



# Marshall Space Flight Center Ground Systems Development and Integration

Engineering Solutions for Space Science and Exploration

## Ground Systems Development and Integration

performs a variety of tasks in support of the Mission Operations Laboratory (MOL) and other Center and Agency projects. These tasks include various systems engineering processes such as performing system requirements development, system architecture design, integration, verification and validation, software development, and sustaining engineering of mission operations systems that has evolved the Huntsville Operations Support Center (HOSC) into a leader in remote operations for current and future NASA space projects. The group is also responsible for developing and managing telemetry and command configuration and calibration databases. Personnel are responsible for maintaining and enhancing their disciplinary skills in the areas of project management, software engineering, software development, software process improvement, telecommunications, networking, and systems management. Domain expertise in the ground systems area is also maintained and includes detailed proficiency in the areas of real-time telemetry systems, command systems, voice, video, data networks, and mission planning systems.

Software and system engineers support the products they develop throughout the entire project lifecycle from concept and requirements development through product delivery and maintenance. They also participate in inter-center and inter-agency technology collaboration and standards work and provide inputs to standards committees such as the Consultative Committee for Space Data Systems (CCSDS) in order to establish the MOL as a leader in technology development within the international community. Prototype tasks that establish the feasibility of new standards and technology are performed as well. Current MSFC Ground Systems include telemetry, command, voice, video, information management, data reduction, and payload planning systems used for managing the execution of on-orbit International Space Station (ISS) payload operations within the Payload Operations Integration Center (POIC). In addition, equivalent services are provided for remote ISS payload users/facilities located throughout the world. The HOSC also provides telemetry, meteorological, voice, video, data reduction, and archiving capability for the Space Launch System (SLS) Engineering Support Facility (ESF) and Small Satellite mission operations.

## Operational Products and R&D Products

- Telescience Resource Kit (TReK)—a suite of software applications that can be used to monitor and control assets in space or on the ground. It has been used to support a variety of NASA programs and projects including International Space Station payload operations, WB-57 Ascent Vehicle



Payload Operations Integration Center

Experiment (WAVE) project, the Fast Affordable Science and Technology Satellite (FASTSAT) project, and the Constellation Program.

- Enhanced Huntsville Operations Support Center (HOSC) System (EHS)—provides a general purpose PC-based command and control system used for distribution and display of real-time spacecraft/payload telemetry, and the generation and transmission of uplink commands to a spacecraft.
- Payload Data Services System (PDSS)—a system used to receive, process, store, and distribute ISS Payload telemetry data to the POIC, local payload users, and remote payload users/facilities.
- Payload Planning System (PPS)—provides a suite of software tools to automate the planning, scheduling, and integration of ISS payload operations during pre-increment planning, weekly planning, and real-time operations execution.
- Remote User Services—The HOSC provides network interfaces in support of payload operations to a number of Telescience Support Centers located at various NASA centers, academic institutions, and other research facilities worldwide, including the European Space Agency (ESA) and the Japanese Aerospace Exploration Agency (JAXA).
- Data Reduction (DR)—The HOSC DR function has historical data, from the start of prelaunch testing before STS-1 in 1981 through the landing of STS-135 in 2011, available via a web browser to the AEON1 portal site. This data from Space Shuttle assembly, rollout, pre-launch, launch, and post launch activities was gathered, processed and stored for engine and propulsion behavior analysis. DR acquired Shuttle data from digital, analog, file and tape sources, processed the data, and archived the data for retrieval and analysis by NASA authorized users. DR provides recorded data sets to users per Data Requirements Forms (DRFs)

# HOSC

The Huntsville Operations Support Center (HOSC) has extensive operations and engineering experience supporting numerous projects such as Shuttle, Spacelab, Hubble Space Telescope, Chandra X-Ray Observatory, Fast Affordable Science and Technology Satellite, and the Payload Operations Integration for the International Space Station. Today, the HOSC provides operations and engineering support for ISS Payload Operations, the NASA Space Launch System, the Department of Defense, Missile Defense Agency, and other projects.

The HOSC provides a range of scalable and adaptable ground support services to support a customer's mission requirements. It provides services within its facility, as well as supporting remote operations locations. The HOSC can facilitate the acquisition of other NASA-provided services such as video teleconferencing or external network services.

## Data Acquisition, Storage, and Distribution

Provides ground systems tools used to acquire satellite or payload science and engineering telemetry, audio and video data, and test facility data. Data integrity and user authentication and authorization are controlled by the data owner. Data can be extracted for distribution (filtered or unfiltered) and distributed via streaming or file transfer to local and remote facilities.

## Data Processing and Computational Services

Performs data conversion, calibration, and limit/expected state sensing are provided through the HOSC's data processing and computational services. These services provide the necessary metadata (e.g., database) services to support a customer's defined data de-computation and processing definitions. Computational services include data quality analysis, filtering, transformation, and characterization.

## Command and Control Services

Executes a suite of software applications to simultaneously monitor and control mission systems in multiple operational modes from any operating location. Users who develop their own software may access HOSC services via available Application Programming Interfaces (APIs).

## Information Management Services

Hosts administrative tools through a web portal providing a source for effective operations communications, collaboration, and knowledge transfer within and across teams, regardless of their location. These tools include: library services, status logs, blogs, forums, and wikis.

## HOSC Communications Services

Offers Voice over Internet Protocol (VoIP) communications and industry-standard format video distribution services to users within the facility and worldwide.

## Network Interface Services

In addition to local network access, the HOSC provides secure remote access to our provided services from anywhere in the world using the World Wide Internet, commercial carriers, and many science and mission networks.

## HOSC Facility Services

Provides users with configurable mission control center support areas with environmental and electrical resources necessary to support mission-related activities

## Customer Support Services

A customer point-of-contact is provided to assist in linking customer operations concepts to specific HOSC services, reviewing service cost options, and documenting approved customer/HOSC agreements for implementation.

## HOSC Ground Operations and Maintenance Support

Ensures system and service availability, response, and integrity as identified by the customer operational requirements.

## Engineering Support

Provides full software and systems engineering support to ensure the HOSC services meet customer requirements.

For more information, please visit [www.nasa.gov/centers/marshall/about/business.html](http://www.nasa.gov/centers/marshall/about/business.html)

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