National Aeronautics and
Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

Acquiring and Using the Advanced Multi-Mission Operations System (AMMOS)

The AMMOS is a NASA resource that can reduce the cost and risk of:

- **Building or acquiring a project's mission operations system**
- **Conducting mission operations**

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Mission Operations Coordinator
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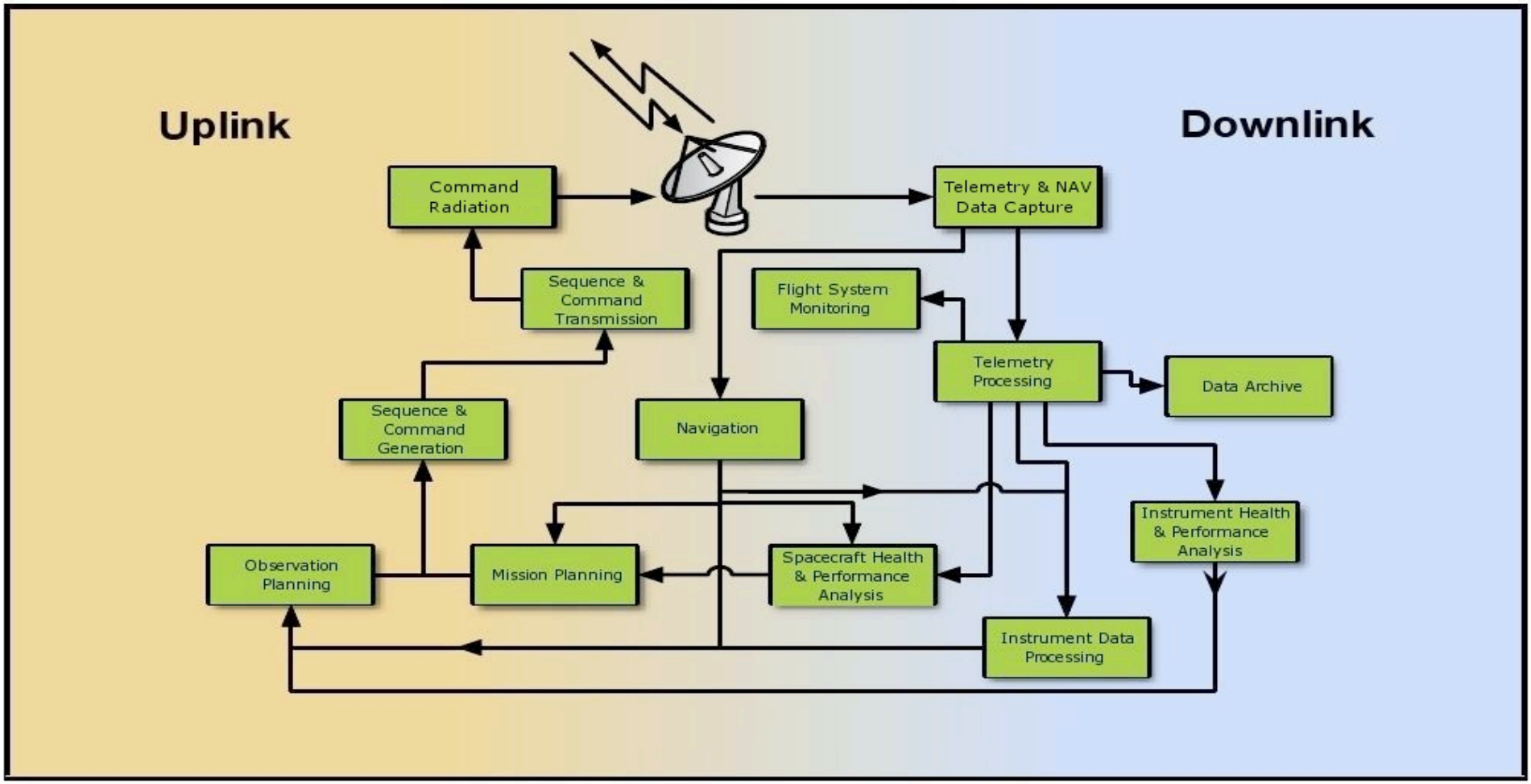
Science Mission Directorate

AGENDA

- What is the AMMOS?
  - Services offered
- What are the potential benefits?
- How to get more information?
- How much does it cost?
- Who to call?

Background

A typical decomposition of an MOS into Functional Elements is shown below



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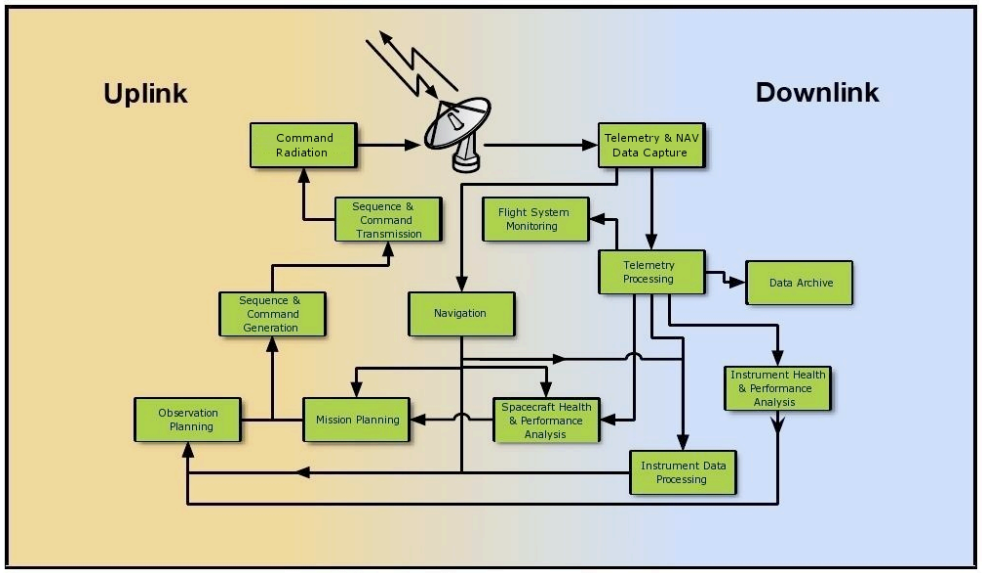


- Your Project must acquire/develop, integrate, and operate each of these 13 functional elements of its MOS
- Each element contains hardware, a number of software elements, people, procedures, and facilities

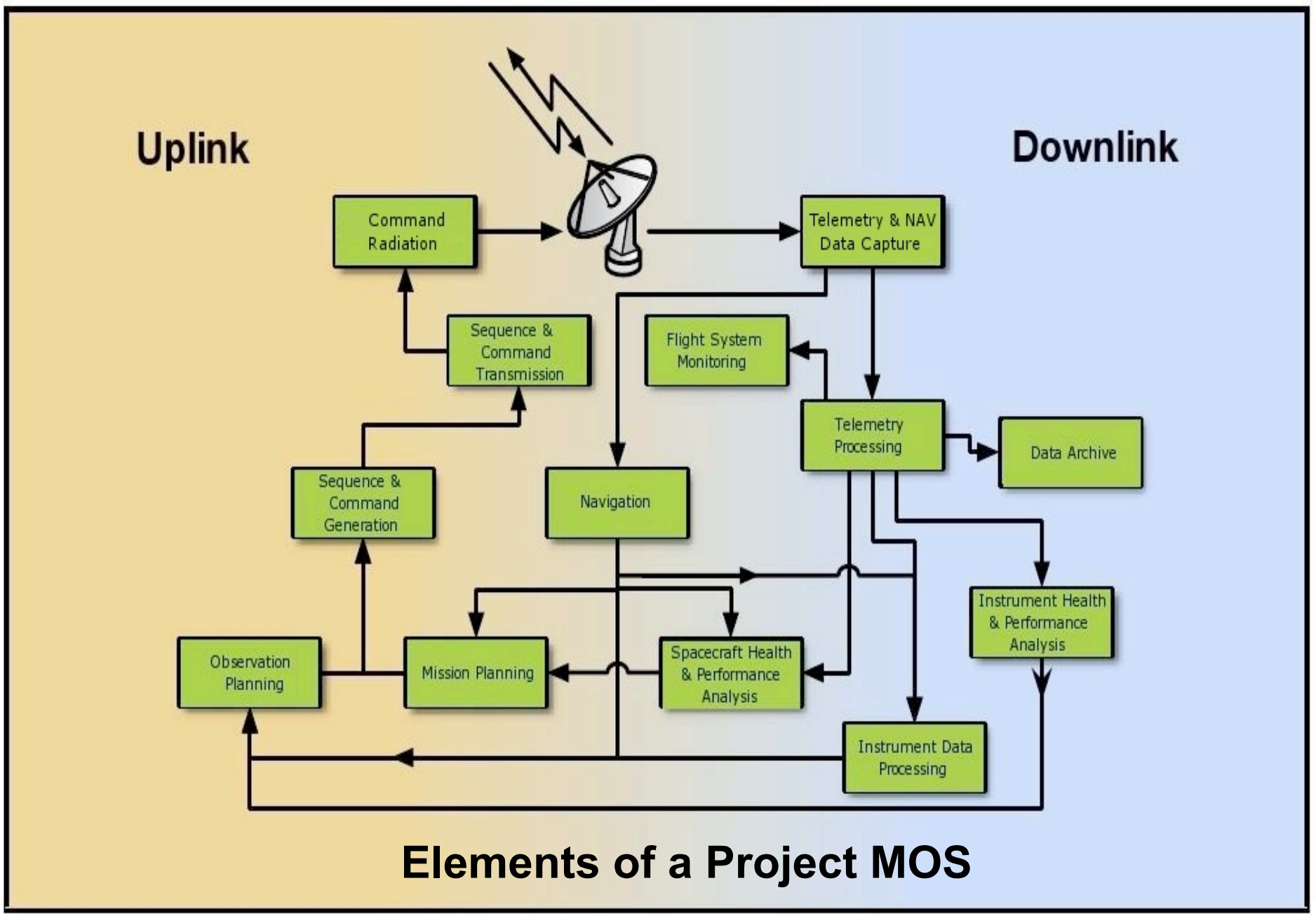
The AMMOS is based upon a simple idea: For those elements of mission operations systems that are common to multiple projects, build them once rather than duplicating that development and maintenance effort for each project

The Advanced Multi-Mission Operations System (AMMOS)

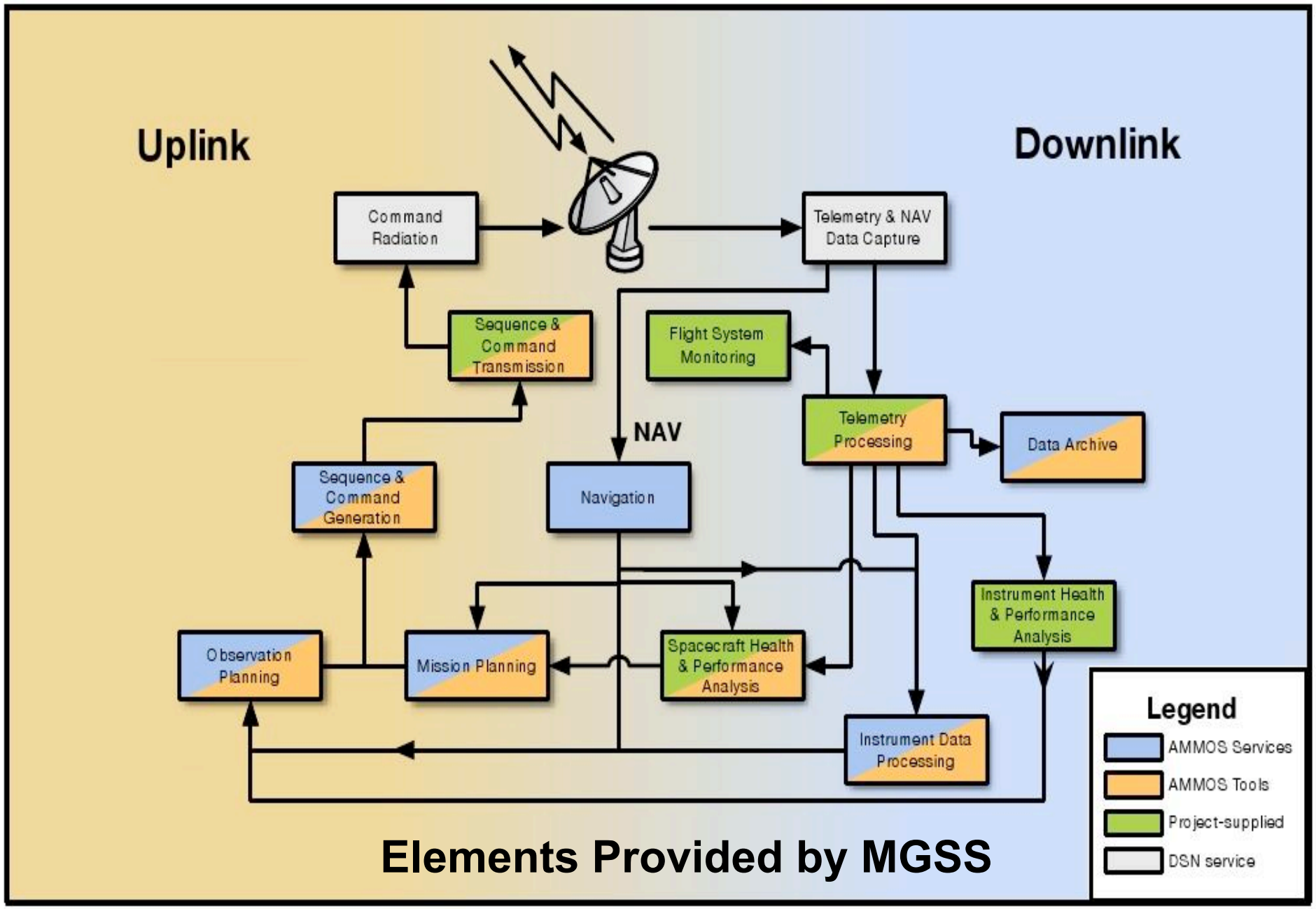
- The Multi-Mission Ground Systems and Services Office (MGSS) at JPL is the organization responsible for managing the AMMOS
- The AMMOS comprises MOS software, systems, and services that can serve multiple projects
  - MGSS provides tools and services that are common to most ***deep space*** and ***astrophysics missions***
  - MGSS exists for one principal reason: Reduce the net cost and risk to the Projects and NASA
- Projects can choose to obtain elements of their MOS from the AMMOS
  - The AMMOS systems must be customized (adapted) to project specifications
  - Project is likely to require some project specific developments
  - The Project integrates AMMOS elements with the project specific elements to produce a complete Project MOS (or MGSS can do that for you)

What is the AMMOS?

- MGSS offers tools and services for:
  - Navigation and Mission Design
  - Mission Planning and Sequencing
  - Spacecraft Health and Performance Analysis
  - Mission Control and Flight System Monitoring
  - Data Management and Archiving
  - Telemetry and Command
  - Computing and Communications
  - Instrument Operations
  - Instrument Data Processing



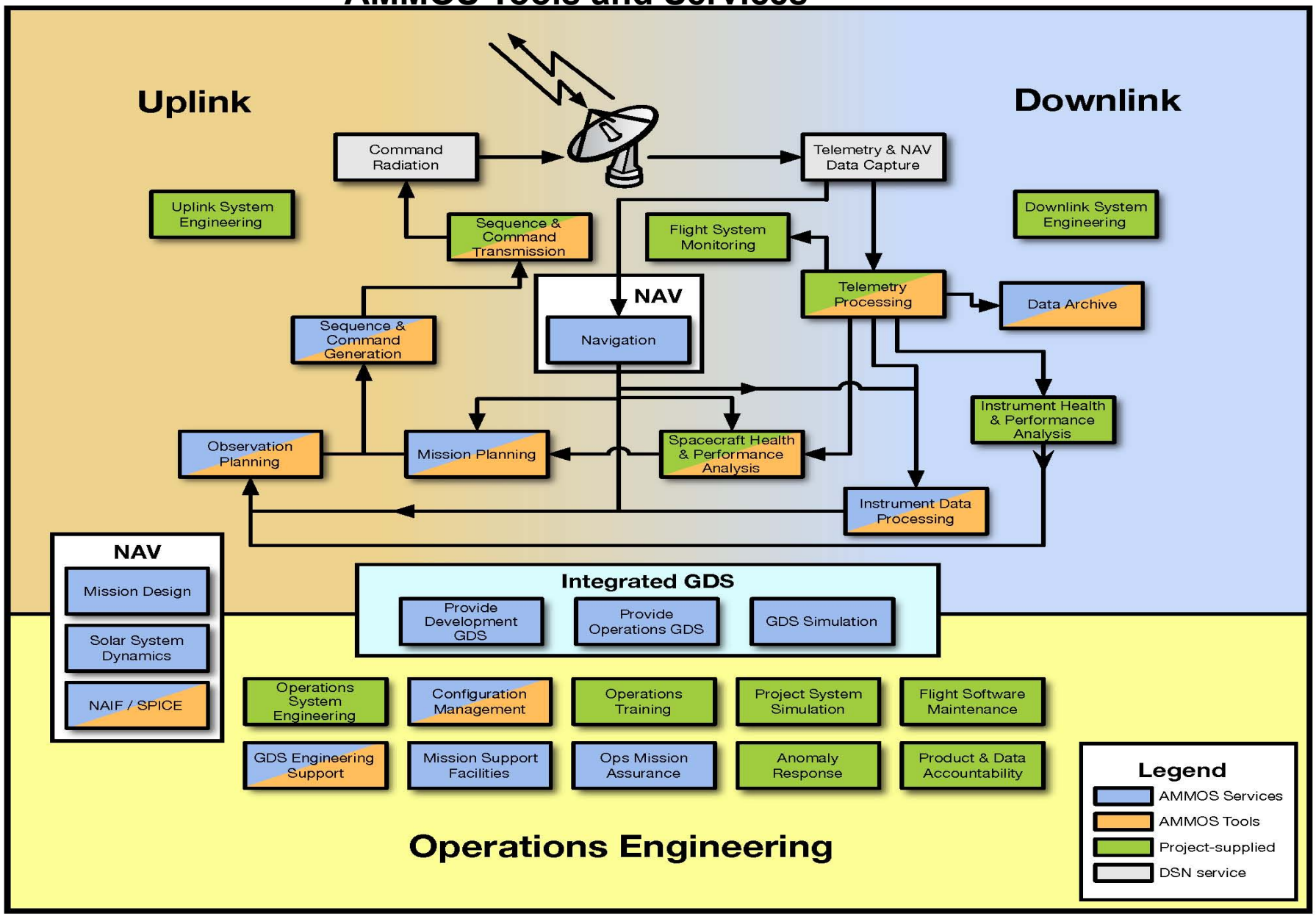
Elements of a Project MOS


Uplink
Downlink
Command Radiation
Telemetry & NAV Data Capture
Sequence & Command Transmission
Flight System Monitoring
NAV
Telemetry Processing
Data Archive
Sequence & Command Generation
Navigation
Instrument Health & Performance Analysis
Observation Planning
Mission Planning
Spacecraft Health & Performance Analysis
Instrument Data Processing
Legend
AMMOS Services
AMMOS Tools
Project-supplied
DSN service
Elements Provided by MGSS

What is the AMMOS?

- MGSS also offers “Operations Engineering” Services
  - Mission Design
  - Solar System Dynamics
    - Planetary, satellite and small body ephemerides
    - Gravity modeling
  - Ancillary Data Dissemination (NAIF/SPICE)
  - GDS Integration, Test, and Deployment
  - Operations Configuration Management
  - GDS Engineering Support
  - Mission Support Facilities Services
  - Operations Mission Assurance

AMMOS Tools and Services



Why Use the AMMOS?

- Lower cost – Project does not have to pay for the development of the capability
- Shorter development cycle – Adaptation takes less time than development
- Lower Risk – The AMMOS is a mature system – most AMMOS elements have been maintained and improved for many years and have been used by a variety of projects in a variety of situations. Most bugs have been discovered and resolved

How Do I Learn About the AMMOS?

- Go to the AMMOS website (http://AMMOS.jpl.nasa.gov)
  - Contains a lot of information about the AMMOS
    - What it is
    - Future plans
    - Benefits
    - Customer list
    - Contact information
- Search the AMMOS Tools and Services Catalog (accessible from the AMMOS website)
  - Provides a list and detailed description of each of the tools and services you can obtain from MGSS
  - Provides two modes:
    - Recommends a system configuration for your mission
    - Expert mode: You select specific tools and services you want
- Contact the MGSS Program Office (see last slide)

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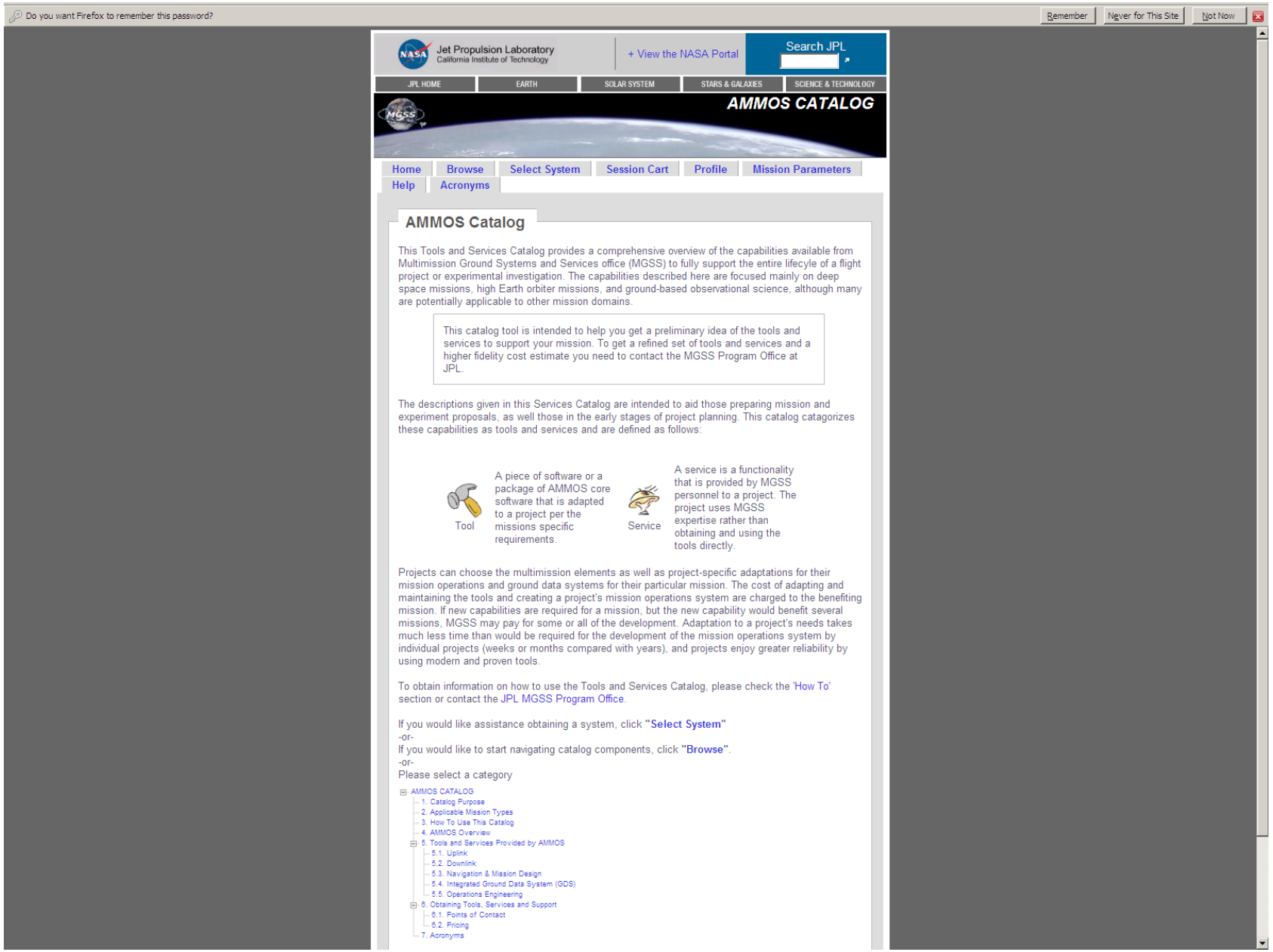

What is the cost to Projects?

- Original development of multi-mission systems is funded by HQ
- Projects pay for use of those systems (market paradigm – full cost recovery)
  - Adaptation
  - Operations services
  - Project hardware (workstations, routers, etc.)
  - Project-specific functionality

Project only "buys" the multi-mission element if it's the best deal!

What is the cost to Projects?

- The AMMOS Catalog includes a “notional” cost for each of the tools and services in the Catalog
  - This provides a ball-park estimate but does not constitute, in any form, a commitment
  - Actual cost is highly dependent upon specific project needs and requires detailed discussion with AMMOS experts
    - Budgeting for AMMOS costs is similar to budgeting other Project elements
    - Team GST can provide an early cost estimate for your MOS
- Additional “cost” to Projects:

  Some reduced control; some compromise to accommodate other projects’ needs

How Do I Work with the MGSS?

- Projects generally assign this responsibility to the MOS Manager or Mission Systems Manager
- In the conceptual phase, the MGSS Commitments Office will assign a commitments engineer to work with your mission
- When the Project is approved, the agreements between MGSS and the project will be formalized in a signed commitments agreement (Service-level Agreement or SLA)
  - The SLA is maintained under configuration control
  - Changes require approval from the Project and the MGSS change boards

Who Do I Call?

- You (or your MOS Manager or Mission Systems Manager) should call:

  Brian Morrison, MGSS Commitments Engineer

  818-354-2458

- Priscilla Parrish, the Deputy MGSS Commitments Engineer, is in attendance today and is available to answer questions and to provide further information

AMMOS Evolution

- NASA has opened the development and evolution of the AMMOS beyond JPL to other key planetary program participants in the NASA community, including (but not limited to) The Johns Hopkins University Applied Physics Laboratory, NASA Ames Research Center, and the NASA Goddard Space Flight Center.
- The AMMOS is funded by the NASA Science Mission Directorate, Planetary Science Division, and is available to proposers as the baseline operations and ground systems option, but is not required.
  - When alternative solutions to the AMMOS are proposed, NASA requests an explanation of the requirements that the AMMOS could not satisfy for the proposal.
    - Please provide feedback to me at william.knopf-1@nasa.gov