DEIMOS
SSC Presentation: May 11, 1998
Sixteenth Quarter

From this time forward, we will be re-organizing our format to follow the DEIMOS Master Schedule, which was given out at the SSC meeting on March 6, 1998, a copy of which is attached.

I. Master Schedule Milestones

- Mar 15: LN_2 can fabricated and leak tested — done.
  - Hold time is 36 hr with cold finger in air.

- Apr 15: Slitmask modifications installed and ready for testing — delayed ~2 weeks.
  - Mechanical modifications are now complete and installed, including motor and drive.
  - Delayed by vignetting rework to slitmask form (see below).

- Apr 15: Fabricate the science dewar and leak test it — done.
  - Fabrication of dewar can complete.
  - Leak test successful.
  - Cooling of dewar next week.
  - FC X-motion is fabricated; focus drive is designed.
  - June 15 is the target date to integrate drives and dewar.

- Apr 30: PA drive and counterweights installed and ready for testing — delayed ~2 weeks.
  - Counterweights installed.
  - Renashaw encoder parts all fabricated, mostly installed.
  - Delayed by vignetting rework to slitmask form (see below); new date to start testing is May 15.

- Apr 30: Finish cross-talk tests of two Orbit chips in the test dewar — delayed 4 weeks.
  - An Orbit CCD has been successfully run in the ESI dewar with the Leach-2 controller. Readout noise was 5-6 e^-, as expected for this chip.
  - This plus the earlier test of the ESI MIT/LL CCD in the same dewar verified the basic CCD electronics design.
  - The two Orbit CCDs have been packaged, and the test dewar is tested and working.
  - The new target date to finish testing is May 30.

- Jun 1: Finish polishing the camera optics — on schedule.
  - Elements 1 and 3 are finished.
  - Element 4 is in progress; both it and Element 6 are due May 30.
  - ORA is developing the final radii of the pickup spheres on Elements 4 and 6.

- Jun 1: Fully fabricated science CCD controller goes to CCD lab — on schedule.
  - Designs for the preamps, mosaic interconnect boards, and other support boards were finalized on the basis of successfully running the MIT/LL and Orbit CCDs.
  - Small modifications were made to the board layouts, and the boards are out for fabrication on schedule.

- Jun 1: Finalize assembly method for science CCD mosaic — on schedule.
  - Two trial assemblies have occurred.
  - Jigs needed for assembly have been designed and are being fabricated.
  - The third and final assembly trial is expected within two weeks.

- June 15: Design and fabricate the focal plane fiber feeds for the FC system — delayed ~2 weeks.
  - Lab tests have started on the design for feeding light into fibers.
  - The design of fiber input mounts on the slitmask form was delayed by the vignetting rework on the form (see below).

- July 1: Finish coating the camera optics — on schedule.
  - The contract with Coherent was finalized at $121 K.
  - The expected reflectivity averaged over all angles and wavelengths is 1% per surface, close to that of ESI.
  - Elements 1, 2, 7, 8, 9, and the dewar window were delivered to Coherent.
  - Witness samples were ordered and are being polished in time to meet the coating schedule.
  - The remaining Elements 3, 4, and 6 are either finished or are on schedule.
  - Coherent expects to carry out two coating runs in May and one in early June.
  - The coating contract does not include the front window, which we will attempt to have coated using Solgel at Livermore to save costs.

- July 1: Assemble the first science mosaic with Orbit CCDs — on schedule.
  - The 8 Orbit CCDs are being packaged.
  - The test assembly of the mosaic is on schedule (see above).
  - A concern is the delay in the cross-talk measurements with the 2 Orbit CCDs (see above).

- July 1: Grating 1 and the flat mirror installed and ready for testing — on schedule.
  - Grating 1 (Pos 1) has been fully fabricated and installed.
  - The flat mirror design is done (Pos 2), and fabrication is 50% complete.
  - The major components of the grating slide drive and slide counterweight system have been installed. The motor is being installed.
  - Design of the 6 × 8 grating modules (Pos 3 and 4) is 75% done.

- July 1: Filter wheel installed and ready for testing — delayed ~4 weeks.
  - Design to have started Apr 1; delayed by ESI.
  - This item will likely be fabricated outside.

- July 1: Finish the band brake — on schedule.
  - The basic brake is fabricated and installed.
  - Struts for vertical stabilization are being designed.

- July 1: Fabricate the parts for the camera barrel — on schedule.
  - The camera drawings are complete, and parts are being fabricated at Hahn.

- July 1: Fabricate and install the motor control panels on the rotating shell of DEIMOS; run cables throughout the instrument — on schedule.
  - The first rotating electronic panel has been completed and installed on a trial basis.
  - The second panel is fabricated and is being tested.
  - Cabling of the instrument is about 50% complete.

- July 1: Fabricate and install the cable wrap — on schedule.
  - An error in the basic design was detected. Recovery is simple because the number and cross-section of the cables in the wrap have been reduced, reducing the total volume needed in the wrap.
  - Redesign is underway; we expect no net delay in schedule.

II. Other activities

- Software and data reduction:
  - A prototype of a graphical tool for the display and analysis of keyword-based engineering telemetry data was completed and tested (EngDataVu). This tool was demonstrated at CARA in March.
  - Further refinements were carried out on the DEIMOS GUI.
  - An automated suite of database sanity-checking software was prototyped and tested.
  - The master list of software modules was updated, and priorities were reviewed as input for the descoping discussion today.
  - Further progress was made on understanding fringing and guider errors on LRIS. Flexure, guiding, and grating reset tests were carried out at Keck, with the following results: 1) Mechanical flexure continues to be generated by the image rotator at the level of ~1 px; this is detected as offsets and rotations of dome flat images taken at the zenith as the image rotator is rotated. Geometric distortions are also detected at the 0.5 px level; their origin is not understood. 2) Flexure drifts during observing at high declination are about 1 px per hour. 3) Flexure motions of 1 px cause flat-field fringe errors of about 0.4%. Errors below 0.2% are needed for good sky subtraction. 4) An attempt to generate spectral flatfields for LRIS based on flats taken at different grating tilts some 40-100 Å away generated encouragingly small residuals; purely synthesized flats and corrections to existing flats may both be possible. 5) Guider errors in the amount of $0''.3$-$1''.0$ seem to be routine; spectra are broadened by typically $0''.4$ over $0''.8$ seeing. Aside from light loss at the slit, the extra sky noise decreased the effective Keck aperture from 10 m to 6.7 m, equivalent to a dollar loss of investment of ~ \$50 M if uncorrected.

- Coupling fluid reactivity tests — yielding results.
  - Five candidate optical coupling fluids are being tested with samples of RTV560 plus 6 O-ring candidate materials. The liquids were placed in test tubes with the materials and have been heated at 35 °C for several weeks.
  - Two fluids show no reactivity with RTV560; Viton O-ring material is also non-reactive with all fluids.
  - Tests with bladder vinyls have recently been started.

- Ghost images/ghost pupils:
  - A study of ghost images was carried out using Zemax.
  - Most ghost images are large and fairly uniform; diameters are thousands of px, and surface brightnesses are down from stellar images by ~22 magnitudes.
  - A handful of ghosts is smaller with minimum diameter ~400 px and uneven surface brightness. Their surface brightness is down by 15 mag.
  - Ghost pupils have not yet been studied.

- Rework the design of the slitmask form to eliminate vignetting of light en route from the tent mirror to the grating — new task.
  - This task slipped through our planning. It has been completed but caused delay in testing the slitmask and PA rotation systems.
  - The redesign of the slitmask form is complete, and the new form is being machined.

- Design and fabricate the temperature sensor system — done.
  - There are two systems, of high and low precision.
  - The high-precision system has 30 sensors. It is made by Hewlett-Packard and has an absolute precision of 0.1 °C. The system has been ordered and is being tested.
  - The low-precision system runs off thermal inputs in the Galil motor controllers. It permits several dozen sensors. Its nominal precision is $\sim$1 °C but may be much better than this after calibration.
  - The locations of the sensors and the holder design have been planned.

- Absorptivity and reflectivity tests of DEIMOS' interior black paint — OK.
  - The interior paint should absorb well at both visible and thermal wavelengths; the former to reduce visible scattered light, and the latter to reduce the internal thermal time constant, which in turn reduces optical misalignments due to temperature gradients.
  - The emissivity/absorptivity was estimated from laboratory tests at 2 μ and 10 μ using radiation from a 100 W bulb and confirmed to be high at both wavelengths.
  - Samples were sent out for reflectivity measurements at various angles of incidence from 4000 Å to 2.5 μ by Optical Data Associates. The reflectivity is a few percent at 90° incidence, rising to 30% at 75°, and fairly flat at all wavelengths. In particular, the rise in reflectivity at 7000 Å that is seen in carbon-based black paints was not detected.
  - DEIMOS' interior paint appears to meet the necessary thermal requirements.

- MIT/LL detectors
  - No further developments since the last report on March 6, 1998.