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The SIRTF Science Center Is Alive And Well And Living In Pasadena

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Abstract. The Space Infrared Telescope Facility (SIRTF) will perform an extended series of science observations at wavelengths ranging from 20 to 160 microns for five years or more. The science payload consists of three instruments delivered by instrument Principal Investigators located at University of Arizona, Cornell, and Harvard Smithsonian Astrophysical Observatory. The California Institute of Technology has been selected as the home for the SIRTF Science Center (SSC)[1]. The SSC is responsible for evaluating and selecting observation proposals, providing technical support to the science community, performing mission planning and science observation scheduling activities, instrument calibration during operations and instrument health monitoring, production of archival quality data products, and management of science research grants. The SSC is currently engaged in development of a major data processing and archive system. The first components of that system have now been operational for over a year, and have been used by Guaranteed Time Observers to submit over 3000 observation requests. In addition, the solicitation for the Legacy Science Proposals has been completed, and proposal teams utilized tools and systems developed by the SSC to submit their proposals electronically for evaluation and selection.

1. Introduction

The Space Infrared Telescope Facility (SIRTF) is now scheduled for launch in July, 2002. The SIRTF Science Center (SSC) on the Caltech campus in Pasadena, CA, will have responsibility for scientific operations during the mission. The responsibilities include solicitation of proposals from the science community, development of integrated science observation planning and scheduling products, transfer of integrated observation schedules to the Jet Propulsion Laboratory for execution by the Observatory, pipeline processing of data from the three science instruments, and development and maintenance of the science data archive for community access. The SSC is responsible for design, development, and operation of the Science Operations System (SOS) which will support the functions assigned to the SSC by NASA.

[1] `http://sirtf.caltech.edu`

In the past year, the SOS has made the transition from a design on paper to an operational system that is currently supporting proposal submission, observation planning by the Guaranteed Time Observers and the general science community, mission planning and scheduling of the first set of post-launch observations, and pipeline design and processing of preflight instrument data. Innovative web-based tools for planning observations with SIRTF have been successfully downloaded to hundreds of user sites, and the observation database at the SSC currently contains thousands of individual observation requests. The proposal submission system has been used to support the call for proposals for the SIRTF Legacy Science program, and proposals will be in evaluation by the time ADASS 2000 takes place.

The SIRTF spacecraft, mission profile, and science instrument design have undergone almost ten years of refinement. SIRTF development and operations activities are highly cost constrained. The cost constraints have impacted the design of the SOS in several ways. The Science Operations System has been designed to incorporate a set of highly efficient, easy to use tools which will make it possible for scientists to propose observation sequences in a rapid and automated manner. The use of highly automated tools for requesting observations will simplify the long range observatory scheduling process, and the short term scheduling of science observations. Pipeline data processing will be highly automated and data-driven, utilizing a variety of tools developed at JPL , the instrument development teams, and Space Telescope Science Institute to automate processing. An incremental ground data system development approach has been adopted, featuring periodic deliveries that are validated with the flight hardware throughout the various phases of system level development and testing. This approach minimizes development time and decreases operations risk.

2. System Design

The system architecture is modular and functional. The most mature elements of the system include the system elements used to plan and schedule science observations.

The Science User Tools consist of a variety of Java-based software elements that are downloaded to the user's PC or workstation. These tools support observation planning in a variety of ways. Users can maintain a catalog of observation targets on their home machines. They can select from one of seven observing modes across the three payload instruments, and input observation parameters to generate an AOR (Astronomical Observation Request). Users can build a library of desired observations on their home systems, and then download the final set of observation requests to the SSC when completed.

The AOR/IER Expansion Editor is used to expand each individual AOR (or Instrument Engineering Request-the IER's) into spacecraft and instrument commands. The user is provided with the resource estimate for each observation following expansion of the AOR or IER into a command sequence. This feedback enables users to provide observation programs to the SSC that fit within their time allocations.

The Science Observations Data Base (SODB) is used at the SSC to hold all information submitted by the community, and will eventually encompass the

project archival data bases as well. Command expansions are transferred to the flight operations systems at JPL for execution via transfer from the SODB to JPL operational data systems. Downlink data is transferred to the SODB by the JPL flight operations system when data are acquired by the Observatory and transferred to the JPL ground data support systems from the Deep Space Network.

The SSC pipeline processing is an automated process that is initiated when data requested by the uplink planning system are delivered to the SODB. The SSC is currently designing and implementing the pipeline systems in conjunction with the instrument Principal Investigators and their support teams.

3. Results to Date

Over three thousand individual AORs were submitted to the SSC prior to the call for Legacy Science Proposals by the GTO community. The SSC processed the GTO requests and produced a Reserved Object Catalog, so the Legacy proposal teams were aware of targets that had been reserved by the GTOs. The database submitted by the GTOs represents a substantial resource that will be used in future testing of the ground data system with the Observatory. It also represents a significant percentage of the first year's observations, and will be used extensively in developing the mission plan for the first year of operations. The Legacy Proposal Teams will add their detailed AORs to the SODB following their selection, so that the majority of first year observations will be available well before launch for mission planning purposes. The GTO database has been analyzed by SSC staff, and the analysis indicates that the design estimate of an average of 30 minutes per observation was a good choice. Analysis also indicates an excellent sampling across the three instruments, the seven available instrument operations modes, and sampling of various areas of the sky.

4. Future Work

Future work includes completion of the expansion logic for three of the seven observing modes that have not yet been completed, and increasing focus on development of the pipeline processing software system. The three instruments were integrated into the cryogenic assembly in December 2000, and have passed their functional tests at operating temperatures. Extensive analysis of available detector data from the three instruments is well along, and algorithms for processing and analysis of the instrument data are in various stages of development and testing. SIRTF project plans include a "week in the life" test of the full Observatory and flight qualified ground data system prior to launch, at which time a typical week-long sequence of science and engineering activities will be executed with the flight hardware.

Acknowledgments. It is a pleasure to represent the efforts of the outstanding staff of the SIRTF Science Center in designing, developing, implementing, testing and operating the systems that will be used to support SIRTF operations, and their efforts in supporting the external scientific community. The cooperation received from the three instrument Principal Investigators, Dr. Giovanni

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