**DEIMOS**
**SSC Presentation: March 14, 2000**
**Twenty-Third Quarter**

Camera/optics:

- Camera assembly is complete except for the thermal compensator; optical testing will begin next week. Testing will involve both imaging performance in parallel light and interferometric tests, on-axis and off-axis.
- Significant delays were encountered in assembling Multiplet 4, which has both lateral and axial actuators. Both mechanisms needed some rework.
- The respace by ORA yielded an estimate of camera performance. Rms image diameters are 0.18-0.20 arcsec, which is about 15% better than the error budget calls for at this stage (assembly errors, wedge, and high-spatial frequency errors are not yet included.)
- The fracture in Element 5 ($CaF_2$) declined in visibility when Multiplet 3 was filled with optical fluid but did not disappear completely, as hoped. We would like to order a spare blank from Optovac ($9000) to have on hand for rapid replacement should this one fracture further during shipment.
- LRIS observations with the 830-line grating were used to analyze and diagnose the ghosting problem that originates from specular reflections off the grating (ghost amplitude in LRIS is $\sim 0.5\%$). The problem will be worse on DEIMOS owing to its wider camera acceptance angle ($11.5°$ vs. $6°$ ), and the 830-line and 1200-line gratings will both be affected over a wide range of tilts. Ways to remove this via software and special data-taking procedures are being investigated.

Detector/mosaic:

- Problems have occurred with the Lot 14 high-$\rho$ devices. Two of the 6 good remaining wafers were broken in thinning. MIT/LL plan to make some of these up in subsequent runs, but not immediately. A higher than expected incidence of cosmetic defects (shorts, hot pixels) is also seen, possibly due to particulate contamination during processing. Prospects for obtaining the needed quota of high-$\rho$ devices for the red side of the array have diminished. On the other hand, one of our Phase I CCDs is red-sensitive, so only three high-$\rho$'s are needed.
- The first detector draft for Lot 9/10 CCDs was held. DEIMOS received 4 excellent CCDs, including 3 out of our 4 top choices. Packaging and thinning of Lot 9/10 is on hold, pending completion of the Lot 14 devices. Possibly as many as 3 more good CCDs exist among the unprocessed portion of Lot 9/10.
- The engineering array was assembled and mounted in the dewar. Six of its 8 CCDs are quite usable.
- A procedure was developed to tune the height of molybdenum CCD mounting pads to an accuracy of a few microns. This is a crucial step in achieving a co-planar array.
- Metrology measurements of science array CCD heights are proceeding this week. Molybdenum pad heights will be then be customized and the science array will be assembled this weekend.

Dewar/LN2 system:

- The dewar handling cart was completed for holding the dewar and the LN2 can. It has a detachable set of wheels for the clean room and works well.
- Cooling tests proceeded on the dead array. Water ice condenses at the periphery of the array due to outgassing of water by the RTV window sealant. Placing a zeolite canister in the dewar does not help. Alternative ways of supporting this window are being explored. Diagnosing this problem entailed significant delays, and fixing could entail further delays. Analysis with an RGA did not detect any other sources of contamination in the dewar, although the surfaces of the CCDs seem to be attracting small droplets of unknown origin.

- CCD temperatures in this test reached -115 C, sufficiently cold. Sweating at the LN2 can/dewar bellows connection was cured. However, CCD temperatures varied by up to 10 C as LN2 evaporated. The probe between the cold finger and the LN2 may need redsign, to ensure good thermal coupling as LN2 runs low.
- Warm tests of the engineering array in the dewar were completed. All 16 signal channels worked. Some preamp oscillations were cured.
- Cold tests of the engineering array have started. An Fe55 X-ray source is now mounted above the array for measuring gain and CTE. The dewar developed a leak at one of the SMA video connectors (they are very fragile) and did not get very cold in this first test (-70 C). However, RO noise was found to be low ($\sim$2.5 $e^-$), and there was no detectable noise or cross-talk between the signal channels in the dewar. The leak, some cable connectivity problems, and other small matters need to be fixed. The dewar is now torn down for these repairs, and cold tests are expected to resume by the end of the week.

Structure:

- The position angle drive system is fully assembled. Basic mechanical tests in December showed that the system is stiff with little windup or backlash. The Renashaw encoders work properly. The system is expected to perform well with appropriate software control.
- Two of the four grating sliders are complete and are installed. Fabrication of the other two sliders is nearly complete.
- Grating-slide drive tests have begun. The drive chain sags when the drive is run vertically, and a stiffener to the chain holder is being fabricated. Tests will resume next week after this rework.
- An alignment jig was fabricated for inserting and aligning gratings in their cells.
- The slitmask cassette holder is being reinstalled this week. Its second rework was completed weeks ago, but it could not be installed while DEIMOS was being rotated and balanced.
- The camera mount was fabricated and test-fitted in DEIMOS. It is now being used to support the camera during the upcoming optical testing.
- The collimator cell was test-fitted into DEIMOS, and the collimator installation fixture was completed and sent out for painting. The collimator was aluminized.
- Mounting fixtures were epoxied to the tent mirror and are undergoing an 800-lb. pull test.
- Assembly of the filter wheel is complete. It was test-fitted successfully into the camera along with the shutter.
- Modifications are being made to the shutter to cure a sticking problem seen on ESI.

Electronics:

- A safety hazard was fixed on the Galil motor stages; motors continued to spin when the power was cut abruptly.
- The AC power distribution system inside DEIMOS is being designed.
- UPS's were received and are being installed.

Flexure compensation system:

- The FC controller, signal chain, and FC CCDs were tested and are ready to be installed in the dewar at the next opportunity.
- The fiber feed system and light source are still being designed. A single CuAr lamp will serve adequately as the light source (plus one backup lamp).

Calibration system:

- The calibration system is still being designed but is quite simple — lights will shine off the inside of the hatch, as in LRIS. The lamp sources will include a quartz continuum lamp, plus Ne, Ar, He, HgCd, and possibly Kr and Xe line lamps.

TV guider:
- No progress.

Software/testing:
- Much manpower continued to be absorbed by ESI and the HIRES exposure meter, while Kibrick worked full-time on the signal chain. Full effort by the software engineers should resume next Monday. Will Deich will join the team to provide expertise on low-level Galil software, a gap caused by Jim Burrous' illness.
- Mosaic descrambling software was completed.
- Fits formats for mosaic images are being negotiated with the Fits community.
- The DS9 RTD has been explored and looks like a suitable tool for quick-look image display. The DS9 design group has volunteered to incorporate several features that we have requested. It appears that NOAO rework of their Ximtool will not be required.

Website/documentation:
- A comprehensive website structure was developed; it is based on the successful ESI design but contains some improvements. Standard forms for archiving test data have been posted on the web. Directories and a naming system for saving test data were developed.

Concerns:
- New design needed for sealing dewar window.
- Dewar contamination.
- Stages and mechanisms that may potentially need extensive rework.
- Acquisition of high-$\rho$ devices: schedule and adequate quantity.
- Software is now seriously backed up.
- Testing and motor control has been seriously hit by the illnesses of three key people.

Schedule and Budget:
- Since Oct. 11, 1999, we have slipped 7 weeks on the critical path. We budgeted 20.5 weeks of work and completed 13.5 weeks.
- The net slip in the Pre-Ship Review date is 4 weeks, taking contingency and other small factors into account. The present Pre-Ship Review date is early December 2000.
- Our efficiency as rated by critical path completion since Oct. 11, 1999, is 1.27, i.e., it takes us 27% longer to complete work than planned (this includes a reduction by a factor of 1.186 to correct for consumed contingency).
- Our efficiency as rated by completion of task-weeks worth of work during the same period is 1.41 (again corrected for contingency). This poorer efficiency reflects the extra effort thrown at the critical path.
- Significant areas of delay, and reasons:
  - Dewar/detector, 7 weeks (ice condensation, cable connectivity problems)
  - Camera assembly, 8 weeks (extensive rework to the cell for Multiplet 4)
  - Instrument lab, 3 weeks (supervisor absent to work on ESI, Shane aluminizing)
  - Grating slide drive, 2 weeks (flexure rework)
  - Software, unknown (ESI, HIRES exposure meter)
- As of Feb. 29, 2000, we had spent \$5.90 million out of a currently allocated budget of \$6.30 million.
- Assuming no further slips, our current estimate of cost-to-complete is \$7.08 million. This is an increase of \$240,000 over our last estimate of \$6.84 million on June 24, 1999.
- Projecting time to the Pre-Ship Review based on the above critical-path efficiency factor (1.27) suggests a further slip of 11 weeks over and above this.