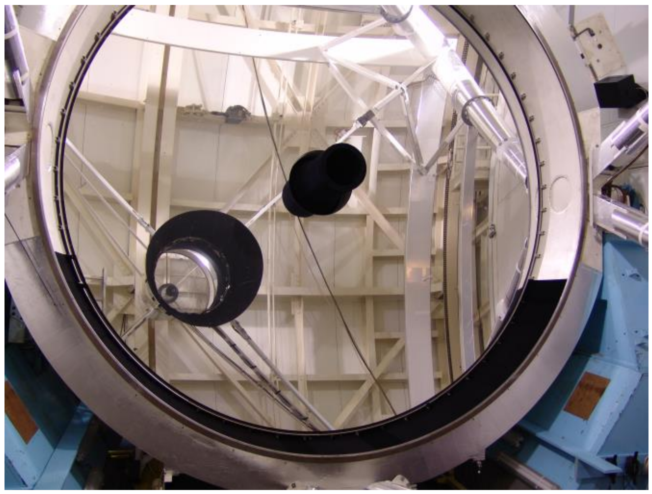
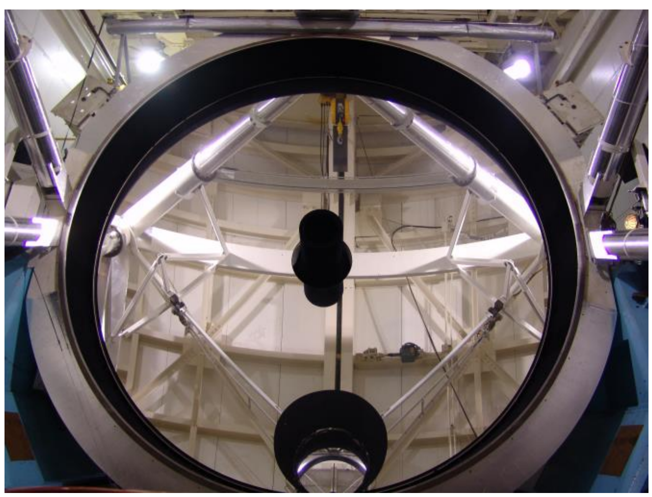
MMT Observatory

Smithsonian Institution & The University of Arizona®

BIMONTHLY SUMMARY

November – December 2004





The primary mirror cell half flocked (top) and completely flocked (bottom). Due to the wide field of view of the f/5 secondary, Megacam detects light rays bouncing off the inside surface of the primary mirror cell. J.T. Williams's idea to attach magnetic-backed flocking to the inside wall of the primary mirror cell quickly solved the problem. Engineering students K. Pearson and N. Forghani took the lead designing the pattern and finding a fabricator, ProLam Plus, to finish this project before the Megacam run in early January. The panels cover more than 99% of the reflective surfaces and are removable for realuminizing the 6.5m mirror.

Personnel

Peter Spencer left the MMTO to take a Senior Engineer position at the Steward Observatory Mirror Lab. Pete joined the organization in 1997 and was a key contributor throughout the 6.5m conversion project. We wish him well in his new position and will miss him on the mountain.

Primary Mirror Systems

No unusual activity to report.

Secondary Mirror Systems

Hexapod Control

The UMAC controller is now used to control motions of all three of the secondary configurations of the telescope. The new *f*/9-*f*/15 control system uses the same motor amplifier electronics as the *f*/5 system and replaces the LVDT position encoders with linear potentiometers, which are simpler and more robust.

The modified *f*/9-*f*/15 hexapod was tested off the telescope during the first week in December, and on December 7 the new controller was installed for the *f*/9 run. T. Trebisky, who spearheaded this effort, was on hand to support on-sky testing of the new system during the first two nights of the run, but bad weather prevented our performing the tests. The weather cleared on Friday December 10 and on-sky testing commenced. Once on the sky, a problem appeared that had gone undetected in prior testing. It turns out the hexapod control matrix was not correctly re-ordered to match the new pod cabling. As a result, the new system executed focus commands correctly, but all other commanded motions caused unexpected image motion. The control software was internally consistent and reported that the hexapod had correctly executed commands, but the hexapod was physically moving in a non-orthogonal manner. As a result, our wavefront sensor was rendered inoperative, and the elcoll collimation look-up table corrections were not useable. J. McAfee was able to work around the problem by using tilts of the primary mirror to collimate the telescope, and by compensating for image motion with pointing offsets. Thanks to his ingenuity we were able to continue observing until the code and cabling were sorted out.

The new system is now in regular use with the *f*/9 secondary, and will be tested in January with the AO *f*/15 configuration. We have retired the National Semiconductor LM628 based motion control system and associated hardware. Having unified hardware and software to support all the secondaries simplifies maintenance and allows any future enhancements to benefit all configurations.

Hexapod Control Matrices

The incident mentioned above prompted D. Blanco to review the hexapod control matrices that convert Cartesian coordinate commands into changes in the hexapod leg lengths, and vice-versa. The *f*/5 matrix was found to be correct, but review of the shared *f*/9-*f*/15 hexapod revealed some problems. A step had been omitted from the calculation; as a result, tilt commands that should pivot the secondary mirror about its vertex were actually rotating the mirror around a remote point. Though small, these errors have been persistent and have likely contributed to inaccuracies in elcoll.

Our intrepid operators have compensated for the problems, wringing good performance regardless. Corrected control matrices have been calculated and will be installed as we cycle through secondary configurations.

In addition to correcting the *f*/9-*f*/15 hexapod matrices, the calculations were extended to include new "dead leg" matrices. By allowing the secondary to rotate slightly about the optical axis, we can operate the hexapod, even if one of the hexapod legs should fail, by using the appropriate control matrix. D. Blanco's new matrices will be documented in a forthcoming technical memo, complete with hexapod drawings.

f/9-*f*/15 Hexapod

Early in November, three *f*/9 hexapod actuators (B, C, and Spare) were disassembled to have their two angular contact bearings tightened in order to increase their axial stiffness preload. Upon reassembly and testing, the stiffness of actuator B had increased significantly; 100 microns of backlash were eliminated and the average stiffness increased to 31.3 N/micron. The same preload was applied to actuators C and Spare, with no improvement. The two preloaded joints on actuators C and Spare were isolated and tested separately, with no unusual behavior that could be attributed to their low stiffness values. Further investigations will be performed.

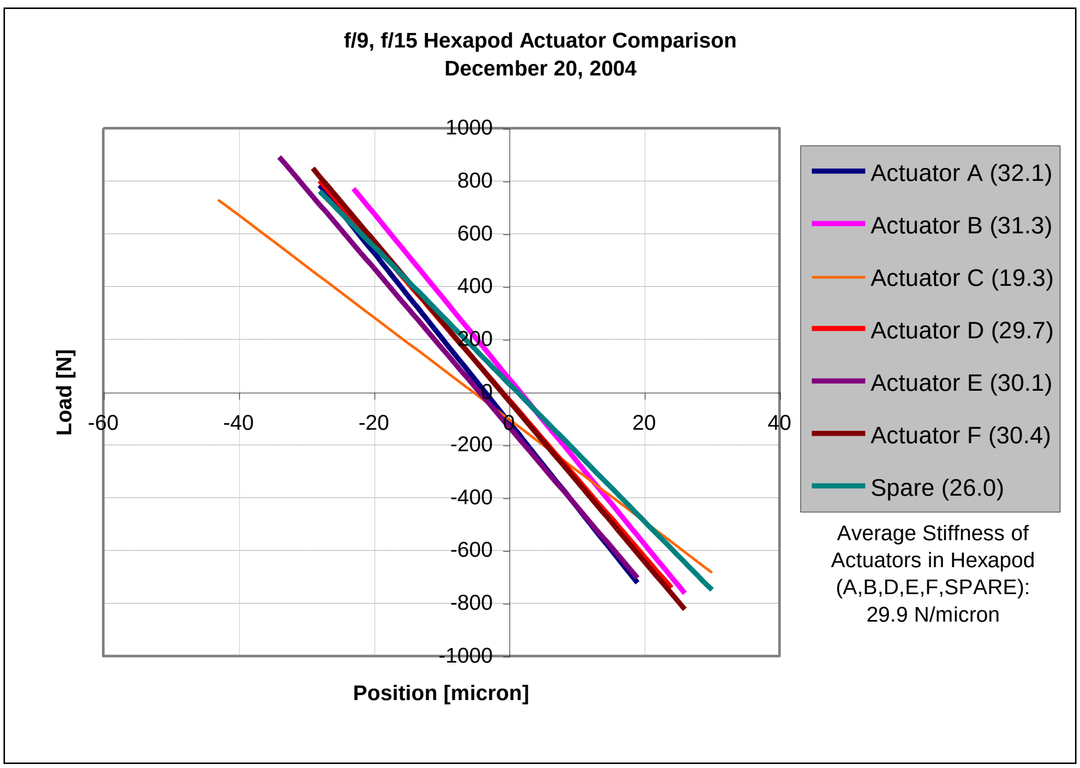


Figure 1: f/9-f/15 hexapod actuator stiffness comparison.

Telescope Tracking and Pointing

Servos

Design and testing of new MMT servos continued. In early November, K. Powell (Steward ETS group) and D. Clark visited the mountain for further refinement of the controller loop. For this run, they tested a command pre-processor and FIR (finite-impulse response) filter as the command signal filter for driving the position loop servo command. The pre-processor is based on Wodek Gawronski's work at JPL's DSN, and a paper discussing it can be found at:

http://tmo.jpl.nasa.gov/tmo/progress_report/42-136/136A.pdf

The command pre-processor applies smooth velocity and acceleration limiting to the command signal path to the servo. This prevents the system from commanding unsafe velocities and accelerations, and rolls off sharp command transitions to avoid excitation of structural vibrations. Some fine-tuning of the pre-processor was done to speed up the response times, but it also worked very well in smoothly commanding the telescope without modal excitation.

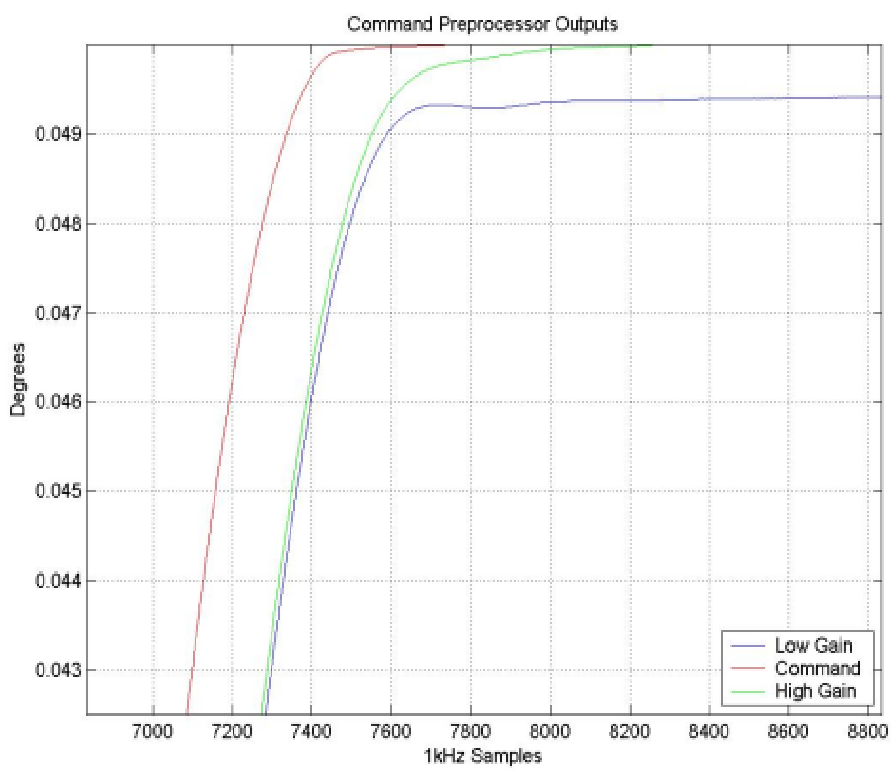


Figure 2: Comparison of command pre-processor outputs in response to a 0.005 degree (18 arcsec) step command input with different gains.

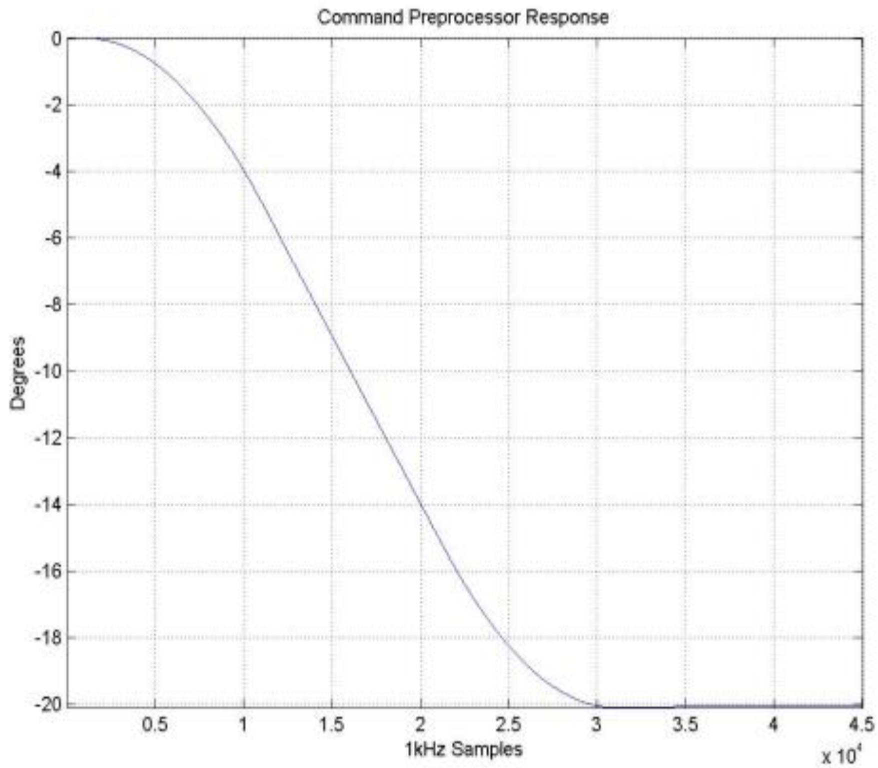


Figure 3: Pre-processed telescope position step command of 20 degrees.

E. Bell, our part-time servo engineer, is continuing to develop numerically stable model realizations in order to develop his controller version. We await the results of his work, and in the meantime we plan to try "road-testing" the Powell/Clark version of the controller in operation in February.

Encoders

An X-Y translation stage and a goniometer from New Focus have been delivered for mounting and aligning the read-head on the east drive arc tape encoder. C. Chute has designed the encoder head mount and is working on the final fabrication layouts. The assembly will be ready for testing in January.

Computers and Software

All-Sky Camera

After an encouraging test using a PC164 video camera and inexpensive wide-angle lens, we purchased a StellaCam II video camera along with a Fujinon auto-iris fisheye lens. The ability of the StellaCam to integrate on-chip up to 256 full video frames (about 8.5 seconds) is an enormous improvement over having to read out and integrate in software via a framegrabber card. The PC164 setup required a carefully constructed dark image and at least two minutes of software frame integration to be able to see 4th magnitude stars. In contrast, a single frame capture from the

StellaCam configured to integrate 256 frames at medium gain easily gets down to 6th magnitude or better. Figure 4 shows a representative image under dark skies. The MMT building and forklift are on the right, summit support is in the upper left, and Nogales is at the bottom. Orion, the winter Milky Way, and a Geminid meteor are easily visible. There are multiple lenses within the fisheye lens assembly, so bright objects are bound to create various internal reflections and caustics. Figure 5 shows an image taken during first quarter moon. The moon itself is on the right near the MMT building. The artifacts are not too bad, fortunately, and the Milky Way is still easily visible in the frame. This system should thus work very well under almost any nighttime condition. The sun is somewhat more brutal, however. Even with the automatic iris clamping down on the input, the sun still creates many artifacts in the image (Figure 6). While the automatic iris makes it safe to leave the camera running during the day, it's not clear how useful the images will be.

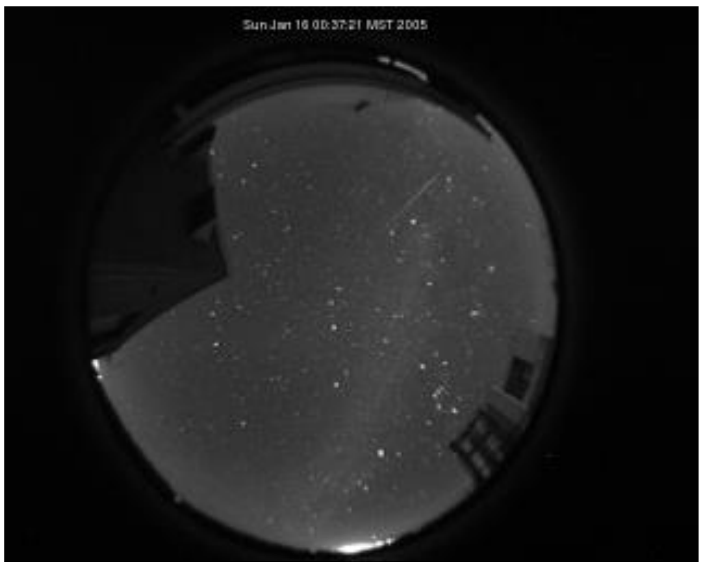


Figure 4: Image taken under dark skies with the StellaCam-based all-sky camera system.

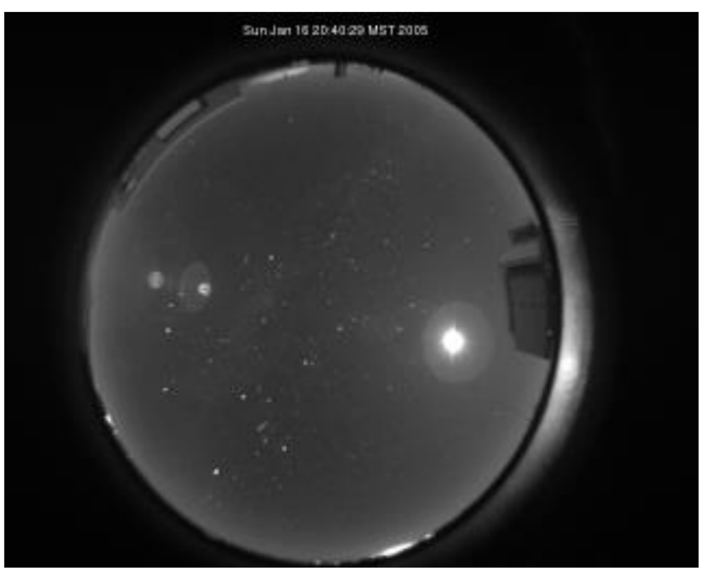


Figure 5: StellaCam image taken during first quarter moon.

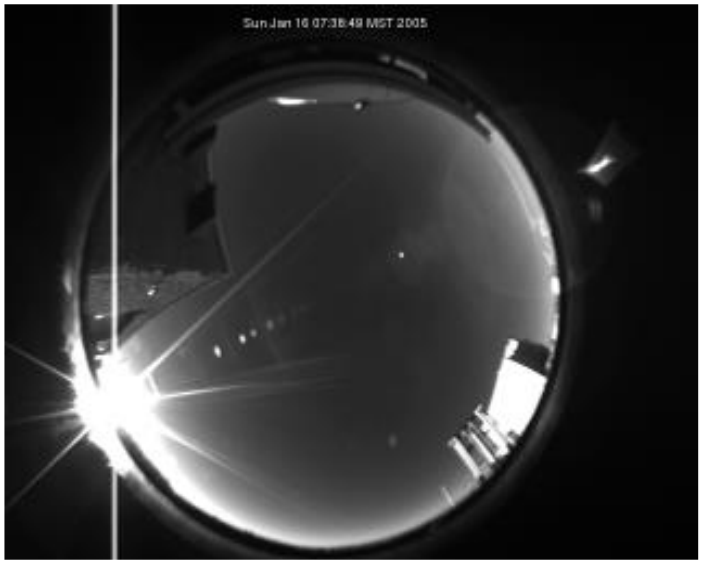


Figure 6: StellaCam image taken just after sunrise. In this image the StellaCam was configured to run at full video rate with the gain set to the minimum value. The automatic iris is running here; otherwise, the entire image would be saturated.

Because the StellaCam has no automatic gain control, and the automatic iris only kicks in under very bright conditions, we purchased the RS232 interface module to allow remote configuration. This module only comes bundled with Windows software, but with the help of Matt Kenworthy (CAAO) we were able to reverse engineer the protocol and develop our own scripts and GUI. A screenshot of the GUI is shown in Figure 7. Somewhat strange and annoying, the StellaCam RS232 protocol only seems to work properly when communicating directly over a serial port. It did not work at all via a Lantronix device and is unreliable via a Cyclades device or software network-serial relay server. The all-sky camera will have a dedicated computer, so that is not a big problem.

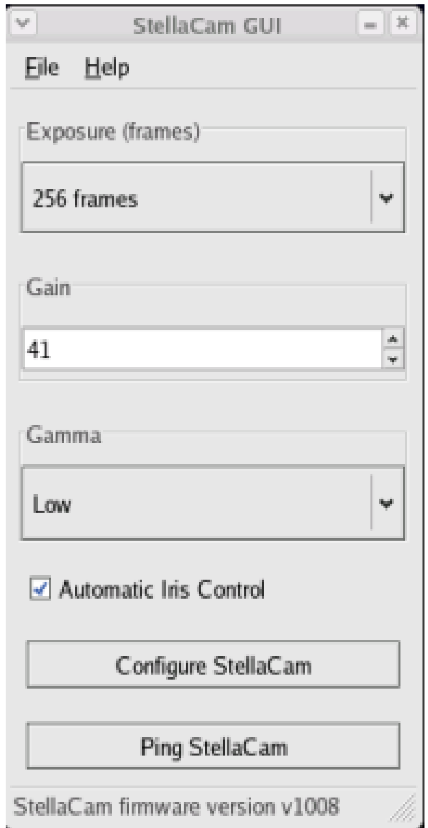


Figure 7: Screenshot of the StellaCam control GUI.

Software Modifications

Code for a new mini-server ("vaisala3") was written to support a new Vaisala weather transmitter, model WXT510. This unit reports barometric pressure, air temperature, relative humidity, wind speed and direction, and precipitation, including rain and hail intensity. A built-in heater allows the unit to operate through the winter. An algorithm was added to the mini-server code to calculate a dewpoint temperature based upon air temperature and relative humidity. The unit will be installed at the MMT in the near future.

A new Lantronix unit, vaisala3, was configured for use with the Vaisala WXT510. The unit was assigned an IP address on the mmt subnet.

Code for all the mini-servers was modified to include additional error reporting and logging. The current status of the mini-servers is available through a new web page:

http://www.mmto.org/engineering/mmt_engineering/mini_server_status.php

Recommended actions, such as checking the status of a unit, are included in this web page. These log files are being monitored to improve reliability of the mini-servers.

Changes were made to the vme_console script, which logs output from the serial port of the VMF crates, to make it more robust. This script reports output from the serial ports of the cell, mount, hexapod, and CCD VME crates. Reliability has improved since these changes.

Parameters for the Lantronix device servers, which are used to connect RS232 serial devices such as the Carrier chiller, were modified to improve reliability of these servers. The Lantronix parameters include an internal timeout option when network or serial port communication fails.

The primary mirror cell mini-server code was modified to gather E-series thermocouple data once every minute instead of once every 5 seconds. The mini-server no longer gathers cell actuator force and influence data from the cell crate. Analysis of cell crate CPU usage showed that obtaining these data from the cell crate at a 5-second or less interval placed a large load on the crate.

Hexapod Code Modifications

The new platform-to-pod and pod-to-platform transformation matrices determined for the *f*/9-*f*/15 hexapod (see Hexapod Control above) have been incorporated into the hexapod crate code. Spreadsheets were created to help calculate equivalent platform and pod positions for the *f*/5, *f*/9, and *f*/15 hexapods. A Ruby script was written to load new transformation values on-the-fly into the hexapod crate.

Data were collected and new count-to-micron conversion equations were obtained for both hexapods. Linear best-fits and 4th-order polynomial fits were defined from the data. These new equations have been incorporated into the hexapod crate code.

MMT Documentation and Engineering Web Pages

Approximately 12 new engineering web pages were created to present weather data from the Vaisala WXT510 unit. These web pages display current and 24-hour weather data in both tabular and graphical form. Future work will incorporate this weather data into the operator's graphical unit interfaces.

Several manuals for the Carrier chiller, old Vaisala (model 243) unit, and the new Vaisala (model WXT510), previously only available in hard copy, were scanned into pdf files and posted to the MMT Documentation web pages.

The MMT Documentation web pages were substantially reorganized to simplify finding user guides, schematics, and manuals.

The MMT telescope balancer web pages were updated with new data supplied by D. Blanco.

Work continues on revising a user guide for "hexgui" (operator's hexapod control). The current version of the user guide does not reflect major changes in this GUI.

The X-Y scatter plots, used to compare and contrast a variety of temperatures, were modified to eliminate data dropouts and unrealistic temperature values.

Miscellaneous

Because of the Hecto fiber positioner problems (see Instruments below), the night of November 3 was used to collect new *f*/5 elevation dependent collimation (elcoll) data. These were the first elcoll measurements since the *f*/5 secondary lateral supports debonded on October 11. The elcoll coefficients were found to be only slightly different from those measured prior to the incident.

Seeing

Hartmann-DIMM Seeing Monitor

Tests of various centroiding methods and algorithms were performed on-sky with the LX200 and a new Kwik-Focus 3-aperture Hartmann mask. Figure 8 shows a representative image obtained using the new mask. The basic center-of-mass algorithm is the same that is used in our (and most) autoguiders: define a box around your source, subtract background, sum counts along both axes to form X and Y histograms, and then calculate intensity-averaged values of X and Y from those histograms. The DAOfind algorithm used by the Shack-Hartmann wavefront sensor software is similar, but uses least squares fits of gaussian profiles to the X and Y histograms. In the poor conditions in Tucson, where the seeing was worse than 2 arcsec most of the time, the DAOfind method proved to be unstable due to the spot shapes frequently being non-gaussian in shape. The center-of-mass method worked well even when the seeing would blow up to more than 8 arcsec, at which point the spots were smeared considerably and became difficult to detect.

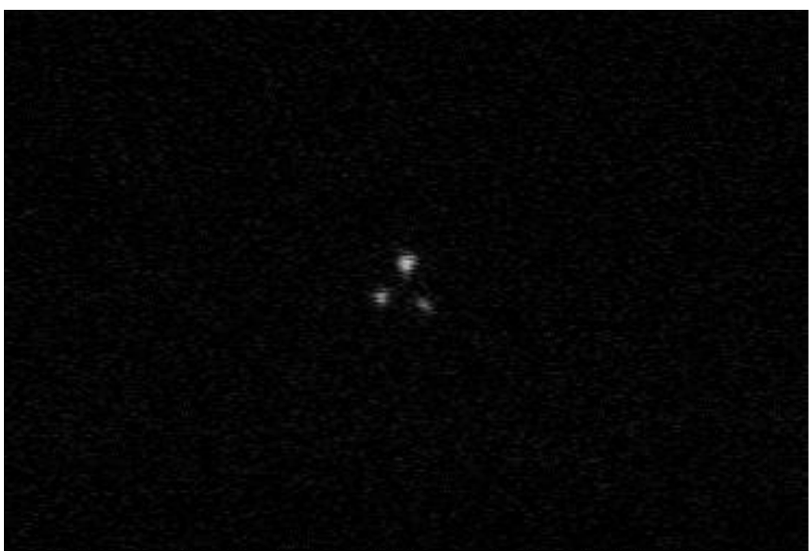


Figure 8: Example image taken with the Hartmann-DIMM seeing monitor with the new 3-aperture mask.

Different methods of thresholding and windowing the data before centroiding were also tried. Given the poor conditions, the results were somewhat inconclusive. Testing under better conditions with independent, external measures of seeing are required to more accurately judge how well a method is working and what kinds of biases it may introduce into a seeing measurement. What has worked best so far has been a constant window radius of 7 pixels and iterating the centroid routine three times per image to converge on a center. This center is then used as the starting point for the next image. Windowing with smaller radii at each iteration sometimes produced unstable results. Thresholding beyond simply subtracting the background measured in an annulus around the spot pattern did not significantly alter the final results in any of the tests.

Two other biasing factors can significantly affect seeing measurements obtained with a DIMM: centroiding noise and exposure time. The former is relatively easy to account for. The per-pixel RMS is determined within the background annulus and used to generate formal uncertainties in the calculated X and Y positions of each centroid. This variance is subtracted in quadrature from the measured variance, and the result used to determine the seeing. Correcting for exposure time is a little trickier. The usual method of doing this is to interleave short exposures with longer ones and then scale the short exposure seeing by the ratio of short exposure seeing to long exposure seeing to estimate "zero exposure" seeing. In essence, this assumes that the measured seeing decays exponentially with exposure time. The calculations of A. Tokovinin (2002, PASP, 114, 1156) show that this isn't quite correct and that a modified exponential gives better results. Interleaved exposures and this modified exponential correction are now implemented and have been tested. Under the conditions that the tests have been made, the centroiding noise corrections have been negligible (<0.05 arcsec) and the exposure time corrections relatively small (0.1-0.2 arcsec out of 2 arcsec or more). In better conditions both of these effects will be much more significant.

A quick test was done to compare the performance of the supercircuits PC164 camera to the new StellaCam II, the latter which will become the new sky camera. At video rate with maximum gain, the StellaCam II was about 10% less sensitive than the PC164 with about the same noise level. This was better than expected given the quoted lux ratings for the two cameras, but the StellaCam II is still not best-suited to real-time video applications.

Software work was completed to fully implement the LX200 mount protocol into a Ruby class. All of the functionality that we will use has been tested and works well. A few bugs have been found in other functionality that Meade claims will be resolved in the next firmware release. A graphical interface, using this class and based on the WFS catalog GUI, was created to allow easier remote control and easy access to a catalog of stars suitable for measuring seeing (Figure 9).

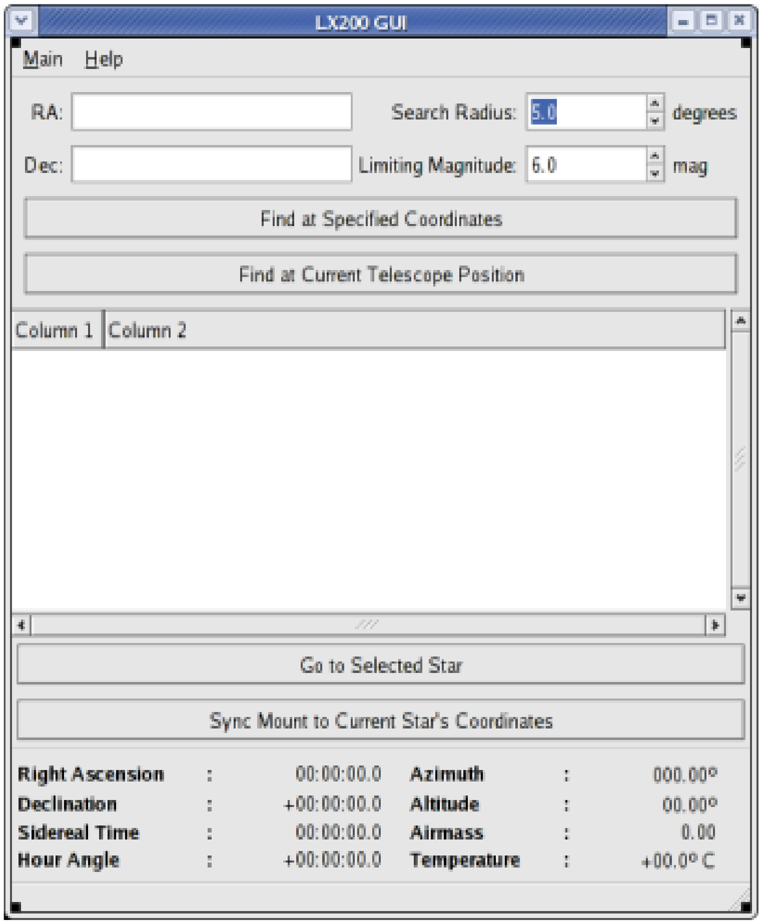


Figure 9: Screenshot of the LX200 catalog and control GUI.

Instruments

Hectospec and Hectochelle

There were 24 Hectospec nights scheduled during November and December. Poor weather hampered a large fraction of the run, allowing only 8.5 nights of data taking, of which only two were full nights. The average completion fraction of the queued observations was 20%. Even so, nearly 15,000 spectra were obtained.

The throughput that observers would obtain for the Hectospec instrument was measured in 1 arcsec seeing using the standard star BD+284211. The results are shown in Figure 10. The figure includes losses at the fiber entrance due to the wings of the stellar psf in 1 arcsec seeing extending beyond the 1.5" fiber diameter. The actual fiber plus spectrograph throughput is higher, and will be presented in a later publication.

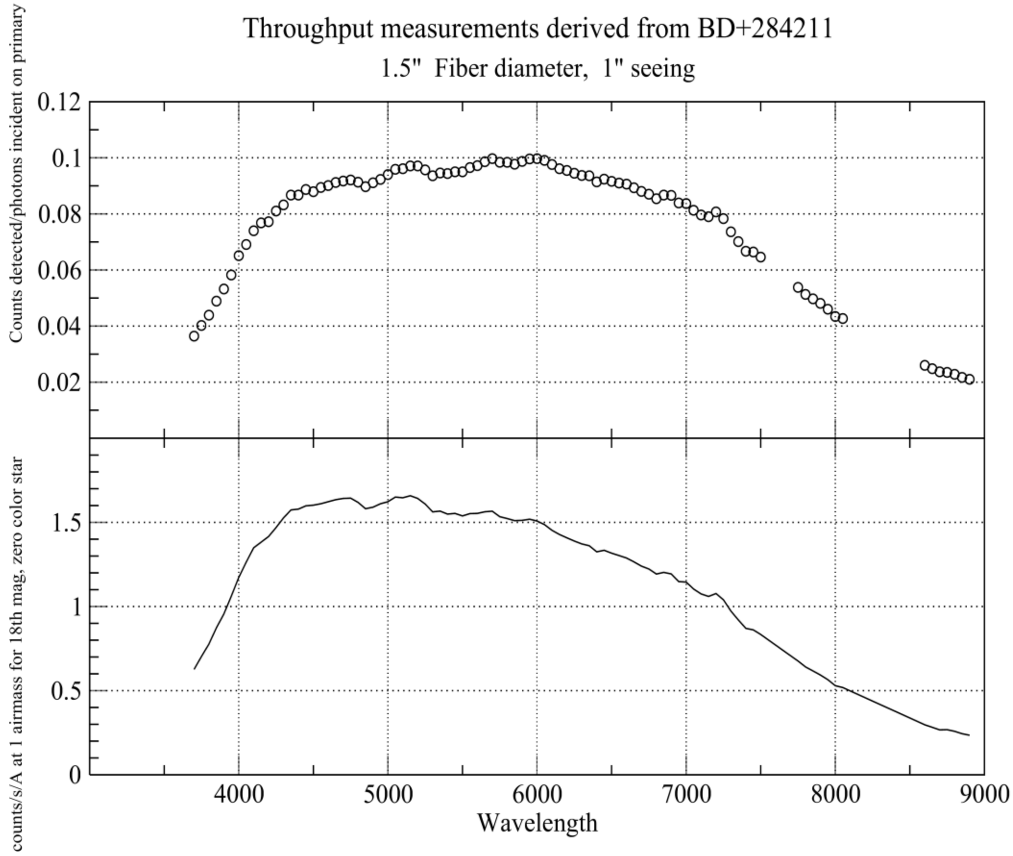


Figure 10: Throughput measurements derived from BD+284211.

On the night of November 3, robot 1 of the fiber positioner experienced problems while homing. After all attempts to remotely fix the problem were exhausted, D. Fabricant and a team of SAO engineers traveled to the mountain on November 4. J. Roll implemented a different homing procedure, which D. Fabricant thoroughly tested. The night of November 3 was used to collect collimation data; Hecto science observations resumed before local midnight on the night of the 4th, thanks to SAO's quick response.

There were 13 Hectochelle nights scheduled, six of which were scheduled for engineering. Poor weather hindered the run, allowing only 40 hours of total observing. During that time approximately 4320 spectra were obtained. In addition, over 50 hours of ThAr calibration data were obtained while the dome was closed.

f /5 Instruments Documentation

Significant progress was made on the Megacam observer's manual. The current html version of the manual is available online at:

http://grb.mmto.arizona.edu/~ggwilli/mmt/docs/megacam/megacam_manual.html

The web page includes links to both pdf and Microsoft Word versions of the manual. The Megacam manual is the result of significant modifications to the Minicam manual. It is considered required reading for all observers who will be using Megacam. The manual is continuously being updated so it is important to check the revision date and consult only the newest revision.

The detailed mounting procedures for the *f*/5 corrector, the *f*/5 wavefront sensor, and the fiber positioner were all modified. No significant changes were made, but some detailed information was added, while a few sections that were no longer relevant were removed. A spiral bound copy of each of the procedures now resides at the telescope.

The web pages for all the mounting procedures were also completed and include checklists in html and postscript format. The checklists will be used only with the detailed procedures when mounting or removing any of the instruments.

PI Instruments

The Max-Planck-Institut für Radioastronomie Speckle Camera run of December 20-28 was hampered by a 20 Hz oscillation at the *f*/9 secondary support. The oscillation caused image motion of 0.3 arcsec amplitude in the azimuth direction (approximate) independent of elevation angle. An accelerometer placed at the secondary mirror cell measured the resonance, but there was no corresponding signal in either the elevation or azimuth encoders or servo control command signals. On December 21 D. Clark changed servo parameters to add damping, but without any effect. The mountain group assembled a mechanical damper from an automobile shock absorber, again with no effect. The structural resonance was clearly excited by wind buffet—we measured a 30 dB gain at 20 Hz when tracking in the wind compared to tracking with the shutters closed. High winds and bad weather continued throughout the entire run. Measurements are ongoing as we try to isolate the source of the vibration. Unfortunately the oscillation severely limited the useful observations for the speckle group.

General Facility

November–December Operations

Winter storms, high winds, and high humidity kept us closed November 5-23 and December 4-9 and 22-29.

Three intermittent problems continued to elude efforts to diagnose and repair. Telescope-building collisions continue sporadically, once or twice at the start of the evening with little effect except annoyance. Intermittent primary mirror panics seemed to clear after two changes: (1) D. Smith identified and fixed a problem with a cold trap at the main air compressor that was icing the lines in the high humidity; and (2) T. Trebisky changed a timing sequence in the cell control code. A third problem occurred on three isolated occasions when the telescope suddenly jumped ~180 degrees in azimuth. The three incidents may be associated with the zero crossing at due north (000º azimuth).

On November 22 the summit took an unusual lightning strike during a snow flurry, unusual in that there was no previous thunder activity. The single isolated strike caught us unprepared—we had not initiated lightning shutdown protection procedures. The strike damaged a fiber optic decoder in the controls to the primary mirror ventilation blower, and damaged an IC chip in the elevation encoder electronics. Both of these were repaired on November 24 prior to the next clear weather.

A third failure may have been related to the strike; on the night of November 24 a 13.8 KV fuse in the summit main power transformer failed and we lost one power phase at the summit. The phase loss caused extensive damage to MMT systems:

- The 480 to 120 volt control transformer in the trench fan shorted out and had to be replaced.
- Electrical components were charred in the housing that controls the rear shutters, necessitating the rebuild of the box and replacement of the contactors and current limit protectors, whereupon it was discovered that the original box had been improperly wired. The overheat condition was caused by attempting to operate the shutter with a phase missing.
- Another short circuit in the switch box of the ventilation blower was caused by water getting into the unsealed housing. Both the housing and the switch have been replaced.

The 13.8 KV is a specialty item; the only available spare was rated at 30 amps instead of the required 40. From November 25 until the correct fuse was delivered and installed on December 9, the MMT operated on reduced power.

To prevent similar incidents, a 480 VAC phase loss detector was installed in the 26 V rack to shut down all of the 26 V safety systems with the loss of a single AC phase. A monitor bit was added to the system from another power source to inform the software of a phase loss. In addition, a lightning protection system was installed on the MGE UPS, which should give it better protection. We also installed a monitor card that provides five circuit contacts to remotely display status of the UPS. This capability will be developed by K. Van Horn.

On November 28 the *f*/5 secondary went into oscillation, causing image motions of about 3 arcsec amplitude. One night was lost. On the 29th we tracked the problem to the mirror support servo control card in the secondary support cell.

November-December was the shakedown period for the new Delta Tau UMAC servo controller for the *f*/5 secondary mirror hexapod. We experienced several minor glitches and bugs that were corrected as they were diagnosed. In early December the *f*/9-*f*/15 hexapod was converted to work with the new controller, including mechanical overhaul of the pod actuators, recabling, and a new ordering of the pods to match the *f*/5 control scheme (see Hexapod Control above).

Instrument Rotator

C. Chute, C. Wainwright, and K. Pearson tested the torque of the rotator brake and the rotator bearing assembly. The torque required to turn just the rotator brake is 1550 in-lbs. The total torque required to rotate the 78" diameter rotator, with the motors powered off and the brake engaged, has been tested to be 29,000 in-lbs.

Miscellaneous

B. Love worked on the methanol-water coolant distribution system, adding a new panel to the west drive arc with quick connects, valves, and flow gages for both dry air and liquid coolant. He re-plumbed the methanol-water coolant lines to the secondary hub, adding cut-off and by-pass valves, eliminating a kinked hose, and adding quick-connect fittings at the secondary hub. There are now a total of four quick connects that are connected with two flexible hoses to provide one supply and one return. D. Blanco and B. Love tested the flow rate of the system to be 3 gpm.

B. Love designed, fabricated, and installed new clips for stowing the neutral beams on the telescope. The new clips allow the beams to be stowed symmetrically—the prior arrangement resulted in imbalance due to asymmetry.

Conduits in the pit, which were a trip hazard, have been relocated into the trench. The old telephone switch panel has been relocated in the pit to provide more working room for the new floor hatch construction.

A mouse caused a short circuit that destroyed a control transformer in the first floor duct heater circuit. J. Labbe, with support from T. Welsh (FLWO), replaced the transformers and ordered spares for each, and replaced the old clockwork timers with digital timers.

The Vaisala humidity sensor has been moved from high on the east wall of the chamber to the bottom of the OSS "V" on the east side. The Young wind indicator's prop and shaft were replaced due to ice damage. The Neslab chiller in the RUPS room has been cleaned, and its thermostat repaired.

The instrument dry air supply line was relocated to the telescope clean air supply tank located in the pit.

Preventive maintenance was performed on the 20 hp Mattei air compressor.

To accommodate future hatch modifications, D. Smith and P. Ritz relocated the telescope air cabinet in the loading dock.

The new instrument vacuum pumping station is now online. It will be used for instrument dewars ONLY. The old station will be available for utility purposes and cryopump regeneration.

Architects and engineers from M3, Tucson Building & Remodeling (TBR), and CE Welding finalized measurements on the new pit access hatch.

The MMTO engineering archive link has now been updated and displays the current drawings and files in the engineering archive.

Visitors

December 9: Two photographers from "Terre Sauvage," a French travel magazine, accompanied by Dan Brocious.

Publications

MMTO Internal Technical Memoranda

04-5 Re-Evaluation of Aluminum Thickness Distribution on the MMT 6.5m Primary Mirror using New Software
W. Kindred

MMTO Technical Memoranda

None

MMTO Technical Reports

None

Scientific Publications

04-60 Determining the Interaction Matrix Using Starlight
Wildi, F. P., Brusa, G.
SPIE, **5490**, 164

04-61 Status of the NGS Adaptive Optic System at the MMT Telescope
Miller, D. L., Brusa, G., Kenworthy, M. A., Hinz, P. M., Fisher, D. L.
SPIE, **5490**, 207

04-62 Field Tests of Wavefront Sensing with Multiple Rayleigh Laser Guide Stars and Dynamic Refocus
Stalcup, Jr., T. E., Georges III, J. A., Snyder, M., Baranec, C., Putnam, N., Milton, N. M., Angel, J. R. P., Lloyd-Hart, M.
SPIE, **5490**, 1021

04-63 Metals and Dust in Intermediate-Redshift Damped Lyα Galaxies
Khare, P., Kulkarni, V. P., Lauroesch, J. T., York, D. G., Crotts, A. P. S., Nakamura, O.
ApJ, **616**, 86

04-64 Metal Abundances of KISS Galaxies. III. Nebular Abundances for Fourteen Galaxies and the Luminosity-Metallicity Relationship for H II Galaxies
Lee, J. C., Salzer, J. J., Melbourne, J.
ApJ, **616**, 752

04-65 GRB 021211 as a Faint Analog of GRB 990123: Exploring the Similarities and Differences in the Optical Afterglows
Holland, S. T., Bersier, D., Bloom, J. S., Garnavich, P. M., Caldwell, N., Challis, P., Kirshner, R., Luhman, K., McLeod, B., Stanek, K. Z.
AJ, **128**, 1955

04-66 A Period and a Prediction for the Of?p Spectrum Alternator HD 191612
Walborn, N. R., Howarth, I. D., Rauw, G., Lennon, D. J., Bond, H. E., Neguereula, I., Nazé, Y., Corcoran, M. F., Herrero, A., Pellerin, A.
ApJ, **617**, L61

04-67 New Brown Dwarfs and an Updated Initial Mass Function in Taurus
Luhman, K. L.
ApJ, **617**, 1216

04-68 A Near-Infrared (*JHK*) Survey of the Vicinity of the H II Region NGC 7538: Evidence for a Young Embedded Cluster
Balog, Z., Kenyon, S. J., Lada, E. A., Barsony, M., Vinkó, J., Gáspár, A.
AJ, **128**, 2942

04-69 Quiescent Observations of the WZ Sagittae–Type Dwarf Nova PQ Andromedae
Schwarz, G. J., Barman, T., Silvestri, N., Szkody, P., Starrfield, S., Vanlandingham, K., Wagner, R. M.
PASP, **116**, 1111

04-70 Linking the Power Sources of Emission-Line Galaxy Nuclei from the Highest to the Lowest Redshifts
Constantin, A.
PASP, **116**, 1153

Observing Reports

Copies of these publications are available from the MMTO office. We remind MMT observers to submit observers' reports, as well as preprints of publications based on MMT research, to the MMTO office. Such publications should have the standard MMTO credit line: "Observations reported here were obtained at the MMT Observatory, a facility operated jointly by the University of Arizona and the Smithsonian Institution."

Submit publication preprints to *bruss@mmto.org* or to the following address:

MMT Observatory
P.O. Box 210065
University of Arizona
Tucson, AZ 85721-0065

MMTO in the Media

No activity to report.

MMTO Home Page

The MMTO maintains a web site (*http://www.mmto.org*) that includes a diverse set of information about the MMT and its use. Documents that are linked to include:

1. General information about the MMT and Mt. Hopkins.

2. Telescope schedule.

3. User documentation, including instrument manuals, detector specifications, and observer's almanac.

4. A photo gallery of the Conversion Project as well as specifications related to the Conversion.

5. Information for visiting astronomers, including maps to the site.

6. The MMTO staff directory.

Observing Database

The MMTO maintains a database containing relevant information pertaining to the operation of the telescope, facility instruments, and the weather. Details are given in the June 1985 monthly summary. The data attached to the back of this report are taken from that database.

Use of MMT Scientific Observing Time

November 2004

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	* Lost to Telescope	** Lost to Gen'l Facility	Total Lost
MMT SG	0	0.00	0.00	0.00	0.00	0.00	0.00
PI Instr	30	348.60	197.75	14.90	13.00	12.00	237.65
Engr	0	0.00	0.00	0.00	0.00	0.00	0.00
Sec Change	0	0.00	0.00	0.00	0.00	0.00	0.00
Total	**30**	**348.60**	**197.75**	**14.90**	**13.00**	**12.00**	**237.65**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	100.0
Percentage of time scheduled for engineering	0.0
Percentage of time scheduled for secondary change	0.0
Percentage of time lost to weather	56.7
Percentage of time not lost to weather lost to instrument	9.9
Percentage of time not lost to weather lost to telescope	8.6
Percentage of time not lost to weather lost to general facility	8.0
Percentage of time lost	68.2

* Breakdown of hours lost to telescope
hexapod card failure 2
primary too warm 4
secondary problem 7

** Breakdown of hours lost to facility
power failure 12

December 2004

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	* Lost to Telescope	Lost to Gen'l Facility	Total Lost
MMT SG	10	120.00	35.80	0.00	1.45	0.00	37.25
PI Instr	20	227.30	137.60	1.00	1.00	0.00	139.60
Engr	1	12.00	12.00	0.00	0.00	0.00	12.00
Sec Change	0	0.00	0.00	0.00	0.00	0.00	0.00
Total	**31**	**359.30**	**185.40**	**1.00**	**2.45**	**0.00**	**188.85**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	96.7
Percentage of time scheduled for engineering	3.3
Percentage of time scheduled for secondary change	0.0
Percentage of time lost to weather	51.6
Percentage of time not lost to weather lost to instrument	0.6
Percentage of time not lost to weather lost to telescope	1.4
Percentage of time not lost to weather lost to general facility	0.0
Percentage of time lost	52.6

* Breakdown of hours lost to telescope
cell server 1
hexapod 1.2
building & az drives 0.25

Year to Date December 2004

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	Lost to Telescope	Lost to Gen'l Facility	Total Lost
MMT SG	88	890.80	467.65	4.13	10.83	4.25	486.85
PI Instr	220	2195.80	879.25	69.90	99.20	13.75	1062.10
Engr	21	215.30	87.20	0.00	3.00	0.00	90.20
Sec Change	6	57.60	11.00	0.00	0.00	0.00	11.00
Total	**335**	**3359.50**	**1445.10**	**74.03**	**113.03**	**18.00**	**1650.15**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	91.9
Percentage of time scheduled for engineering	6.4
Percentage of time scheduled for secondary change	1.7
Percentage of time lost to weather	43.0
Percentage of time not lost to weather lost to instrument	3.9
Percentage of time not lost to weather lost to telescope	5.9
Percentage of time not lost to weather lost to general facility	0.9
Percentage of time lost	49.1

MMT OBSERVATORY

FINANCIAL STATUS REPORT

HL 12/9/04

November 30, 2004

FUNDS BY CATEGORY

	Budget	Expended 7/1/04-11/30/2004	Encumbered 11/30/2004	Unencumbered Balance 6/30/2005
SALARY	1556578	492285	685791	378502
E.R.E.	461969	152428	213270	96271
OPERATIONS	120099	84510	42297	-6708
TRAVEL	11903	4515	973	6415
CAPITAL	357799	17486	66582	273731
TOTAL	**2508348**	**751224**	**1008913**	**748211**

UNENCUMBERED BALANCE BY SOURCE

	STATE	SI O, M, & D**	SI O, M, &D**	SAO FEDERAL*	VP RES'RCH	STATE	**TOTAL**
UA #	[111130]	[342580]	[335320]		[579620]	[111133]	
SI #		SK4-04004	SK3-03002				
SALARY	1582	169375	207303	-1	267	-25	378502
E.R.E.	-301	46532	49957	1	91	-9	96271
OPERATIONS	-14014	75302	-79697	11701			-6708
TRAVEL	7378	9200	-10163				6415
CAPITAL	28737	72130	172864				273731
TOTAL	**23383**	**372538**	**340264**	**11701**	**358**	**-33**	**748211**

* Salary for J.T. Williams (.60) and $17000 "Petty Cash" in Amado.

** "O, M, & D" = Operations, Maintenance, and Development Activities

SI #: first two digits of the last five digits = Federal fiscal year. (E.g. SK3-03002 = Federal FY'03)

UA #: Internal "FRS" system account number

RE: SK4-04004: the contract estimate to complete does not exceed the contract value.

MMT OBSERVATORY

FINANCIAL STATUS REPORT

HL 1/11/05

December 31, 2004

FUNDS BY CATEGORY

	Budget	Expended 7/1/04-12/31/2004	Encumbered 12/31/2004	Unencumbered Balance 6/30/2005
SALARY	1556578	580392	597174	379012
E.R.E.	461969	179825	185798	96346
OPERATIONS	120099	99628	63287	-42816
TRAVEL	11903	5488	952	5463
CAPITAL	357799	40112	45178	272509
TOTAL	**2508348**	**905445**	**892389**	**710514**

UNENCUMBERED BALANCE BY SOURCE

	STATE	SI O, M, & D**	SI O, M, &D**	SAO FEDERAL*	VP RES'RCH	STATE	**TOTAL**
UA #	[111130]	[342580]	[335320]		[579620]	[111133]	
SI #		SK4-04004	SK3-03002				
SALARY	1490	168182	209064	0	300	-24	379012
E.R.E.	-332	46185	50399	1	102	-8	96346
OPERATIONS	-19569	75302	-96139	-2410			-42816
TRAVEL	7378	9200	-11115				5463
CAPITAL	28737	72130	171642				272509
TOTAL	**17704**	**370999**	**323851**	**-2409**	**402**	**-33**	**710514**

* Salary for J.T. Williams (.60) and $17000 "Petty Cash" in Amado.

** "O, M, & D" = Operations, Maintenance, and Development Activities

SI #: first two digits of the last five digits = Federal fiscal year. (E.g. SK3-03002 = Federal FY'03)

UA #: Internal "FRS" system account number

RE: SK4-04004: the contract estimate to complete does not exceed the contract value.