DEIMOS
SSC Presentation: October 16, 2000
Twenty-Sixth Quarter

Camera/optics:

- Tent mirror installed, with piezo actuator on dummy tent mirror.
- Collimator installed.
- Backup imaging mirror installed in Slider 1; clamped mounting.
- 600-line grating installed in Slider 3; clamped mounting.
- Pupil simulator fabrication complete.
- First light: Aug. 25, 2000, with Cohu camera (minus Element 9).

Detector/mosaic:

- The blue science mosaic was installed in DEIMOS and tested. Results are given below.
- We expect a minimum of 6 high-quality red-sensitive CCDs from Lot 14 for the red science array. This meets our minimum target. We are negotiating with Gerry Luppino and others to try to find 8 Lot 14 devices to fill the whole final array.
- We would like to install the red science mosaic *after* the Pre-ship Review, while the instrument is being packed and shipped to Hawaii. CARA has not yet agreed to this plan.

Dewar/LN2 system:

- The dewar and LN_2 can were test-fitted in DEIMOS.
- Modifications were completed to the CCD power supply system.
- Lab testing of the blue science array is complete:
  ◦ Two of the original 8 science CCDs proved unusable (one was damaged in the dewar). These were replaced with Lot 14 engineering devices (which allowed us to test them in the array early, an advantage). A third CCD had worse CTE than previously measured. A total of 4 good blue CCDs are available for the red science array, which is sufficient should they be needed.
  ◦ All 8 CCDs are operating with 16 working amplifiers.
  ◦ Dark current and X-ray gain tests are complete, but not linearity tests.
- The remaining four Leach II controller boards needed for 16-amp operation were ordered.
- Contamination status:
  ◦ The ion pump still produces a detectable "dark current" glow (few DN per hour), but the level is lower with each pump down.
  ◦ A thin condensate (water vapor?) was observed at last cooldown. This has tended to decline with time in previous cooldowns. No special action is being taken.
  ◦ Water absorption tests of the zeolite cannister were conducted; capacity appears adequate.
- Dewar X and focus stages:
  ◦ Both stages were operated successfully under keyword control.
  ◦ The focus stage is sticky but is OK for now. A 4-1 gear reduction will be retro-fitted when the red science mosaic is installed.
  ◦ Electrical interference appears if the motors are run during CCD readout. However, this condition is easily avoided during operations.
- The shutter was tested with the CCD controller.

Electronics:

- The electronics staff have been supporting software testing of various mechanical stages and installing and wiring the major electronics components in the electronics ring (see below).

Structure/installation:

- The filter wheel and shutter were installed.

- Final machining on the slitmask form and its support was completed, and the form was temporarily installed.
- The major electronics components were installed in the electronics ring, and a large fraction of the general wiring within the spectrograph was completed.
- Cladding and insulation were fabricated and installed on the electronics ring (nose and barrel cladding still remain to be done).
- Installation of the dewar (with blue science array) and LN_2 can has started; this is due to finish Oct. 23.
- Major upcoming milestone: first light with science dewar, Oct. 24, 2000.
- Expected status of the instrument as of Nov. 1: All major systems installed and operating *except* grating system, FC system, rotation control, TV system.

Flexure compensation system:
- The FC CCDs and CCD controller were operated successfully as part of as part of the blue science array testing.
- Parts were completed for the telescope focal plane FC fiber mounts and will be installed by early November. The FC light source is under construction.

Calibration system:
- All parts were completed for the calibration lamps. They will be installed by early November.

TV guider:
- No progress.

Integration/alignment/optical testing:
- The initial optical alignment was checked using the pupil simulator and was found to be quite good, certainly good enough for current optical tests.
- Near end-to-end image quality tests were conducted with the Cohu camera (Element 9 not in system; small FOV only). Preliminary image quality looks OK.
- Near end-to-end image motion tests were conducted with the Cohu (the dewar was not included, and rotational flexure could not be measured because of the small FOV). Results were as follows:
  ◦ A total of 40 pix (pk-pk) image motion is present as DEIMOS is rotated.
  ◦ 22-26 pix has been traced to the grating box. An FEA model of the box is being constructed. Flexure appears to be coming partly from the box itself, and partly from the loading of the box support points by the drive disk and camera mount. Bracing the box reduces total flexure to 14 pix.
  ◦ 3-5 pix has been traced to collimator tilt, which we think can be reduced.
  ◦ 1 pix has been traced to the tilt of the camera. We do not plan to attack this.
  ◦ Motions from the tent mirror and the slitmask mount appear to be small.
  ◦ Unknown sources of image motion presently total 8-14 pix; this is smaller than the correctable range of the FC control system, which is 20 pix.
  ◦ An in-house meeting to review flexure is scheduled for Oct. 26.
  ◦ Prospects for meeting the final flexure goals are good, provided the FC system is implemented.
- **Completing the FC software should be restored to the list of deliverables.**

Software/testing:
- A major rework was required of the motor control software, caused by the decision to replace manual hand-paddle control with pushbuttons near each stage. These complications were unforeseen and caused the loss of several weeks in the motor-control software schedule.
- The TV focus/filter and dewar focus/X-motion stages were operated under keyword control.

- Mosaic descrambling software finally *is* complete. We are displaying full mosaic images using our reworked version of FIGDISP, soon to be replaced by DS9.
- Permission was received from CARA to use a Linux-based PC system to provide rapid real-time communication between DEIMOS PA rotation and the Keck II DCS. The PC and other pieces have been received, and the system is being assembled.
- Roughly 7 person-weeks were lost because three key SPG personnel were needed to support a manpower crisis in the Observatory computer support group.

Website/documentation:
- An outline was agreed to with CARA for the DEIMOS interface control document.
- A method was devised for posting Postscript documents on the DEIMOS website.

Shipping and commissioning:
- The plan is to ship the main structure on a Matson container ship at the top of the load (above decks). Barging was considered but was deemed to be rougher and more exposed to salt water. DEIMOS is too large to fit in a standard container, so we will have to build one. There seems to be no way to ship DEIMOS below decks.
- A three-day meeting was held with CARA staff in Santa Cruz to review the commissioning activity. Highlights included:
  ◦ A joint CARA/Lick task list was prepared. CARA manpower is short, so Lick will help wherever possible.
  ◦ An unresolved item is whether the final red science mosaic must be completed before the Pre-ship Review. On our schedule, this is to be done after the review, during packing and shipping, but CARA has concerns. Putting this before the PSR would add 2-3 months to the final delivery date.
  ◦ The carriage-mover mechanism was moved from the underside of DEIMOS to the rear of the structure, solving an accessibility/servicing problem on the Nasmyth platform.
  ◦ Access to electronic components in the undercarriage compartments was improved.
  ◦ Discussions started on how to meet DEIMOS' tight pupil alignment requirements to the telescope.
  ◦ A preliminary CARA schedule to accomplish DEIMOS tasks before delivery indicated that six months of elapsed time would be needed, precipitating a collision with the Laser Project and implying a delivery date of DEIMOS to Hawaii of March 1, 2002. Since this would severely compromise the DEEP Survey, plans are being explored to accommodate both instruments earlier.

Concerns:
- Flexure, and the amount of time and money needed to cure it.
- Possible impact of flexure on the present grating select system. Considerable rework of the grating system may be required if the flexure is large. Delay in fixing flexure postpones our understanding the grating system.
- The CCD makeup of the red science array is still unspecified.
- Switchover to 16-amp operation entails testing the new Leach boards inside DEIMOS, where access is limited.
- The CCD cables are proving fragile and will have to be rebuilt; history suggests that debugging them may take time.
- Dewar contamination has not been totally eliminated and will probably increase again when we install the red science array.
- Switchover to the red science array will entail some risk.
- Software is now on the critical path; outside pressures on the software group are unpredictable.

- FC software needs to be written; it is not included in the current schedule.
- Rotation control of the instrument involves an unfamiliar hardware package.
- Telescope baffling needs a study with CARA, and a plan.
- Lack of CARA resources to prepare for DEIMOS.

Schedule and budget:

- We undertook a complete update of the DEIMOS schedule using a new estimation technique. Punch lists were solicited from the various group leaders and then reviewed and intercompared. Many new tasks were uncovered in this way.
- A detailed schedule for software now exists through Apr. 1, 2001, the date for assembling the integrated instrument. This is followed by 8 weeks of uninterrupted testing before the Pre-ship Review, on Jun. 7, 2001.
- The schedule has slipped nearly 3 months from the previous "realistic" schedule of our last report (July 2000). Seven weeks of that have occurred so far. Reasons include delays in finishing the dewar/science array, delays to software (including the motor control software), and diversion of resources for studying and fixing flexure.
- The total estimated cost to complete has increased by $650K, $580K occasioned by the 3 months delay and $70K due to increased effort to deal with flexure during the last quarter. Total estimated cost to complete is now $8,275K.