

Glenn's Telescience Support Center Provided Around-the-Clock Operations Support for Space Experiments on the International Space Station



Jack Lekan operates the InSPACE experiment aboard ISS from the Glenn TSC.

NASA Glenn Research Center's Telescience Support Center (TSC) allows researchers on Earth to operate experiments onboard the International Space Station (ISS) and the space shuttles. NASA's continuing investment in the required software, systems, and networks provides distributed ISS ground operations that enable payload developers and scientists to monitor and control their experiments from the Glenn TSC. The quality of scientific and engineering data is enhanced while the long-term operational costs of experiments are reduced because principal investigators and engineering teams can operate their payloads from their home institutions.

Glenn plays a major role in conducting space experiments. In 1993, the TSC began providing ground support for experiments aboard space shuttle flights. During 2000 and 2001, the TSC went through a major renovation and expansion, more than doubling its capacity. The TSC is now a secure, multipurpose facility designed to provide dedicated support for simultaneous training, simulations, and real-time operations of space experiments. The current configuration consists of the Payload Operations Center, the Communication and Network Support Room, the TSC Operations and Support Room, and a visitors viewing area that provides access on a noninterference basis.



Voice communications enable researchers to interact with the Payload Operations Integration Center at the NASA Marshall Space Flight Center in Huntsville, Alabama

Since 2001, the TSC has provided over 26,000 hr of continuous support for diverse microgravity research experiments onboard the ISS, 24 hr a day, 7 days a week, while requiring less than 100 hr of crew intervention. Secure, dedicated audio, video, and data interfaces are provided to payload teams, including a digital stream of two channels of video from the ISS and the ability to communicate directly with the ISS crew. Hardware and software provide the ability to send commands to payload hardware and to receive feedback via telemetry data and video links.

Pre-mission planning and post-mission debriefing support is provided for all payloads. The TSC staff begins planning for support of a payload up to 18 months prior to the start of operations, depending on the complexity of the payload's operational requirements. Payload developers plan the operations, such as mission timeline development, resource planning, simulations, and training from the TSC. The TSC staff trains all the payload operations teams prior to mission operations. Training is tailored to each payload and covers all aspects of operations.



The TSC has an elaborate network system to support voice, video and data distribution within the TSC.

In addition to 5000 ft² for conducting payload operations, the TSC is also a communications and data center. The TSC provides secure digital audio links with the ISS Huntsville Operations Support Center. Audio systems at the TSC provide 45 separate digital channels for payload developers to communicate with the various groups working to support ISS operations. All data, voice, and video resources are available for each payload at its respective console workstation. Workstations and unique audio channels are configured for each payload team according to the team's needs so that the team can receive specific data from their flight hardware on orbit. The TSC provides at least two workstations for each payload and can manage dozens of terabytes of downlinked data from payloads.

Real-time video also is networked to the TSC, allowing payload developers to view ISS video, which displays crew members interacting with their experiments on orbit and can include images of experiment execution. The TSC can receive two of the four ISS video channels simultaneously, and can route video directly to the payload developer's console position, on the basis of the developer's requirements. All systems are monitored by the sustaining engineering staff daily and by automated systems around the clock. Short- and long-term storage of scientific and engineering data and access to a public Web site containing processed data are also provided. Technical support can be provided to operation sites outside Glenn when requested.



DAFT is operated on the ISS by Glenn engineers.



DAFT operators review data received from their experiment on the ISS.

In fiscal year 2004, six ISS payload teams (SAMS, MAMS, BCAT-3, CFE, INSPACE, and PIMS) successfully operated their experiments from the Glenn TSC. The TSC upgraded 33 workstations to Windows XP and installed a state-of-the-art hot failover firewall system. Also, in preparation for the launch and subsequent operations of the Fluids and Combustion Facility (FCF) aboard the ISS, the FCF Central Data System hardware, which provides 29.4 TB of disk storage, was integrated into the TSC network.

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