Goddard Ground System Environment
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Ben Lui
Goddard Space Flight Center

www.nasa.gov
• Goddard Ground System Environment
• Mission Utilization of Ground Systems
• Observations
• Lessons Learned
• Ground System Infrastructure
  – Provides component plug-and-play capability over a software bus
  – Calls for standard interfaces, not components
  – Allows for mix of heritage and new components
  – Facilitates scalability, extensibility, and technology infusion

• Named runner-up in 2008 NASA software of the year
  – Used by many Goddard missions, Air Force and other fed agencies
GMSEC Users

NASA and Other Government Users

- **Operational (since 2005)**
  - TRMM
  - SMEX Series
  - ST-5
  - ISS (MSFC)

- **In Development (2009)**
  - Terra
  - SDO
  - GLAST
  - MMOC (multiple)

- **Planned (ongoing meetings)**
  - Aqua
  - Aura
  - LDCM
  - GPM
  - LRO-em
  - MMS

- **Facilities and Labs**
  - Cx Const. of Labs
  - CSTL
  - White Sands
  - FDF
  - GSFC Server Farm
  - OTF (JSC)
  - Wallops

- **External**
  - Air Force
  - ORS
  - Homeland Security
Telemetry and Command Systems

• ASIST (Advanced Spacecraft Integration and System Test)
  – Originally developed to support Medium Explorer (MIDEX) missions in the early 1990’s

• ITOS (Integrated Test and Operation System)
  – Originally developed to support Small Explorer (SMEX) missions in the early 1990’s

• Both systems have supported
  – Board and box level development
  – Spacecraft and instrument development
  – Flight software development
  – Integration and test (I&T)
  – Missions operations
• MOPSS (Mission Operations Planning and Scheduling System)
  – Originally developed in the 90’s for SOHO and WIND/POLAR
  – Has been expanded to support several other Goddard missions
• AMPS (Automated Mission Planning and Scheduling System)
  – Designed to support constellation missions
• FlexPlan
  – Acquisition from GMV Space Systems Inc. to support LRO
• GTAS (Generic Trending and Analysis System)
  – Originally developed for SOHO and WIND/POLAR Missions
• DTAS (Data Trending and Analysis System)
  – Designed in the mid 90’s for SMEX missions
• ITPS (Integrated Trending and Plotting System)
  – Provide access to full-resolution mission telemetry data archive
  – Unlimited data point plot
Data Management and Distribution

• DMS (Data Management System)
  – Designed to handle and distribute a large volume of science data
  – Using FedEx approach where data distribution can be tracked in realtime
  – Designed for LRO, can be used by other missions
## Mission Utilization of Ground Systems

### Past and Current Missions

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Upcoming Missions
Observations

• Goddard has used various ground components to support a variety of missions over the last 20 years
• Like the industry, old components are replaced by newer/better components
• Some newly developed components last for many missions, some don’t
Lessons Learned

• Avoid system lock-in
• Provide an open environment that allows interoperability
• There is no one size fits all solution. Most missions have unique requirements and demand unique solutions
• Succession planning for both people and systems
• AETD – Applied Engineering and Technology Directorate
• AMPS – Automated Mission Planning and Scheduling System
• ASIST – Advanced Spacecraft Integration and System Test
• COTS – Commercial Off-The-Shelf
• DMS – Data Management System
• DTAS – Data Trending and Analysis System
• FedEx – Federal Express
• GMSEC – Goddard Mission Services Evolution Center
• GTAS – Generic Trending and Analysis System
• I&T – Integration and Test
• ITOS – Integrated Test and Operation System
• ITPS – Integrated Trending and Plotting System
• MOPSS – Mission Operations Planning and Scheduling System
• NASA – National Aeronautics and Space Administration
• SED – Software Engineering Division
Missions

- CREAM – Cosmic Ray Energetics and Mass
- EO-1 – Earth Observing - 1
- FAST – Fast Auroral Snapshot Explorer
- GLAST – Gamma-Ray Large Area Space Telescope
- GPM – Global Precipitation Mission
- HST – Hubble Space Telescope
- IMAGE – Imager for Magnetopause-to-Aurora Global Exploration
- JWST – James Webb Space Telescope
- Landsat 7
- LDCM – Landsat Data Continuity Mission
- LRO – Lunar Reconnaissance Orbiter
- LWS SET-1 – Living With a Star Space Environment Testbeds - 1
- MMS – Magnetospheric Multiscale Mission
- POLAR
- Rhessi
- SAMPEX – Solar Anomalous and Magnetospheric Particle Explorer
- SDO – Solar Dynamics Observatory
- ST-5 – Space Technology - 5
- SWAS – Submillimeter Wave Astronomy Satellite
- Swift
- Themis – Time History of Events and Macroscale Interactions during Substorms
- TRACE – Transition Region and Coronal Explorer
- TRMM – Tropical Rainfall Measuring Mission
- WMAP – Wilkinson Microwave Anisotropy Probe
- WIND
- WIRE – Wide-Field Infrared Explorer
- XTE – X-Ray Timing Explorer
• AMPS – CSC
• ASIST – Design America Inc. (DAI)
• DMS – the Hammers Company
• DTAS – GSFC
• ECLIPSE – Raytheon
• FlexPlan – GMV Space Systems Inc.
• ITOS – the Hammers Company
• ITPS – Honeywell
• MOPSS - CSC