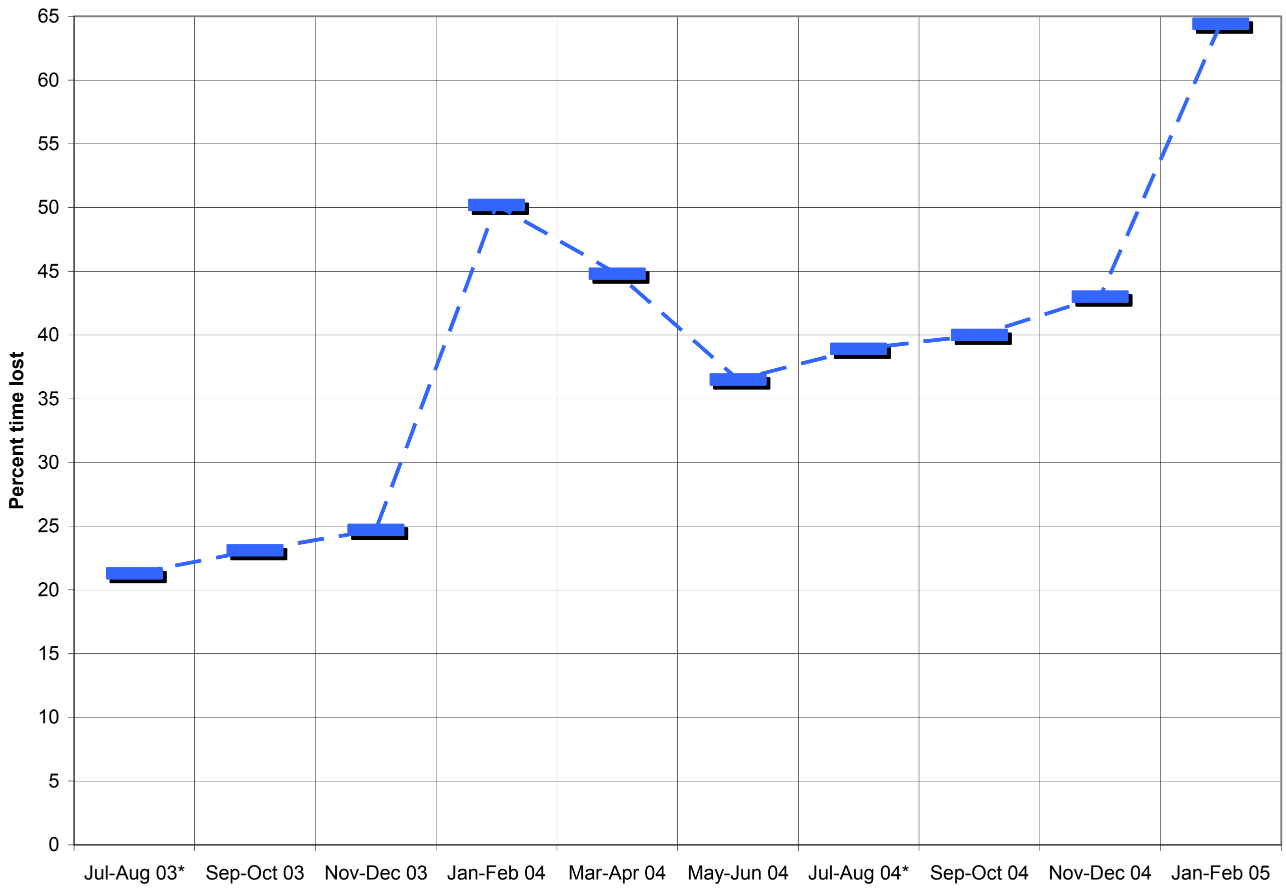
Smithsonian Astrophysical Observatory & Steward Observatory, The University of Arizona

MMT Observatory
Smithsonian Institution &
The University of Arizona®

BIMONTHLY SUMMARY

January - February 2005



*Lost time statistics (due to weather) for the 20-month period July 2003 through February 2005. The MMT 6.5m telescope scheduled observing time lost to weather has been unusually high for the last year. (*No observing time was scheduled during the months of August.)*

Personnel

At the January 25 Steward Observers' Lunch, Dan Fabricant (CfA) reported on the status of queue observing with the *f*/5 instruments on the MMT. His overview was followed by an open discussion to allow Steward observers to voice their thoughts and concerns.

Primary Mirror Systems

Aluminizing

Work continued on finding a replacement for our fragile, aging MOSFET system. A candidate welder supply from Miller Electric has been identified, and we acquired two test units from their local representative. We modified them for a lower minimum output voltage (10 V to 3.5 V), and built interface hardware to get isolated analog signals in and out of the welders for setpoint control and to acquire their output voltage and current. Bill Kindred built a test fixture that holds 40 filaments (one complete aluminizing circuit pair with neutral bus), and we plan to test the welders fully loaded as they would be in the mirror coating operation. A complete test report is available at *http://www.mmto.org/MMTpapers/pdfs/itm/itm05-1.pdf*. The test yielded successful results in all respects. In the near term, we will acquire more welders and build their interface control hardware for aluminizing in 2005.

Secondary Mirror Systems

f/5 Secondary Mirror Support

On February 22, Creighton Chute and Court Wainwright replaced all three of the *f*/5 secondary tangent rod assemblies. The major difference between the two tangent rod designs is the amount of over-travel in the breakaway mechanism. The new design of the breakaway allows for 0.276 inches (7 mm) of travel in both compression and tension. The preload of each breakaway was set to 30 pounds for each direction. At the end of the 0.276 inches of travel, the initial preload increases to approximately 55 lbs. Once installed, Brian Comisso tuned the electronics, with phone support from Dusty Clark and Cory Knop. The servo system supported the secondary mirror through all angles as expected. Near horizon pointing (0.9 degrees elevation angle), we measured the travel of each tangent rod when it was broken away. The average of the southwest tangent rod extended by 0.062 inches, the southeast by 0.023 inches, and the north by 0.006 inches.

Hexapod Control

Our first run with the *f*/15 adaptive secondary using the new UMAC motion controller took place in January. The motion of the hexapod with the *f*/15 mounted is tightly constrained, and care was taken to determine and verify a new set of software limits. New hexapod limit switches were installed to prevent hub collisions, and software changes were made to accommodate this. We discovered several small problems—"switch bounce" for one—that required revisions to the control electronics. When we got on the sky (briefly) we found that we were not able to collimate given the range of motion constrained by the switch. We were able to work around this by tilting the primary and re-pointing the telescope. Our calculations indicated that within the isoplanatic patch the aberrations from this compromised collimation would be negligible.

Intermittent problems occurred with the *f*/9-*f*/15 hexapod, now configured to run with the UMAC controller. Occasional—and sometimes frequent—hexapod dropouts were finally traced to two power supplies that were plugged into a single rack-mount UPS that was failing. Bypassing the UPS eliminated the dropouts. However, we are still seeing a second intermittent problem in both the *f*/9 and *f*/5 hexapods. Occasionally on boot-up the hexapod telemetry registers incorrect values, which vary widely. We are still working to identify the source of the problem.

Hexapod Control Matrices

Last period we reported that errors were discovered in the original *f*/9-*f*/15 hexapod control matrices. In January a new hexapod matrix was developed and installed, and was tested on February 13. We verified our math by re-deriving the *f*/5 hexapod matrix, which works correctly; however, the new *f*/9 hexapod matrix still gives slightly non-orthogonal motions. We suspect that this may arise from revisions to the hexapod geometry that were not recorded on the drawings. During engineering time on February 27, we were able to "tune" the matrix based on measurements taken both on and off the sky. The new empirically derived matrix is very close to correct, and the control GUI is now working almost as intended.

Hexapod Control Software

Several changes were made to the hexapod crate code. The "Undo" functionality that had been within the hexapod graphic user interface, hexgui, was moved into the hexapod crate code. This change allows hexapod motion commands to be undone from any source, such as the wavefront sensor, and not just from hexgui. The "Undo" button on hexgui now controls this functionality in the hexapod crate.

Telescope Tracking and Pointing

Servos

Currently, motions of the telescope are controlled by a VME-based computer running VxWorks. The heart of this computer is an MVME167 processor board with 16M of RAM and a Motorola MC68040 processor running at 33 MHz. Our options to improve servo performance are severely limited by this outdated hardware.

We are experimenting with a new version of the mount software running under VxWorks on a 600 MHz Pentium-III processor with nearly unlimited memory. (This could be accomplished with a faster system such as a 3.6 GHz Pentium-IV.) Nearly all of the software has been ported, including the necessary IP module drivers, and is being tested in the mount simulator environment that we have long used on campus. We may gain improved performance by simply deploying this faster hardware and running the servos at a faster update rate. A faster computer with more memory will allow us to develop improved telemetry for servo tuning, development, and logging, and in particular will allow us to replace the LM628 motion controller chips with a much more flexible software-based servo control algorithm (which may be developed using Simulink or some other methodology). For the foreseeable future, we will retain the existing VME hardware to handle the multitude of control and status signals known as the interlock subsystem.

We tested a new candidate controller using user datagram packet (UDP) communication with the existing mount computer. The existing mount software was modified to send position commands via UDPs to the new controller, which returned status and position over the same link. This allowed us to leave the existing software infrastructure intact to support operator GUIs and astronomical calculations while exercising new servo software. We expect to continue testing new servo algorithms in the months to come.

Encoders

A new mechanical alignment stage for the east elevation encoders has been installed and is ready for use. During the initial alignment in February, Creighton Chute and Dusty Clark discovered the encoder read head was faulty. Dusty is in the process of resolving this issue.

Computers and Software

Revision of mmt_xephem

A new version of mmt_xephem (an adaptation of XEphem for use at the MMTO) was created from the current version of XEphem (version 3.6.3), an open-source, ephemeris-generating software package available from *http://www.clearskyinstitute.com*. The previous version of mmt_xephem was based on XEphem 3.5.2, and substantial software changes were made between these two versions. Testing was performed on the new mmt_xephem code during MMT engineering time, including on-sky pointing and tracking of sidereal and non-sidereal objects. No problems were found for sidereal and most non-sidereal objects, including planets. However, two problems were found with earth-orbiting satellites: 1) pointing was slightly off; and 2) an update rate of 1 Hz was not sufficient for smooth tracking. The pointing problems are believed to result from improper handling of epoch calculations. The tracking issues are related to how quickly new coordinates can be transferred from mmt_xephem to the mount crate via a network socket connection. To address these two issues, work has begun on transferring non-sidereal code from mmt_xephem into the mount crate code.

Mountain Linux Updates

The four Linux workstations in the control room were all updated to Fedora Core 3 from Fedora Core 1. This brings them up-to-date with the new server and the other Linux workstations that are in use on campus and on the mountain. To better support the growing number of Linux machines, we now host our own local Fedora mirror at *http://www.mmto.org/fedora/*. This mirror is updated nightly and all machines now point to it for their automatic updates. The update process included updating IRAF to 2.12.2p2 on all machines, and modifying the device drivers for the DT3155 and FlashBus MV framegrabber cards to work with the new Linux kernel.

Wavefront Sensor Software

Work was done to clean up and streamline much of the wavefront sensor (WFS) interface code. Both *f*/9 and *f*/5 systems and all instrument profiles are now supported by a single program. This will also ease additional support for new instruments and wavefront sensors as they come on-line. The WFS interface now sports an internal network server to allow remote access and control. This makes it possible to develop external programs that automate WFS tasks without having to modify the core WFS code itself. Such programs have been written to automate acquisition and analysis of tempfoc and elcoll data. In addition, the WFS now logs hexapod and temperature data after every set of corrections, which will help further refine and characterize elevation and temperature dependencies over time. Another GUI was written to automate routine WFS data acquisition, analysis, and application of primary and secondary corrections. It has worked well so far, and work will continue to further automate and simplify WFS operation.

Logging

We are beginning a review of the logging performed by various subsystems. For some time we have had an event log that keeps a record in chronological order of events submitted by various real time computers (a.k.a. VxWorks crates), and deemed worthy of logging by the subsystem in question (such as the mount, hexapod, or cell). This log has been kept in XML format, and has proven useful even in this raw form. It has long been intended to provide a viewer that strips the XML markup and presents the log in a "user friendly" format, and this was recently done as a web based tool. Even in its initial rudimentary form it has proven quite useful. The nightly operator log has been augmented to provide hypertext links into the event log, which correspond to the time of the operator entry; this has already proven helpful in troubleshooting. Having ready access to the logs has motivated new work in revising and enriching the entries contributed by the various subsystems. The log has previously been most useful to the software staff, but in its new form it is proving useful to engineers not directly involved in software development.

We have other "periodic logs" that are generated by querying the real time control computers for the full set of parameters they export, and then logging them all at regular time intervals. These complement the event log, and provide a view of the night's activities that augments the information provided by the event logs. This log information will be reviewed and standardized in the near future.

GUI and Web Page Updates

Minor changes were made to various GUIs and web pages. The telescope balance web page was modified to include the laser optics hardware in the default telescope moment. The telescope status GUI used primarily by observers, telstat, was modified to obtain mount and hexapod information from mini-servers rather than directly from the mount and hexapod crates. In addition, telstat now uses the old Vaisala unit (model 243) for relative humidity and dewpoint instead of the RainWise unit, which has been retired from service. Both chamber and outside temperature reported in telstat are obtained from the TempTrax digital thermometers.

Instruments

f/9 Topbox

The bright quartz lamp in the *f*/9 topbox failed on February 4 and was replaced by Dennis Smith on February 5. During the SPOL run that started on February 8, the observers found a previously unobserved feature in the spectrum of the new lamp at approximately 5750 Å. The lamp was replaced but the feature was still present. Dennis noted that the new lamps, which were manufactured circa 2000, had not been previously used in the *f*/9 topbox. The lamp was replaced with an older unit from a batch manufactured circa 1990 and the spectral feature was not present. The feature is likely the result of a manufacturing modification to the lamps made between 1990 and 2000, perhaps an absorption feature in the glass casing. Dennis is working with the manufacturer, Gilway Technical Lamp, to obtain older devices to be used as spares. Figure 1 compares the spectra from a lamp manufactured circa 2000 to that of a lamp manufactured circa 1990 (courtesy Gary Schmidt).

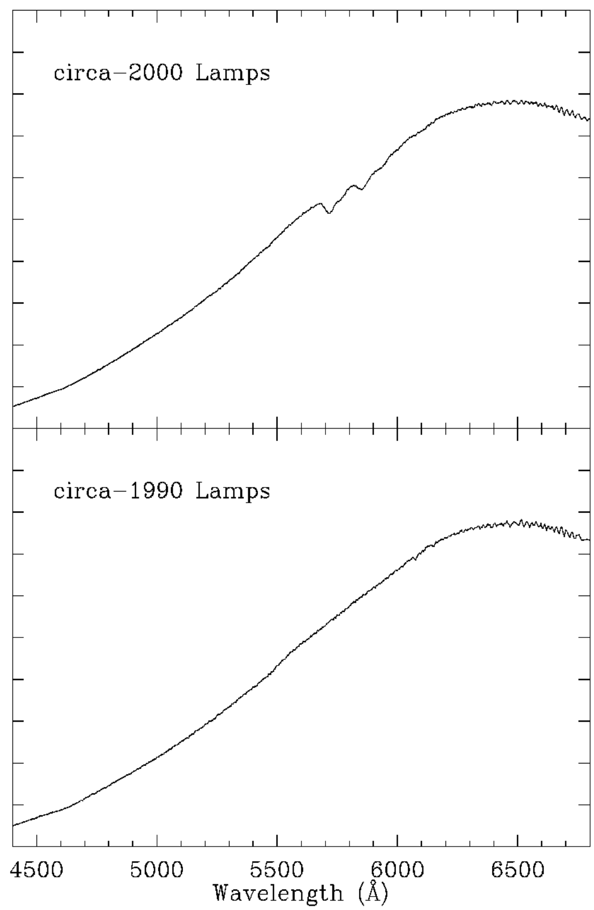


Figure 1: Comparison of spectra from a lamp manufactured circa 2000 to that of one manufactured circa 1990.

Blue Channel and Red Channel Spectrographs

A discrepancy was discovered between the Red Channel gain value listed on the UA Imaging Technology Laboratory (ITL) web page and the value written to the image header. The web page indicated that the gain was either 2.6 e/DN in the low gain setting or 1.3 e/DN in the high gain or default setting. The value of the gain in the image headers is 1.7 e/DN. In order to measure the correct gain, a set of flats and biases was obtained on February 17. To determine the gain, the IRAF “findgain” routine was used with several different combinations of biases and flats. The gain was measured to be 1.7 e/DN, in agreement with the image header value. The ITL web page has been updated to indicate the measured value.

Red and Blue Channel throughput data taken by Mark Wagner and Tim Pickering in 2003 have been fully reduced. Some of the data obtained during poor seeing conditions yielded questionable results and therefore are not presented here. The following tables list the available gratings for both Red and Blue Channel. The third column indicates the central wavelength of a set of acceptable throughput data.

Table 1. Red Channel

Grating	Blaze(order/wavelength)	Central Wavelength	Filter
Echellette	11th/5235		
150	1st/4800	6090	UV36
270	1st/7300		
300	1st/4800		
600	1st/4800	4800	L-38
600	1st/6310	6300	L-38
1200	1st/5767	5870	UV36
1200	1st/7700		
Lo-res. Ech.	7th/5134		
Hi-res. Ech.	18th/5790		

Table 2. Blue Channel

Grating	Blaze(order/wavelength	Central Wavelength	Filter
300	1st/4800		
500	1st/5410		
800	1st/4050	4300	Clear
600	2nd/4800 1st/9630	5000	CuSo4
832	2nd/3900 1st/7790		
1200	1st/4830	4840	Clear
Echellette	12th/4480		

A representative plot of the throughput for Red Channel using the 600 gpm/6310 grating is shown in Figure 2. Additional plots and tabular data will be added to the MMT's instrument web pages (*http://www.mmto.org/instruments/rcupdate.shtml* and *http://www.mmto.org/instruments/bcupdate.shtml)* in the near future. We plan to obtain data for the remaining configurations during engineering time next trimester.

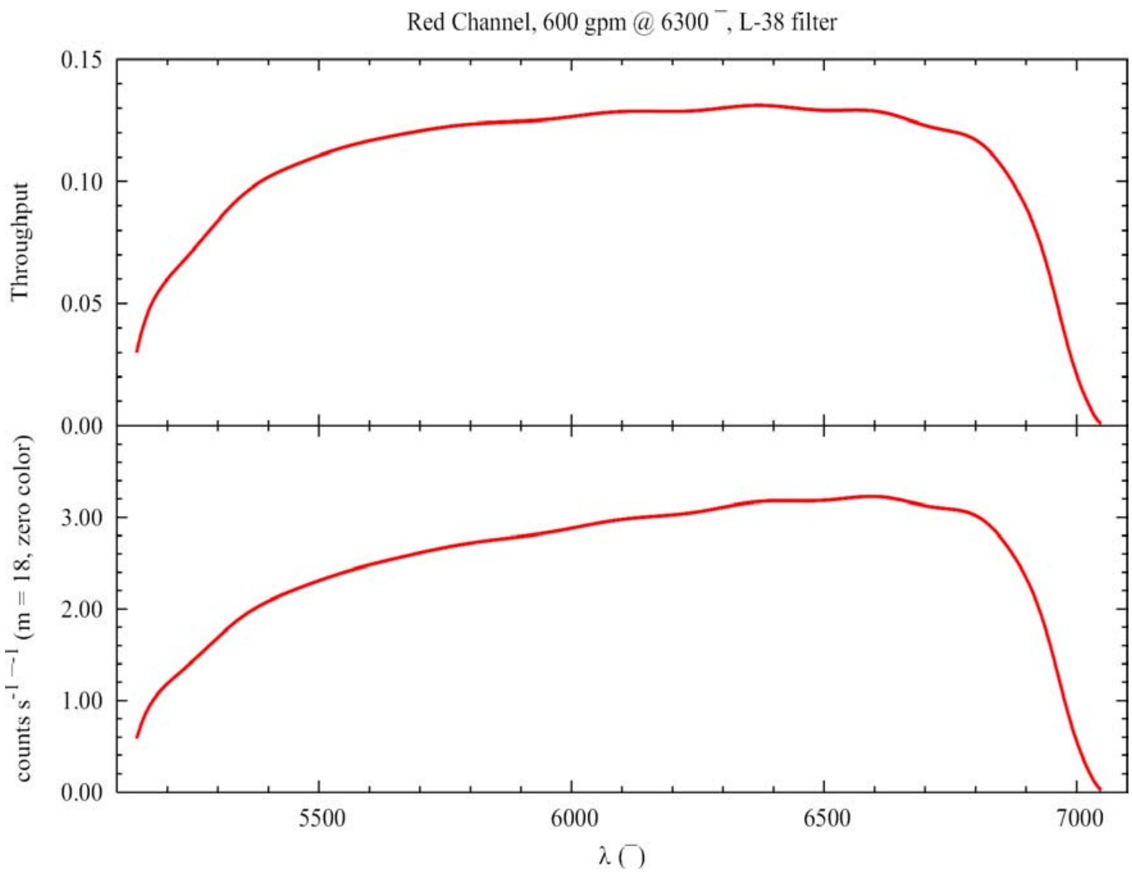


Figure 2: A representative plot of the throughput for Red Channel using the 600 gpm/6310 grating.

Instructions for moving the Red Channel camera for cross-dispersed work were completed, and were posted on the instrument mounting procedures web page.

Adaptive Optics

The AO run January 19-30 was plagued by inclement weather and a progressive failure of the building drive system, which provided plenty of time for testing the new hexapod limit switches meant to prevent secondary package-to-hub collisions (see Secondary Mirror Systems, Hexapod Control above). Little on-sky time was available to quantify and correct AO secondary mirror collimation problems.

Laser Guide Star

The Laser Guide Star (LGS) group at CAAO was allocated two cloudy nights for instrument engineering during February hatch installation. They installed their hub optics, a new dust shield, and ran several tests.

Instrument Usage

The pie charts in Figures 3 and 4 show observing time scheduled by instrument for 2003 and 2004. Use shifted from *f*/9 to *f*/5 from one year to the next, although the MMT Spectrograph still remains a popular choice. Use of the *f*/15 AO system temporarily decreased due to upgrades performed during the fall of 2004. The year 2004 was the first full year with the *f*/5 instruments, and included the commissioning of SWIRC. In addition, Hectospec, Hectochelle, and Megacam are now available for Public Access observing time. With continuing PI support, "queue" observing has been implemented for all Hecto instrument runs. MAESTRO will become available in early 2006.

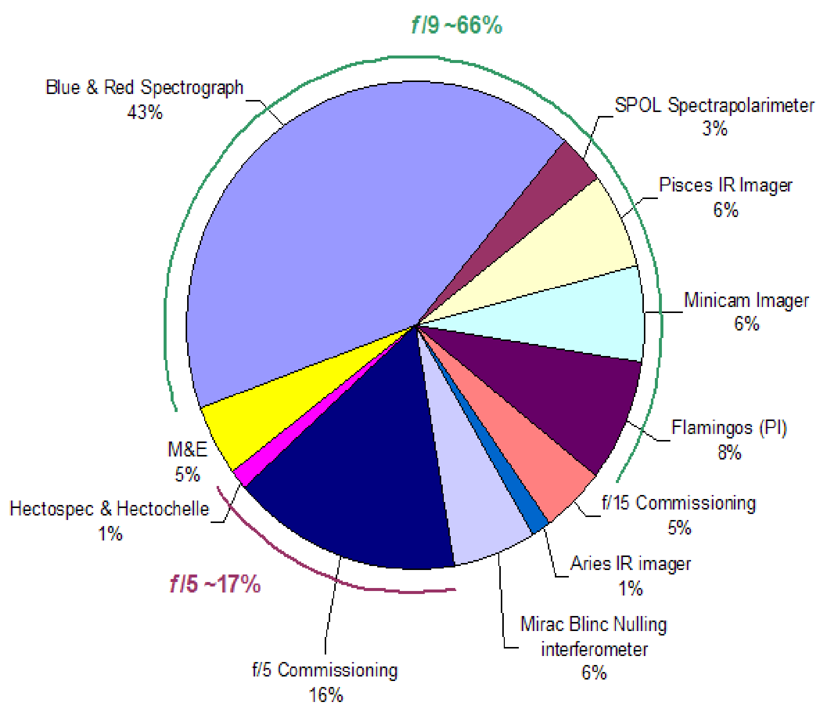


Figure 3: Time allocation by instrument for 2003.

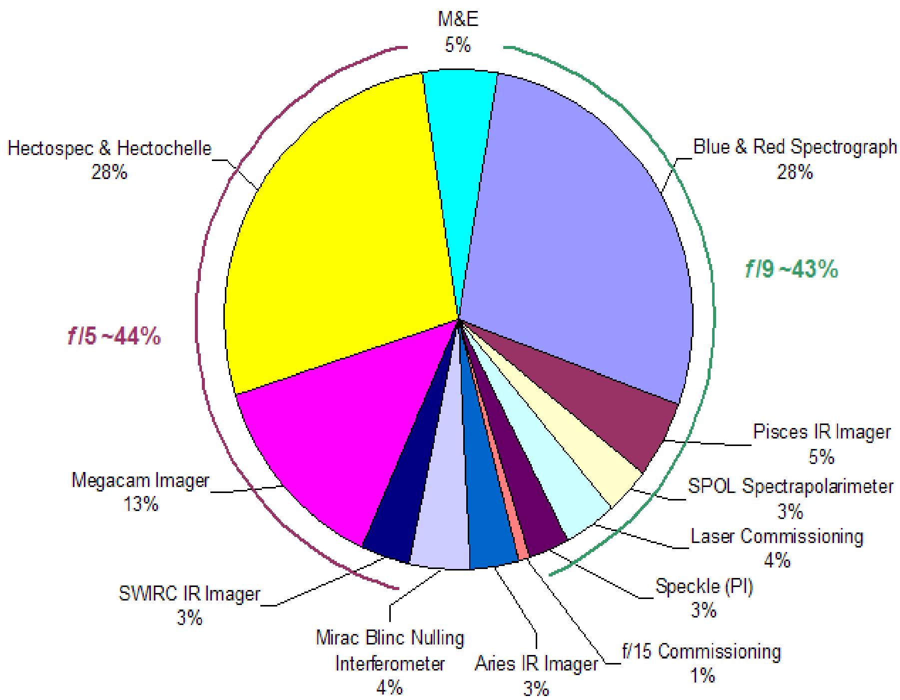


Figure 4: Time allocation by instrument for 2004.

General Facility

January-February Operations

The weather was patchy through most of the period, and three winter storms kept us closed January 19-27 and February 4-12 and 21-26.

Intermittent problems with the building azimuth drive dropping out recurred with increasing frequency until January 30 when this long-standing problem was isolated. A fault condition was recurring in the building drive amplifiers, which indicated a low DC voltage fault. This was a transitory condition that had been clearing itself. It was determined that the drive amplifier voltages were correct, but upon consulting documentation we found this fault could also be triggered by any interruption in cooling fan power. The fans were reconfigured to run on an external power supply; we have not seen dropouts since. Spare fans are on order.

February 21-26 we were closed for major work on the building. During the week, contractors from Tucson Building & Remodeling (TBR) and C&E Welding arrived on site to cut a new full-sized hatch between the ground floor and the pit (see New Pit Hatch below). Sections of concrete floor were demolished, major building steel was removed, new steel was installed and welded in place, the new hatch doors were installed, and concrete was poured to the new hatch frame. The work went very smoothly.

We had originally planned to use some of the nights for limited observing, but weather kept us closed. We were able to make good use of the daytime, concurrent with the hatch modifications, and it was a very successful mini-shutdown. Some of the tasks accomplished include the following:

- A new servo controller was tested;
- We removed the east elevation drive, installed missing alignment pins, re-assembled the drive, and re-installed and aligned it to track smoothly;
- The west elevation brake was overhauled;
- The west elevation encoder read head was partially installed;
- New tangent rods were installed on the *f*/5 secondary, the alignment was checked, and cell electronics were tuned and checked;
- The wide field corrector lens was swapped in preparation for the March Hecto run;
- Control room computers were upgraded;
- Three new radiant panel heaters were installed under the control room console for creature comforts, and seem to be much appreciated;
- The Mattei 515 air compressor (primary mirror support) was serviced, inspected, and o-rings and a coupler were replaced.

On the afternoon of February 27, JT Williams, Dennis Smith, Dan Blanco, and Ale Milone removed the building stow pin, cleaned the building track, did a final inspection of the building modifications, and started the building while monitoring the new hatch framing for any signs of flexure. All building rotation systems worked smoothly with the new, large hatch in place.

That evening we ran *f*/9 hexapod tests, tested newly installed control algorithms for non-sidereal tracking, and gathered data on the focus behavior as temperature changes (tempfoc). On Monday February 28 we installed the *f*/5 secondary, wide field corrector, and wavefront sensor. That evening we continued M&E with tests of wavefront sensor automation and more tempfoc measurements. Seeing on these two nights was spectacular, with many 10-second WFS exposures measuring 0.25 arcsecond.

New Pit Hatch

The February installation of our new pit hatch was the culmination of two years of assessment and effort, led mostly by Dan Blanco, to increase storage space inside the building for the new generation of facility instruments. This space could be accessed with the installation of a new hatch the same size as, and directly below, the existing chamber hatch. Much of the wear and tear on instruments comes from moving horizontally across uneven floors. The vertical lift to storage in the pit should be fairly benign and make handling quicker and more convenient.

Installing the new hatch required cutting through some of the major building steel. In summer 2003 M3 Engineering was commissioned to do a design study on the impact of the hatch on building performance. Their analysis, corroborated in a peer review by Simpson Gumpertz & Heger, indicated that we could cut through the existing diagonal bracing and replace it with 1" thick steel plate to frame the new hatch in order to obtain equivalent wracking stiffness in the building. This work was contracted to TBR by Smithsonian, using facility modification funds.

We still have much cleaning and construction of suitable enclosures to do, but we can already use the pit for storage of ancillary equipment such as baffles, carts, and handling fixtures. This should help to relieve overcrowding in the rest of the facility.

All-Sky Camera

A weather-tight enclosure was obtained for the StellaCam II video camera, and the camera system was handed off to the electronics group to assemble and prepare for installation. In the meantime, software for the data pipeline was completed. When operational, the camera will take an image every 10 seconds, and after every image is taken the last 100 images will be combined into an animated gif file. Each image is analyzed to determine whether the gain or integration time of the camera needs to be changed. This allows the camera to automatically adapt to changing lighting conditions. Upon sunrise and sunset, image acquisition will be paused and the accumulated images combined into DivX format movies and then purged. A night's worth of raw images takes up to 4 GB or more of disk space while a high quality DivX movie generated from the same images will usually be 20 MB or less. DivX movies can be viewed under Linux using either mplayer or xine. Windows and Mac players can be downloaded from *http://www.divx.com*.

Other Facility Improvements and Repairs

During January Phil Ritz and Brian Love installed a new man-access hatch to the pit in preparation for the hatch modifications (see above). The switch for the pit lights was relocated adjacent to the new man-access hatch.

Dennis Smith found that the pressurized air supply hose for the primary mirror support was underrated. A new hose was installed between the first-floor air cabinet and the storage tank in the pit. A second air pressure regulator was installed in the old control room. This supplements the existing regulator for the *f*/5 secondary and allows off-telescope testing of the *f*/9 secondary in its cell. A leaking air pressure regulator (for the *f*/9 secondary mirror) in the yoke room was replaced.

The new Vaisala WXT510 weather transmitter was delivered and tested. This unit will provide measurement of wind speed and direction (using ultrasonic probes), liquid precipitation, barometric pressure, temperature, and relative humidity. The unit has a built-in heater for operation during snow and ice conditions. A site on the communications tower west of the summit support building is being prepared for installation. Code written for the new Vaisala mini-server ("vaisala3") has been completed.

We added an additional transformer to the Carrier chiller to share some of the load that has been added over the years by various upgrades. This should eliminate a potential overload, which has blown a fuse in the past.

Surface mount conduits were added to the cabling going to and from the SAO calibration source lamp boxes, which have been placed on the fourth floor mezzanine.

One of the surface-mounted AC outlet boxes in the chamber was imbedded into the wall to remove an aisle-way obstruction.

A new power outlet has been added in the west wing wall to allow both the secondary mirror and west counterweight hoists to operate simultaneously.

The south perimeter heater was replaced and the north repaired—it had failed due to corrosion.

The dock pad heater had been originally configured with two heat mats in series, one of which has failed. By rewiring the series configuration the remaining unit is now functioning.

Modifications to the 26 volt cabinet front panel were completed. The panel now gives a much better graphic display of the 26 volt system status.

A wider angle lens was installed on the north chamber view camera.

A new card was installed in actuator #136, which had failed in operation.

The Young wind vane that was reading faulty wind directions was repaired.

Visitors

January 31: SAO director Charles Alcock made his first visit to MMTO and FLWO as CfA Director. He took the time to meet with staff members on Mt. Hopkins, at the FLWO basecamp, and at the UA campus facilities.

February 1: Blue Channel observer Ed Olszewski (SO) hosted a small group of former students from his "Stars" course for non-majors.

February 16: Lt. Col. Darrell Wallis (Air Force Research Laboratory), Dr. Howard MacEwan (SRS Technologies Inc.), and Dr. Sarma Gullapalli (National Reconnaissance Office), accompanied by Peter Worden (SO).

Publications

MMTO Internal Technical Memoranda

05-1: Generation III Aluminizing Power Supplies – A Test Report
D. Clark

MMTO Technical Memoranda

None

MMTO Technical Reports

None

Scientific Publications

05-1 Resolved Mid-Infrared Emission around AB Aurigae and V892 Tauri with Adaptive Optics Nulling Interferometric Observations
Liu, W. M., Hinz, P. M., Hoffmann, W. F., Brusa, G., Miller, D., Kenworthy, M. A.
ApJ, **618**, L133

05-2 Hard X-Ray Emitting Active Galactic Nuclei Selected by the *CHANDRA* Multiwavelength Project
Silverman, J. D., Green, P. J., Barkhouse, W. A., Kim, D.-W., Aldcroft, T. L., Cameron, R. A., Wilkes, B. J., Mossman, A., Ghosh, H., Tananbaum, H., Smith, M. G., Smith, R. C., Smith, P. S., Foltz, C., Wik, D., Jannuzi, B. T.
ApJ, **618**, 123

05-3 High-Resolution Mid-Infrared Imaging of the Asymptotic Giant Branch Star RV Bootis with the Steward Observatory Adaptive Optics System
Biller, B. A., Close, L. M., Li, A., Bieging, J. H., Hoffmann, W. F., Hinz, P. M., Miller, D., Brusa, G., Lloyd-Hart, M. Wildi, F., Potter, D., Oppenheimer, B. D.
ApJ, **620**, 450

05-4 Abundance Profiles and Kinematics of Damped Lyα Absorbing Galaxies at $z < 0.65$
Chen, H.-W., Kennicutt, Jr., R. C., Rauch, M.
ApJ, **620**, 703

05-5 *XMM-NEWTON* and Optical Follow-Up Observations of Three New Polars from the Sloan Digital Sky Survey
Homer, L., Szkody, P., Chen, B., Henden, A., Schmidt, G. D., Fraser, O. J., Saloma, K., Silvestri, N. M., Taylor, H., Brinkmann, J.
ApJ, **620**, 929

05-6 Accretion, Kinematics, and Rotation in the Orion Nebula Cluster: Initial Results from Hectochelle
Sicilia-Aguilar, A., Hartmann, L. W., Szentgyorgyi, A. H., Fabricant, D. G., Fűrész, G., Roll, J., Conroy, M. A., Calvet, N., Tokarz, S., Hernández, J.
AJ, **129**, 363

05-7 Magnetic White Dwarfs from the SDSS II. The Second and Third Data Releases
Vanlandingham, K. M., Schmidt, G. D., Eisenstein, D. J., Harris, H. C., Anderson, S. F., Hall, P. B., Liebert, J., Schneider, D. P., Silvestri, N. M., Stinson, G. S., Wolfe, M. A.
Submitted to *AJ*

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 Smithsonian Institution and the University of Arizona."

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.

NOTE: Beginning January 2005, the formula for accounting lost time on the telescope has been changed. Previously, time lost to weather was deducted from the total observing time before calculating time lost to instrument, telescope, and facility from the remaining balance. From now on, the time lost to each source is computed as a fraction of the total scheduled time.

Use of MMT Scientific Observing Time

January 2005

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	* Lost to Telescope	Lost to Gen'l Facility	Total Lost
MMT SG	3.0	36.00	30.25	0.00	0.00	0.00	30.25
PI Instr	26.5	311.30	173.20	4.50	13.75	0.00	191.45
Engr	0.0	0.00	0.00	0.00	0.00	0.00	0.00
Sec Change	1.5	17.70	6.00	0.00	0.00	0.00	6.00
Total	**31.0**	**365.00**	**209.45**	**4.50**	**13.75**	**0.00**	**227.70**

Time Summary Exclusive of Shutdown	
Percentage of time scheduled for observing	95.2
Percentage of time scheduled for engineering	0.0
Percentage of time scheduled for secondary change	4.8
Percentage of time lost to weather	57.4
Percentage of time lost to instrument	1.2
Percentage of time lost to telescope	3.8
Percentage of time lost to general facility	0.0
Percentage of time lost	62.4

* Breakdown of hours lost to telescope

primary panic 1.25
az drive drop outs 1
hexapod, az drives 1.5
building drives 10

February 2005

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	* Lost to Telescope	** Lost to Gen'l Facility	Total Lost
MMT SG	17	191.30	155.95	0.00	4.00	2.50	162.45
PI Instr	3	33.90	28.60	4.00	0.00	0.00	32.60
Engr	2	21.80	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	**22**	**247.00**	**184.55**	**4.00**	**4.00**	**2.50**	**195.05**

Time Summary Exclusive of Shutdown	
Percentage of time scheduled for observing	91.2
Percentage of time scheduled for engineering	8.8
Percentage of time scheduled for secondary change	0.0
Percentage of time lost to weather	74.7
Percentage of time lost to instrument	1.6
Percentage of time lost to telescope	1.6
Percentage of time lost to general facility	1.0
Percentage of time lost	79.0

* Breakdown of hours lost to telescope
hexapod, wavefront sensor 3
hexapod 0.5
az drives 0.5

** Breakdown of hours lost to facility
partial power failure 2.5

Year to Date February 2005

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	Lost to Telescope	Lost to Gen'l Facility	Total Lost
MMT SG	20.0	227.30	186.20	0.00	4.00	2.50	192.70
PI Instr	29.5	345.20	201.80	8.50	13.75	0.00	224.05
Engr	2.0	21.80	0.00	0.00	0.00	0.00	0.00
Sec Change	1.5	17.70	6.00	0.00	0.00	0.00	6.00
Total	**53.0**	**612.00**	**394.00**	**8.50**	**17.75**	**2.50**	**422.75**

Time Summary Exclusive of Shutdown	
Percentage of time scheduled for observing	93.5
Percentage of time scheduled for engineering	3.6
Percentage of time scheduled for secondary change	2.9
Percentage of time lost to weather	64.4
Percentage of time lost to instrument	1.4
Percentage of time lost to telescope	2.9
Percentage of time lost to general facility	0.4
Percentage of time lost	69.1