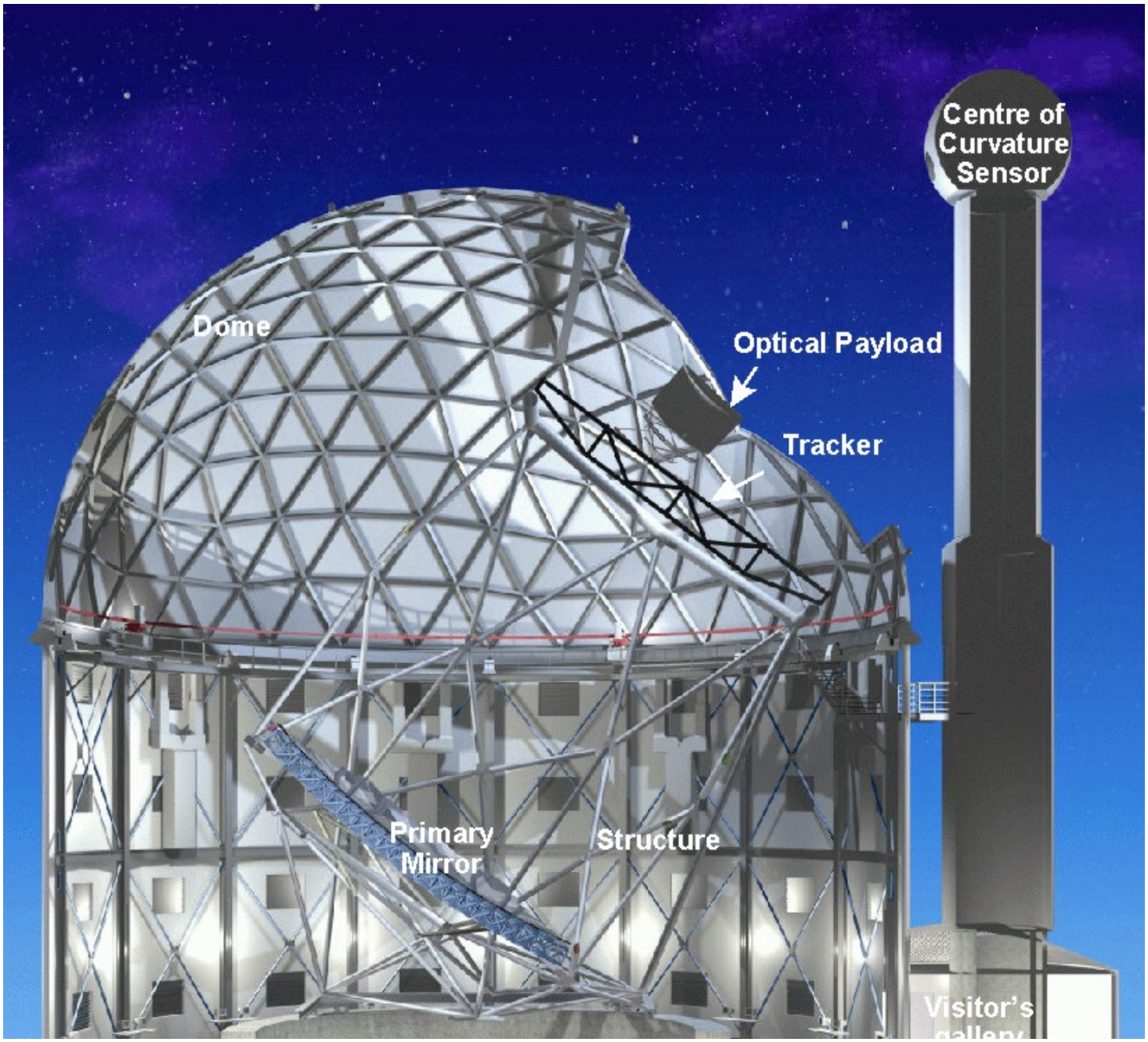
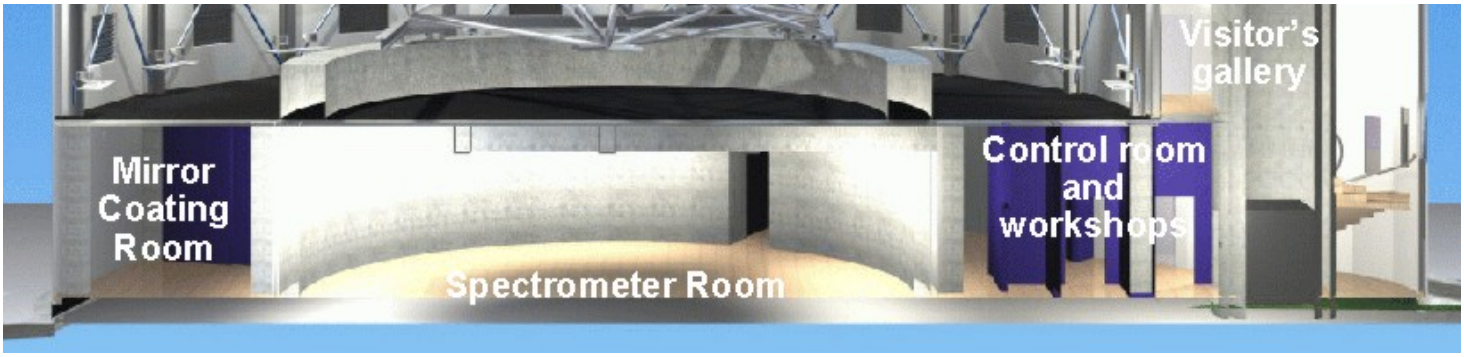
Southern African Large Telescope (SALT)

Overview

Rutgers University is a partner in the Southern African Large Telescope consortium, SALT, a group of countries and universities that have jointly constructed a 10-meter optical telescope optimized for spectroscopic work that closely resembles the Hobby-Eberly Telescope (HET) at McDonald Observatory in west Texas. Memoranda of Understanding signed by partners in Africa, Europe, Australasia, and North America established the SALT Foundation, which will own and operate SALT. Rutgers astronomers have a 10% share of the telescope and the telescope time.





Partners

The construction and operation of this world-class astronomical facility has been made possible by the participation of its partner institutions. Both private and public funds were pooled to create what is, at this time, the largest diameter optical telescope anywhere int he world. SALT is a truly multi-national endeavour and will be a catalyst for scientific and educational co-operation between participating nations well into the 21st century. The partners in SALT are:

- The National Research Foundation of South Africa
- Nicolaus Copernicus Astronomical Center of the Polish Academy of Sciences
- The Hobby-Eberly Telescope Board
- Rutgers, the State University of New Jersey
- Georg-August-Universität Göttingen
- The University of Wisconsin-Madison
- Dartmouth University
- The University of North Carolina
- Carnegie Mellon University
- Consortium of New Zealand universities
- Consortium of United Kingdom universities and institutions

The project is being managed by a team of people based at the SALT Foundation headquarters located at the South African Astronomical Observatory complex in Cape Town. The full team commenced work on the project in January 2000 and will have completed the task by the end of 2005. Shared-risk science observations have begun and the formal inauguration of SALT is scheduled for November 2005.

Telescope

SALT is closely modelled on the Hobby-Eberly Telescope (HET) situated in west Texas. However, almost every subsystem has been redesigned using the lessons learned from HET. Two of the most notable changes are a redesigned reflective spherical aberration corrector (SAC) and an active primary mirror alignment system utilizing capacitive edge sensors to measure primary mirror segment movement. The SAC has an 8 arcmin diameter field of view (four times the area available with HET), improved image quality (EE50<0.2 arcsec), and multi-layer Ag/Al coatings on the four mirrors which

enhances the sensitivity at short wavelengths (capable down to 320 nm).

Like the HET, SALT will specialize in spectroscopic observations using an array of state-of the-art instruments, although a facility CCD imager will also be available. SALT is a fixed altitude telescope, and therefore observing with it is more complicated than observing with most ground-based telescopes. SALT can access 70% of the sky observable from Sutherland, but only during specific "windows of opportunity". Objects are not always observable by SALT, even though they may be above the horizon. However, the dates an object can be observed during the course of a year are almost identical to that of a more traditional telescope.

Instrumentation

The first-generation instrumentation for SALT was developed by the SALT Science Working Group (SSWG) consisting of representatives from all of the SALT partner institutions and is chaired by the SALT Project Scientist. These instruments were developed to satisfy the top-level user requirements for SALT, known as the SALT Observatory Science Requirements. The three first-generation instruments are:

- SALTICAM: A prime-focus camera that will image the entire science and guider fields of view (i. e., ~10 x 10 arcmin) onto a 4K x 4K detector area. The detector is a mosaic of two E2V CCD 44-82 chips. The optics are designed to allow observations from 900 nm to 320 nm (the UV atmospheric cutoff). SALTICAM will be able to obtain images at a rate of at least 10 Hz, extending the domain of time variability studies on 10-m class telescopes. This instrument is currently being used for telescope verification.
- PFIS (Prime Focus Imaging Spectrogragh): An efficient low to medium resolution imaging spectrograph operating from about 320 nm to 900 nm. There is an upgrade path for a near-IR arm (to 1.7 microns) using a dichroic beamsplitter. Efficient and tuneable Volume Phase Holographic gratings provide resolutions up to R ~ 6000 with 1 arcsec slits and R ~ 10,000 with 0.6 arcsec slits. Laser-cut graphite focal-plane slit masks will provide multi-object spectroscopy of up to about 100 objects at a time. All Stokes mode spectropolarimetry and imaging polarimetry are provided by 1/2 and 1/4 waveplate retarders and a large Wollaston beam-splitter mosaic. Three Fabry-Perot etalons, with two sometimes used in series, provide imaging spectroscopy in the range 430-860 nm with resolutions of R = 500-1000, ~2500, and ~12,500. PFIS is being built by the University of Wisconson-Madison and Rutgers University (the latter providing the Fabry-Perot subsystem and the PFIS Invar structure). It will be delivered to SALT in early 2005.
- HRS (High Resolution Spectrograph): A single-object echelle spectrograph fed by a pair of 300-500 micron (1.3-2.2 arcsec on the sky) diameter optical fibers. A dual-beam, white-pupil R4 spectrograph will deliver a resolving power of between R=17,000 (un-sliced 500 micron fibers) and 80,000 (350 micron fibers with an image slicer). The wavelength coverage of the two beams, split by a dichroic, will be 370-560 nm (blue) and 560-870 nm (red). Complete free spectral ranges are covered, though there may be a small gap in each red order if a mosaic of two CCDs is the detector for this beam. This instrument is being built by the University of Canterbury, New

Zealand. It is scheduled to be completed in early 2007.

Site

SALT is located at the South African Astronomical Observatory (SAAO) near Sutherland in South Africa's Northern Cape Province. SAAO has operated telescopes on this desert hilltop, far from city lights and pollution, since the early 1970s. SAAO operates SALT under contract from the SALT Board and the SALT design and engineering team is based at SAAO in Cape Town.

Project Status

The official groundbreaking for SALT took place in early September 2000. The full project development team commenced work in January 2000 and will complete their task by the end of 2005. Shared-risk science observations have begun with the SALTICAM imager and the Prime Focus Imaging Spectrograph (see the descriptions above). The formal inauguration of SALT is scheduled for November 2005.

Rutgers astronomers Chuck Keeton, Jack Hughes, Jerry Sellwood, Laura Ferrarese, and Pat Cote (from left to right) visited the SALT site in October 2003 as part of the second ``Science with SALT'' workshop.

The SALT dome in winter makes another pretty picture.

For more information see the official SALT website, or contact williams_at_physics.rutgers.edu