

**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.

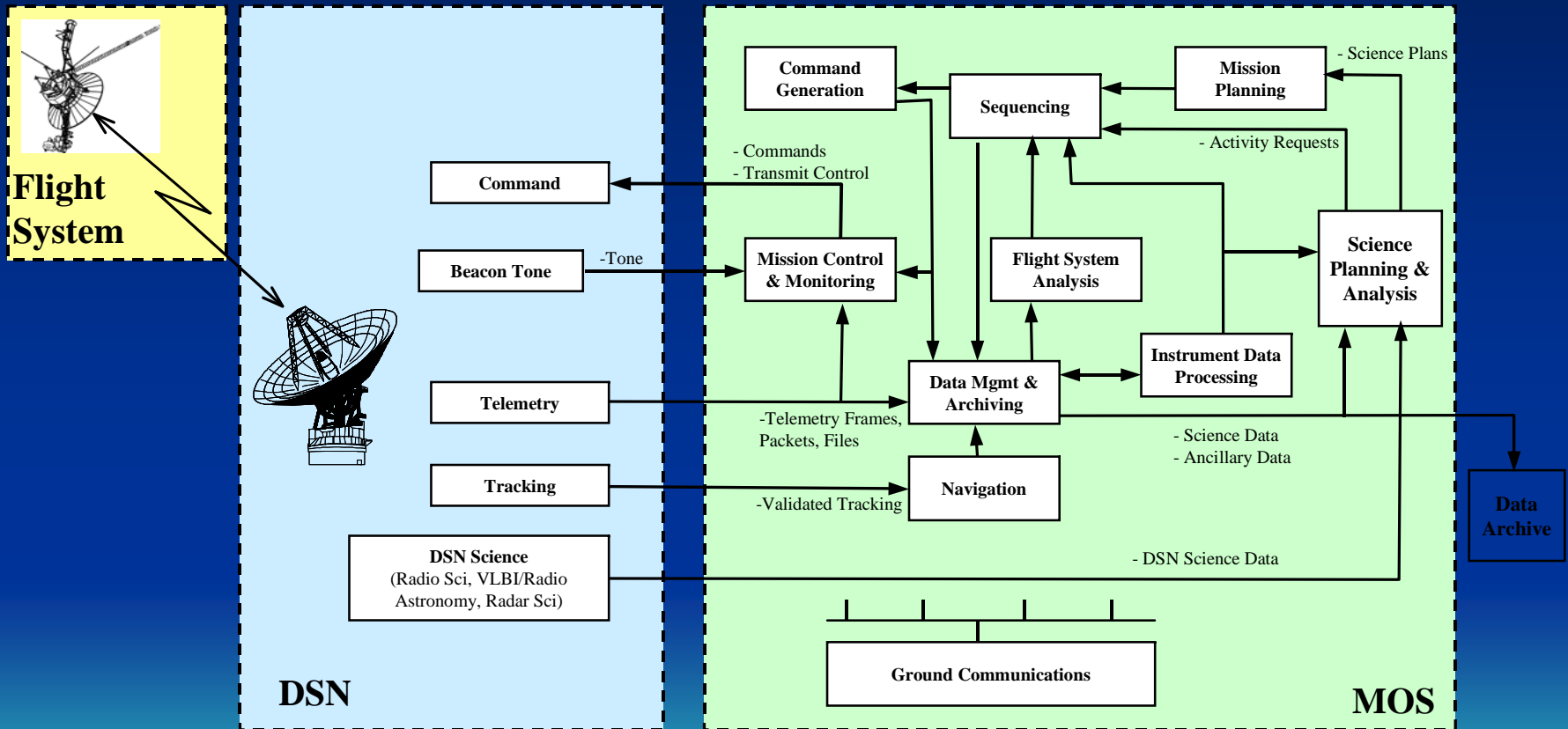
# Discussion Topics

- 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

# Typical Ground Data System for Planetary 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

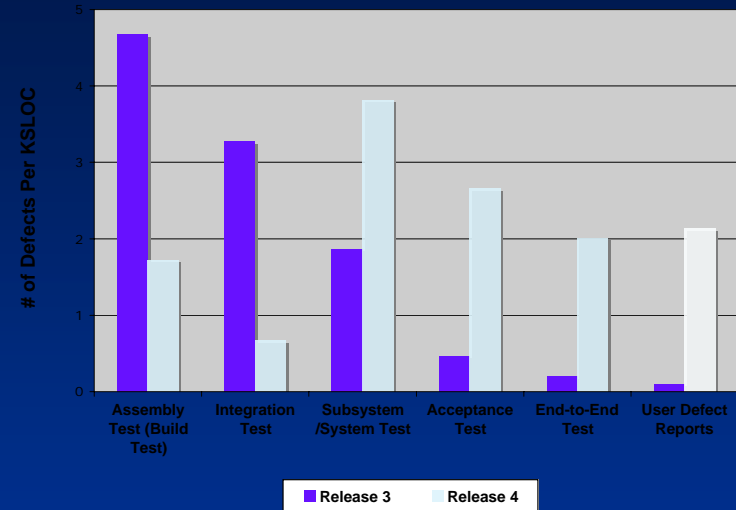
- JPL does many one of a kind missions
- GDS needs to be flexible and adaptable to address these unique missions– “one size does not fit all”
- Exploring ways to reduce costs, especially involving industry, for selected “standardized” elements
  - Take advantage of economies of scale across space sector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

# CMMI Benefits

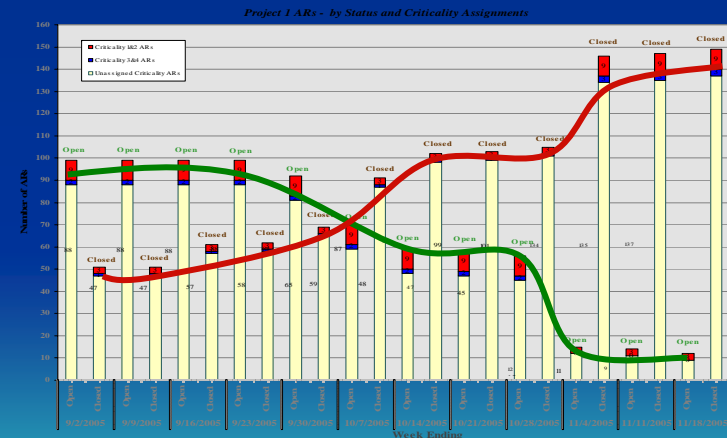
- JPL currently appraised at CMMI Level 2
- On-track to achieve CMMI Level 3 in 9/07
- Specific benefits to date include:
  - Standard practices and procedures
  - Creation of templates and guidelines
  - Use of institutional tools
  - Collection of data and metrics
  - Training courses
- Discussions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