements
- **Future Mission Architecture**
 - Streamlined code
 - Modular design

Selected Acquisition Best Practices

- Selected JPL Acquisition Best Practices include, but are not limited to:
 - Competitive vs Non-Competitive Selection Process
 - “Make or Buy” Decisions
 - Capability Maturity Model Integrated
 - Industry COTS Study

Competitive vs Non-Competitive Selection Process

- “Make or Buy” assessment is required by JPL
 - Illegal to make a selection subjectively or randomly without going through the formal selection process
 - Other NASA centers have been challenged and lost in court
- Why is non-competitive procurement recommendation challenged?
 - NASA believes the only way to be sure they are getting "best value" for their money is through competition
 - NASA imposes special rules and processes for noncompetitive procurements then audit them frequently and thoroughly
- No minimum (or maximum) number of sources, must be identifiable and capable
- COTS item excluded from Make or Buy decision when they can be purchased from a catalog
- Ownership of intellectual property is an issue

“Make or Buy” Decisions

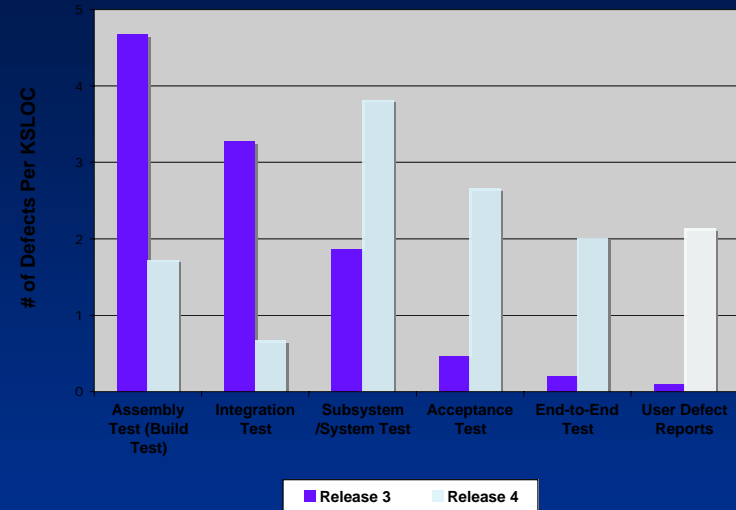
- JPL does many one of a kind missions
- GDS needs to be flexible and adaptable to address these unique missions– “one size does not fit all”
- Exploring ways to reduce costs, especially involving industry, for selected “standardized” elements
 - Take advantage of economies of scale across space sector domain, even outside of NASA
 - Acquisition issues include, but are not limited to:
 - Risk
 - Integration and Test
 - Infusion

CMMI Benefits

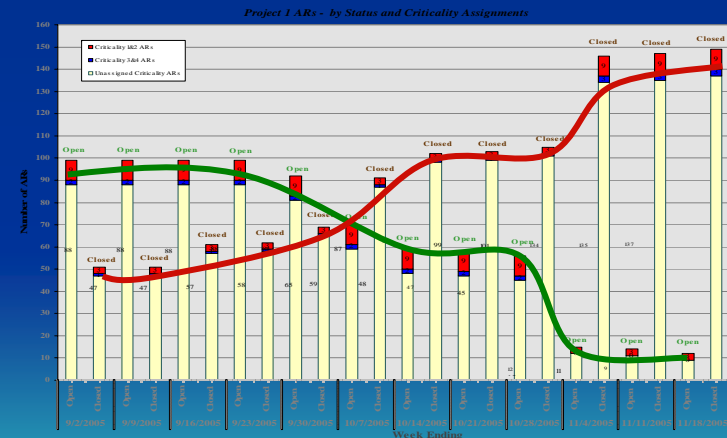
- JPL currently appraised at CMMI Level 2
- On-track to achieve CMMI Level 3 in 9/07
- Specific benefits to date include:
 - Standard practices and procedures
 - Creation of templates and guidelines
 - Use of institutional tools
 - Collection of data and metrics
 - Training courses
- Discussions for pursuing CMMI Levels 4 and 5 in progress

CMMI Data Benefits

- Data collections
 - Monthly Measures
 - Milestones Measures
- Benefits
 - Can prove progress
 - Supports accurate estimates
 - Calibrate models
 - Reduces risk



Defects Discovery by Phase



Open and Closed Anomaly Reports

Industry COTS Study

Objective:

To identify external providers of Ground Data System capabilities for potential incorporation into JPL GDS where cost-effective

Approach:

- Survey other applicable COTS studies
 - JPL
 - GSFC
 - Others (TBD)

Industry COTS Study

Approach:

- Work with JPL acquisition to develop GDS COTS RFI
- Develop list of potential COTS providers
 - *Suggestions welcome
- RFI to be released - March 2007
- Analysis of data in high leverage areas - May 2007
- Selection criteria includes, but not limited to:
 - Vendor viability
 - Technical capabilities
 - Life-cycle cost

Future Trends

- The current plan for improving the GDS is to increase:
 - Use of COTS for ground system applications
 - Cost modeling and trade studies based on design, mission scenarios, and performance
 - Use of standardized system engineering tools
 - Infusion of industry-standard tools and processes to lower costs, and be cost effective
 - Partnering with commercial, academic and external entities
 - Attention to standard development processes
 - Reliance on multi-mission tools to reduce costs
 - Interest in the application of interoperable/unified architecture
 - Automation
- As new requirements for our Ground Data System evolve, the list of improvements will be modified

Summary Conclusions

- Acquisition methods need to evolve as the nature of Ground Stations change
- Structure work being performed to match the mission – One size does not fit all!
- Important to consider life-cycle cost-benefit analysis in a “make – buy” decision
- CMMI certification is critical to acquiring high quality software thereby minimizing cost and risk
- Special studies should be conducted to optimize the acquisition process
- External acquisition of Ground System capabilities to play a larger role in the future