# LUNAR UTILIZATION CONTROL AREA (LUCA): CONFIGURABLE MISSION CONTROL ROOMS AND THE BENEFITS TO FUTURE SPACEFLIGHT

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Current Paradigm

The ISS Mission currently operates with a 24/7/365 support structure. As such, the Payload Operations Integration Center (POIC) was created over 20 years ago as the home of all US-based payload operations. Previously, any payload developer or technical expert needed to be physically in-house to represent their facility or science, but now with the tools implemented by the Huntsville Operations Support Center (HOSC) we are able to pipe payload data, voice, and video anywhere in the world. This allows the core team to support in-house at MSFC while the payload experts can choose to sit in-house as well or support from their university, company, or institution.
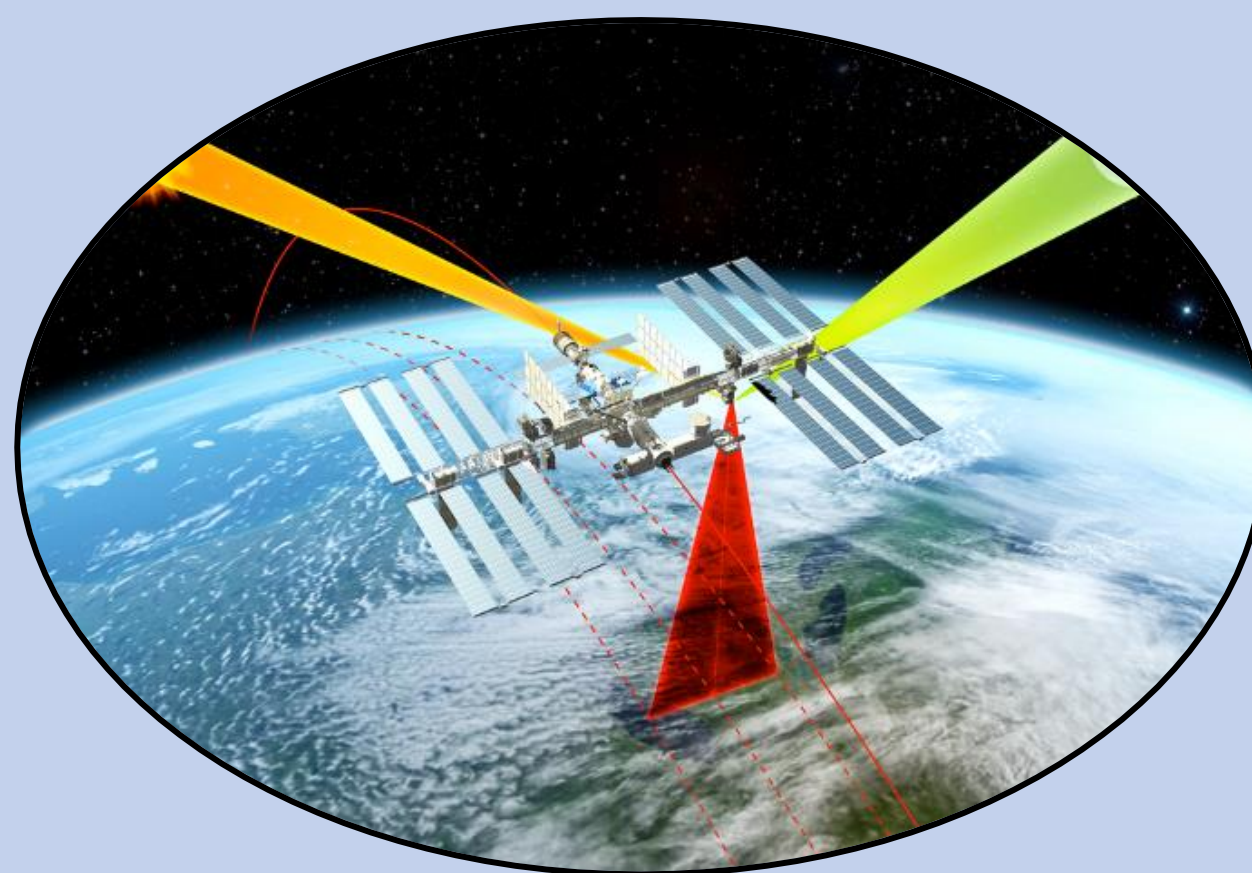
TReK

To facilitate the distributed architecture POIC has helped to cultivate, the HOSC has developed the Telescience Resource Kit (TReK). This powerful software suite contains the tools for the end-user to maintain global monitoring and control of space and ground assets.

Users can easily create, modify, and uplink command sequences through the integrated tools, replay recorded telemetry, and forward it to other applications. TReK supports various communication protocols, excels in data handling, and provides robust metadata and file transfer features on both Windows- and Linux-based systems along with API integration via C++, .NET Framework, and Python. TReK's comprehensive capabilities make it an invaluable tools for anyone working on science-on-orbit.

trek.msfc.nasa.gov

- 24/7 Helpdesk technical support
- Easy-to-use interface
- Extensive applications and libraries for integration with vehicle systems
- Flight proven on both crewed and uncrewed missions
- Supports local and remote users
- Integrates easily with customer ground systems
- Includes support for CCSDS, Delay Tolerant Networking (DTN) protocols, and CFDP File Transfer
- Highly portable ground system that can run on a laptop, with mobile device support coming soon

With the launch of Lunar Node-1 onboard the Intuitive Machines-1 lander this February, users have already begun to use MSFC's flagship CCR, LUCA, for real-time operations. Lunar Node-1 will be a beacon to demonstrate navigation technologies on the lunar surface for landers, surface infrastructure, and astronauts.
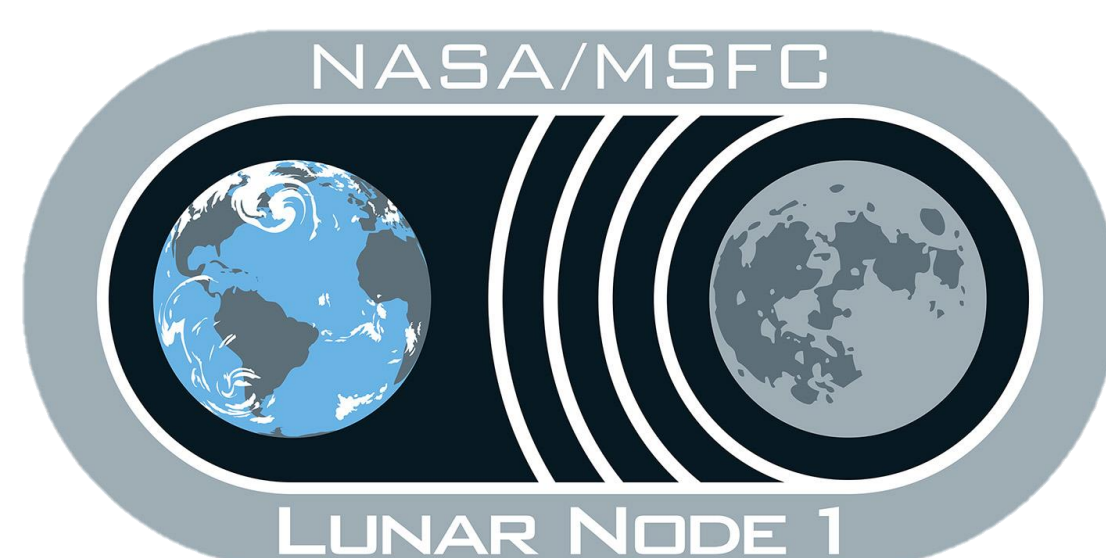
Configurable Control Rooms (CCRs)

Configurable Control Rooms provide the ability to rapidly change capabilities from mission to mission and customer to customer. Future missions will likely not have the 24/7/365 need for a dedicated mission support room, and CCR could easily be adapted for continuous support if needed. CCRs offer physical, centralized locations for teams to support, and the HOSC provides a secure, reliable facility with constant monitoring by network specialists. Institutions and payload teams can cost save by utilizing a CCR at MSFC eliminating the need to assemble an entire custom control room at their location. This new paradigm in flight operations can ease the creation of any mission from a cubesat to a New Frontiers or Flagship program and anything in between.

- Multiscreen Video Wall
- Local and remote voice capabilities
- Video routing capabilities in SD, HD, Encrypted, and Streaming
- Flight controllers can be user provided or trained in-house
- Virtual desktops for easier software testing and updates
- Worldwide commanding and telemetry capabilities with 20+ years of proven reliability

Past - Shuttle Era
All control rooms onsite.
No remote support

Present - ISS
Prime control rooms onsite.
Significant remote support

Future - Artemis and Beyond
Prime control rooms onsite and configurable.
Significant remote support