BIMONTHLY SUMMARY

July - August 2007

Thomas Stalcup (MMTO) took this picture during the laser guide star run in early July. The city of Nogales is seen in the background.

MMT Observatory • The University of Arizona • Tucson, Arizona 85721 • PHONE: 520. 621. 1558 • FAX: 520. 670. 5740

Personnel

Mia Romano, aka the Princess of Darkness, left the MMTO in mid-August after completing her internship addressing the issues of light pollution affecting Mt. Hopkins specifically, and southern Arizona in general.

Cory Knop gave a presentation on the Computer Based Safety Training (CBST) program to the Steward Observatory Safety Council. The Council was impressed and asked whether the program could be implemented throughout Steward, and what would be needed to expand the program (more videos, a server to store the video, man-hours to install and format the material). Cory is working with the Steward Safety Council to develop generic safety requirements that apply to all units under the Steward umbrella.

Primary Mirror Systems

Thermal System

Significant progress was made on the new T-series electronics. Layout of the data-acquisition boards was completed by Cory Knop, Brian Comisso, and Dondi Gerber, with more changes and edits to the board yet to be done. We have spent considerable effort in "right the first time" layout to save expensive errors in board manufacturing. The current design uses an LT1777 switching power supply. This was required because the previous voltage regulator produced excessive heat. Once all changes and layout checks are complete, we expect to have them manufactured. We will be ready to start populating them once in hand, as all parts are in stock. The firmware for running the data acquisition was 90% completed by Dusty Clark. A test and evaluation is now running in the lab using our adjustable Peltier cooling plate with a copper junction block housing six type-T thermocouples, a platinum resistance temperature detector, and a TempTrax thermistor probe for fully cross-checking all the available temperature-measurement hardware and software. We expect to complete the firmware development when the new hardware is fully assembled with all the hardware channels available for testing.

A failure of the thermal monitor MUX card occurred after a lightning strike. The card was diagnosed, and a software work-around was developed for use until summer shutdown. During shutdown, the card was removed and thoroughly tested and repaired. The card was manufactured by Steward without sockets for the ICs, and had no filter capacitors in its design. Capacitors had been added to the back of the card. A test tool was designed and fabricated, and a procedure was written to test the card. Testing revealed that seven 28-pin ICs were bad, some of which had been bad for some time and had been ignored by the software. All have now been carefully replaced with socketed replacement ICs. Cory Knop located and populated a spare circuit card assembly.

Secondary Mirror Systems

f/5 Secondary Support

Jill Cooper finished modeling the "iron maiden" trunnion test fixture, and we are now determining the best way to rotate the f/5 assembly in the fixture. Previously, a crane and several safety straps were used. While this was effective, it is not a long term solution to the problem. At J. T. Williams's request, Jill created a dimensional drawing of the maiden in order to determine whether the f/5 will fit into the fixture as is, or whether the removable neutral member hub and milkstool will have to be removed. This option is perhaps the quickest, but mechanical reassembly of f/5 may result in absolute position errors.

Oscillatory behavior of the f/5 mirror support electronics was reported shortly before the August shutdown. This prompted a review by Dusty Clark to study the possibility of re-designing the mirror support board to a) clean up long-standing signal integrity issues, b) add more diagnostic channels to the on-board data-acquisition, and c) go to direct Ethernet data connectivity. Some design alternatives were explored, sketched out, and left for evaluation using a commercial part-evaluation board from Linear Technology to replace the on-board analog-to-digital conversion circuits. We await the results of this testing before making any more evolved design decisions.

f/5 Baffles

The black flocking material that covers all the f/5 secondary baffles was replaced on the upper baffle by Jill Cooper, Bill Stangret, and Creighton Chute. The flocking was peeling off due to rough handling and poor adhesion on the seams of the material. The existing flocking was removed, the baffle was then covered with new flocking, and the seams were glued down using "Liquid Nails."

f/9 Mirror Cover

A new f/9 mirror cover is in the design phase. The original mirror cover had flocking covering the inside surface. The flocking may have contributed, through outgassing, to the hazy film that covered the mirror's surface prior to its wash last year. The new cover will be stronger, lighter, non-outgassing, and easily handled and installed by one person.

Telescope Tracking and Pointing

Servos

During the reporting period the elevation servo controller was tested using both the VxWorks and xPC Target incarnations using the same hardware, the IP-Quadrature encoder counting module and the PCI-DAC6013 digital-to-analog output board, to determine whether differences in hardware implementation would explain the difficulties encountered in deploying the new servo. Both incarnations resulted in nearly identical behavior, so this possibility must be discounted. We await (yet more) on-sky testing with the VxWorks system to show us if the previous problems were intermittent.

Computers and Software

Control Room Telstat Displays

Two new telstat monitors are being added to the control room to display additional information to the operators and observers. These two monitors will display the following information at all times: primary mirror thermal information and actuator force/air pressure status, altitude/azimuth/rotator status and position, hexapod status, weather radar loop, local lightning strikes, and Vaisala weather station information. Work is in progress by Dallan Porter and Duane Gibson to complete the content of these monitors.

Safety Training Video Web Page

Dallan Porter and Cory Knop developed a safety training website that will allow MMT staff to view a collection of over 10 safety training DVDs online in a web browser. The site is nearly ready to deploy. Dallan is researching hardware and bandwidth requirements prior to making the site available to all staff. The system allows monitoring and tracking of users, which will enable work center safety monitors to track training progression.

Sky Camera Image Database

Work is underway on a database that will store sky camera header information. This database will allow for faster searching through sky camera image files, as well as the ability to generate time lapse movie files based on user-defined begin and end times. So far the database has been created on *hacksaw*, and a large portion of the archived sky camera images have been processed and added to the database. Once all of the old images have been added to the database, a web based front-end will be created to allow users to search through the data and generate movie files.

Instrument Control Software

Skip Schaller provided software support for image acquisition with Maestro while it was in the lab, and later during its commissioning run at the MMT in late July. Minor changes were made to the ICE image acquisition to support odd binning on split serial chips to match what the AzCam server was providing. Skip also worked with Mike Lesser (ITL) to identify problems in the AzCam server for gen 3 SDSU CCD controllers. One such problem is the inability to query the camera and dewar temperatures during an exposure. This and some other more minor problems are still outstanding.

Single Sign-on Authentication

Skip Schaller worked on setting up a lightweight directory access protocol (LDAP) server for the mmto.org domain. This was implemented using the open-source Fedora Directory Server. This provides a unified way to authenticate all modern operating systems (Windows, Linux, OS X, and others), network file access via samba, and web page access. A user will be able to use one username/password combination for all authentication. This will allow us to improve security by doing away with public accounts such as mmtstaff and mmtop. A user's password can be changed from any machine, and the change will be immediately reflected on all machines. Two servers were configured, acting as redundant backups for each other. If one server is down or otherwise unreachable, the client will automatically use the other server. Thus, the outage will be mostly transparent to the user.

The deployment of the LDAP servers was completed in late August, and most observatory Linux workstations were modified to use them, including all of the control room workstations. The migration went quite smoothly. Most of the issues involved the LDAP server on *hacksaw* being I/O starved at times and making itself unavailable. This tripped up some bugs in the NSCD (name service cache daemon) server that Linux clients use to buffer LDAP access. Fortunately, when the issues cropped up, they would sort themselves out within a minute or two. We also tuned some I/O intensive tasks that *hacksaw* runs to make them more efficient, and tweaked some kernel parameters to improve response latency when the I/O load is heavy. No LDAP errors have been reported since these changes were made.

Remaining work includes integrating the FDS and Windows Active Directory LDAP servers. The Fedora Directory Project distributes software to facilitate this, so it should mostly be a matter of configuring that for our environment. We also need to migrate our password authenticated web pages to use LDAP in lieu of the .htpasswd files we currently use. All of the software necessary to support this is in place, so this just requires tweaking and testing the .htaccess configuration files we use. This should be completed in mid-September.

/tcs Virtual Memory on *hacksaw*

A shared memory, temporary file system ("tempfs") has been implemented on *hacksaw* under /dev/shm. The /tcs directory has been mounted to this tempfs file system to create an in-memory file system. This shared memory improves overall system performance and facilitates data sharing between processes.

At the present, one subdirectory has been created within the /tcs directory: /tcs/devices/. Within this directory are subdirectories for the various miniservers. The value of each variable within each miniserver is stored in a separate file within the tempfs. These files are updated only when the value of the variable changes. Symbolic links can be created, as needed, in order to quickly change data sources. For example, an "outside ambient temperature" variable could be linked to a temperature variable within the Yankee, Vaisala3, or TempTrax1 miniservers, depending on availability of data.

Miniserver Code Unification

A new Perl module, mini.pm, was written that consolidates code related to the miniservers. The main advantage of this module is code reuse and standardization among the various miniservers. This module contains two Perl classes: one for a miniserver client, similar to the existing PHP Miniserver class, and one for a miniserver socket server, which uses code from Lincoln Stein's book on "Network Programming with Perl." Conversion of the various miniservers to use this Perl module is almost complete. This code is also used for updating the MySQL background logs for the miniservers.

Web Services

Much work was done on consolidating support of various formats for web support of miniserver data. After several revisions, a mod_perl handler was created for web services that takes advantage of the /tcs/devices/ shared memory directory described above. This mod_perl handler can either not block or block until new data have been posted by the appropriate miniserver, allowing real-time updating of web pages and other client applications without the need for constant polling for new data. A web page example with this real-time updating is:

http://hacksaw.mmto.arizona.edu/engineering/carrier/carrier.html

The mod_perl handler can provide data in XML, JSON, CGI, and the MMT-specific "all" format. Only selected parameters can be returned, if desired.

Control Room Linux Workstation Upgrades

The workstations that the telescope operators use, *yggdrasil* and *hoseclamp*, were last significantly updated over three years ago. Some components in them actually date back more than five years, and their enclosures have been complained about for years for being too bulky and noisy. In August we replaced them with new 2.4 GHz Core 2 Duo-based workstations from Dell. The new machines are very noticeably much faster than the old ones, run significantly cooler, and are much quieter. They each have 2 GB of RAM, a 250 GB disk, PCI Express-hosted gigabit Ethernet, and dual-head video cards. What they don't offer, however, are any legacy ports such as serial, parallel, or PS/2 for mice/keyboards. The only ports they provide are USB and sound I/O. This necessitated replacing the previous PS/2 keyboards with newer USB models, reconfiguring the UPS's to use their USB interfaces, and moving the operator's hardware paddle to a different machine.

Another twist with the new machines is that the Core 2 processors they use are now native 64-bit. They can run 32-bit operating systems and applications, but there can be a significant performance gain when running 64-bit applications. Some quick benchmarks showed that 64-bit browsers ran update-intensive Ajax web pages about 2.5 times faster than their 32-bit equivalents. Given this, and the fact that our main server computers were already running 64-bit operating systems, we decided to bite the bullet and run the new computers in full 64-bit mode. Although the 64-bit format offers noticeably faster performance, software support is not as widespread as for 32-bit systems. For example, the Flash and Java browser plugins are not available in 64-bit format. To work around this, a Ruby/Gtk script, using the GtkMozEmbed embedded browser, is being used for both 32-bit and 64-bit web applications. This approach has several advantages: 1) each web page runs in a separate process, reducing the inter-dependencies between web-based GUIs; 2) the embedded browser is streamlined compared to Firefox and requires fewer system resources; 3) a compiled version of the Ruby/Gtk script can be built on a 32-bit machine, then used on a 64-bit machine, allowing use of 32-bit browser plugins. Work continues on other 32-/64-bit issues, such as recompiling C libraries used by XEphem and the edb_gui application for non-sidereal tracking.

In addition, the computer that runs the telescope status displays, telstat, was also upgraded. It was previously a Shuttle small form-factor machine that could only support one PCI video card in addition to an AGP video card. Since we want to eventually support six status monitors, we need to support at least one more video card. A suitable replacement became available that is faster than the previous machine and can support three video cards with a PCI slot to spare. This machine was deployed in August and the spare slot used to host the DT3155 framegrabber card used by the SAOguider. This was done because the DT3155 driver limits its host to 896 MB of RAM. We didn't want to throw away more than half the memory in any of the new machines, and telstat is otherwise single-purpose, so it made sense to also be a guider host. Unfortunately, this rearrangement broke the existing desktop entries for bringing up the SAOguider. The interim workaround is to ssh into telstat and run the command "saoguider." The new telstat computer is also the current host for the operator hand paddle. However, there appears to be some incompatibility between the paddle driver and the current Linux kernels that needs to be addressed.

In the course of setting up the new machines, some improvements were made to the way user accounts are configured. An mmt_env package was created to ease the installation and management of MMT-specific configurations and modifications. So far this package is used to automatically install and solve dependencies for software packages we use, to install configuration files that set up user environments, and set up a top-level desktop menu called "MMT." The "MMT" desktop menu itself has been enhanced and divided into the following sub-menus by category: 1) autoguiders; 2) cell GUIs; 3) hexapod and M2 GUIs; 4) MMTAO GUIs; 5) mount GUIs; 6) thermal system GUIs; and 7) WFS GUIs. Running individual applications from these menus assures that the appropriate version is run in an optimal environment. Work continues on adding applications to this menu system as well as adding entries to bring up sets of applications at once.

Instruments

f/15 Instrumentation

The position actuators that position the adaptive secondary on its test stand were redesigned and fabricated. The new design allows the threaded portion, which adjusts the secondary height as well as tip/tilt, to rotate while the feet (that support the weight) remain stationary.

Natural Guide Star (NGS)

During the past two years of operation there have been three gap contamination events. These were worked down while the mirror was still mounted on the telescope to prevent lost time. The accumulation of this contamination, however, was beginning to cause occasional problems, so the decision was made to remove the shell and clean it. This was done by Guido Brusa, Richard Sosa, and Manny Montoya from LBT and Steward, with Thomas Stalcup and Creighton Chute from the MMT assisting. The mirror was removed, cleaned, and inspected. After reinstallation, the gap was found to be completely clean and the mirror is ready for observing in the fall trimester.

Laser Guide Star (LGS)

Following the successful closed loop testing described in the previous bimonthly summary, the laser group had four nights scheduled in July. Predictably, the monsoons hit with a vengeance and the chamber was only open for a total of five hours spread over two different nights. For three hours of this, the seeing was 2-3 arcseconds or worse. During the remaining two hours, the LGS loop was closed controlling only defocus. Although this is only a stepping stone to full order correction, it is an important milestone in the LGS system and is the first time an AO correction loop has been closed using multiple laser guide stars anywhere in the world. During testing on the AO test stand, the full order loop was closed within hours of closing the defocus only loop. Unfortunately the storms rolled in and these few additional hours on the sky were not possible. The next run, scheduled in October, should produce full order closed loop results.

f/9 Instrumentation

Red Channel Spectrograph

During summer shutdown, the Red Channel Spectrograph and the Steward Observatory Guider systems were sent to ITL for routine maintenance. The ITL engineers investigated the increased operating temperature of the Red Channel detector from approximately -120C to approximately -105C. They concluded that there is probably a slight thermal short that would be very difficult to alleviate. The camera will be left as is, but we will monitor its performance to determine if servicing is required.

f/9 Top Box

Two of the f/9 top box Type III cards were repaired and retested. The power wiring for the f/9 top box was redone to make it neater and to provide easier lightning shut down.

f/5 Instrumentation

Hectospec

The Hecto positioner was serviced in early August by Dan Fabricant, Joe Zajak, Mark Mueller, Bob Fata, John Roll, and Marc Lacasse. Tom Gauron provided much excellent remote support on electronics and systems questions.

Two gimbal actuators on robot 1 were replaced because of intermittent errors during moves and home sequences. The motion of the old units was also observed to be non-uniform during tests. Later inspection of the units revealed the lead screws were worn. The electronics levels were reset for the new units and they have behaved well so far.

Work on the robot 2 y-axis linear actuator/cable was paused as we could not repeat the previously observed lost encoder pulse error in multiple tests at this time. The servo will continue to operate from the redundant rotary encoder, and the linear encoder output will be monitored to diagnose the problem.

The positioner unit and the focal plane were carefully inspected and cleaned prior to wrapping the positioner in plastic for the chamber floor replacement.

The CfA crew wishes to thank the MMTO staff for their usual enthusiastic help, including Shawn Callahan, Dennis Smith, Ken Van Horn, Cory Knop, and Tom Gerl.

Two fiber interface cards in the SAO computers and their counterparts in the two Hecto camera electronics chassis were changed, and we await the completion of the chamber floor installation and the rerouting of the fiber optic cables to test them.

MAESTRO

The MAESTRO team successfully obtained first light with the echelle spectrograph on the night of July 29 during their first commissioning run at the MMT. Though the weather did not cooperate for most of the run, it did clear long enough to allow a few exposures of the star Vega to be taken on the last night before summer shutdown.

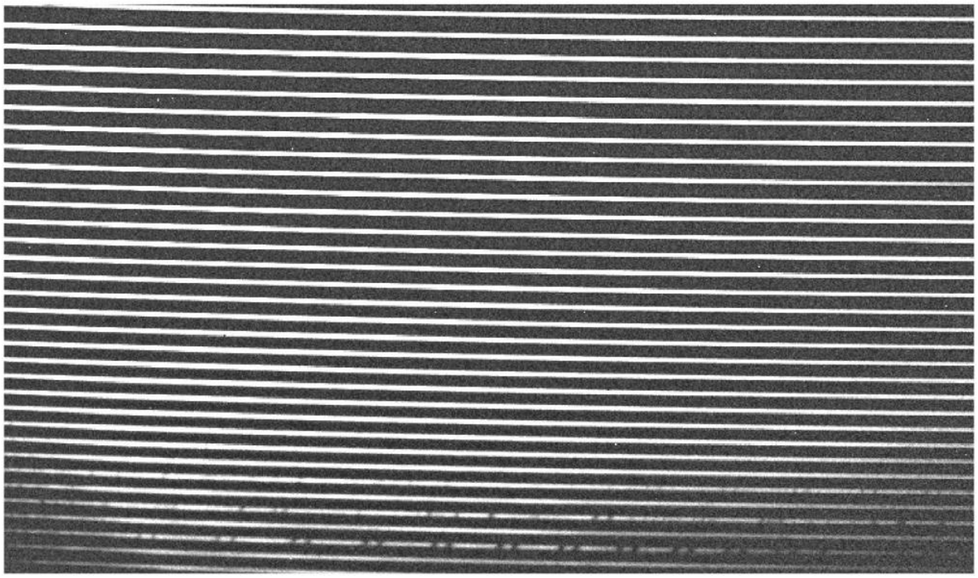

Figure 1: Part of the spectrum of Vega after a five minute exposure. The red orders are located at the bottom where some telluric absorption lines are visible.

Much effort was carried out by the MAESTRO instrument team and MMT staff to get the telescope and instrument ready. Though the spectrograph was neither fully finished nor ready to take science quality data, it was able to show "proof of concept," which was vital for the team during the July run. Positives to be taken out of the run include:

- Safe and efficient transport of the instrument back and forth from the Steward Observatory and the MMT with no thermal or physical shocks to the instrument. Due to temperature concerns, the instrument was moved at night using MMTO's air ride truck. Bill Stangret added anchor points in the truck for help in loading the instrument.

- Safe transfer of the instrument through the hatch into the chamber and mounting onto the telescope, with many lessons learned on how to make improvements to the instrument cart and counterweights to ease the procedure.

- Successful cabling of the instrument with all services (ethernet, AC power, dry air) from the telescope drive arcs. The dry air supply to the dewar window needs to be upgraded to offer a stronger supply, and an audio alarm is needed to indicate when the compressor has failed.

- Full integration of the MAESTRO control software into the summit computers was very successful, as was using IRAF/ICE to control the spectrograph's science CCD.

- The instrument guide camera functioned well and was easily controlled by the Lesser-Schmidt acquisition GUI. The guide camera was found to be misaligned to an extent that the center of the slit was not visible on the camera, which prevented our being able to accurately place a star on the slit.

- Many closed-dome engineering exposures were taken using both the on-instrument calibration lamps and the telescope's f/5 topbox lamps. Successful tests completed included focus of a Th-Ar spectrum, flat field and noise calibrations, scatter light measurements, and some flexure testing.

The MAESTRO team learned much about the instrument being able to operate at various gravity vectors for the first time. The July commissioning run identified a few areas that need re-work to make the instrument ready for science operation. These include: redesign of the grating mounting platform to increase stiffness and to allow the grating to be placed in the correct position in the optical path (currently not possible due to mechanical problems), realignment of the slit viewing guide camera for object acquisition, replacement of the shutter mechanism with a new system, improve functionality of a number of mechanical stages, manufacture the spectrograph's covers and external baffles to control scattered light, and improvement of the slit insertion assembly. All this work has been approved and is well underway in preparation for the next MAESTRO commissioning run November 26-29. MMTO students John Di Miceli, Jill Cooper, and Todd Jackson are assisting the MAESTRO team with design work for many of the above items.

Since so much work was required on the instrument before the next run, the decision was made to bring the spectrograph back to Steward rather than place it in a storage tent in the pit at the MMT. MAESTRO will be taking up permanent residency at the MMT after the coming November run, so all work on the storage area must be completed before the end of the run.

Documentation

We received our digitized drawings back from the Smithsonian Institution; they turned out great! We will continue to ship the MMT archive of drawings to Smithsonian, where they will be scanned and converted to digital copies. These digital copies will be located on SiteScape for easy access. If the originals are ever needed, they can be recovered from the Smithsonian archives.

LOTIS Aluminizing Project

We successfully coated a set of 57 test slides for the LOTIS project during the reporting period, with no problems of note with the vacuum system, power supplies, or the data-logging system. We did, however, need to take one welder offline due to a shorted filament circuit we discovered during the initial warm-up period on the filaments. Thanks to the redundant interleave of the filament sources and oversize circuit cables, we were able to coat in spite of this, as the system is designed to accommodate this failure mode.

For the first time, we were able to capture wonderful video images of our "glow discharge" cleaning process in the MMT belljar, thanks to the network camera we borrowed from the MMT chamber. In Figure 2 below, the image on the left shows a green glow that corresponds to pure Oxygen being introduced into the vacuum chamber. Energizing two electrode rings ionizes the Oxygen-rich molecule bombardment, generating a green glow. Adding Argon on the other hand creates a more purple glow, seen in the next image. The red features around the center are the result of the sun illuminating a red tent covering the belljar, and should be ignored.

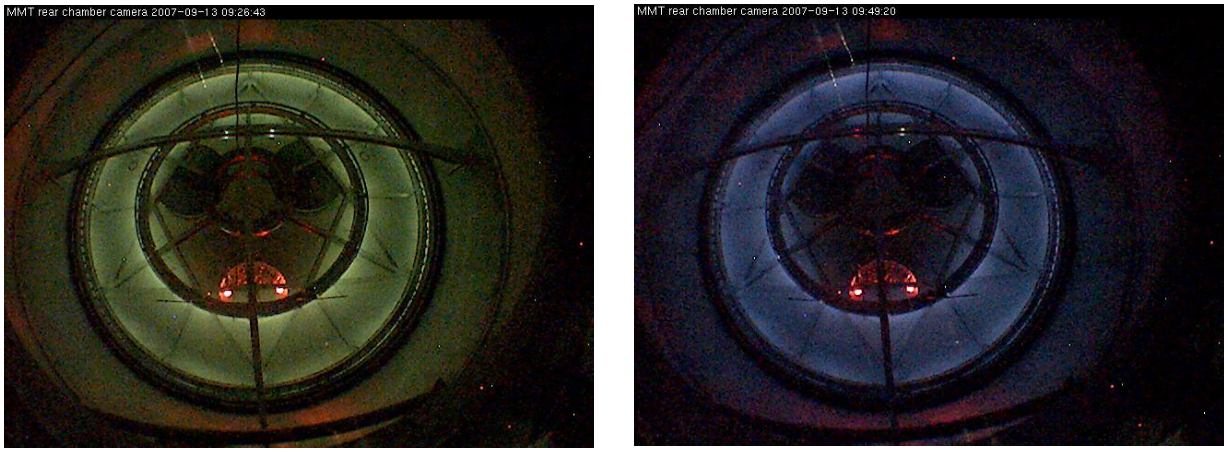

Figure 2: Oxygen rich (left) then Argon rich (right) gas glows in the 6.5-m coating chamber during the glow discharge (ion bombardment) cleaning phase, immediately before aluminum deposition.

Thin-film thickness monitors (STM-100/MF from Sycon) were used in two locations. One in the center of the mock 6.5-m mirror recorded a total aluminum deposition of 1.24 kAngstroms; the other at the mirror edge recorded a total of 1.17 kAngstroms. After physical thickness measurements, we discovered that our sensors need recalibration.

With the use of our Spectra RGA (Residual Gas Analyzer), we successfully monitored the trace gas changes inside the belljar through the pumping and coating process. We await the next shoot to confirm the timing of rapid changes in constituent gases at the start of and during aluminum deposition.

Glass cleanliness issues were a problem. Water residue and tissue marks were present on the majority of the samples, compromising adhesion and some of the peel-coat testing. Apparently, the final step of the LOTIS cleaning procedure was not completed before the samples were mounted in the MMT vacuum chamber.

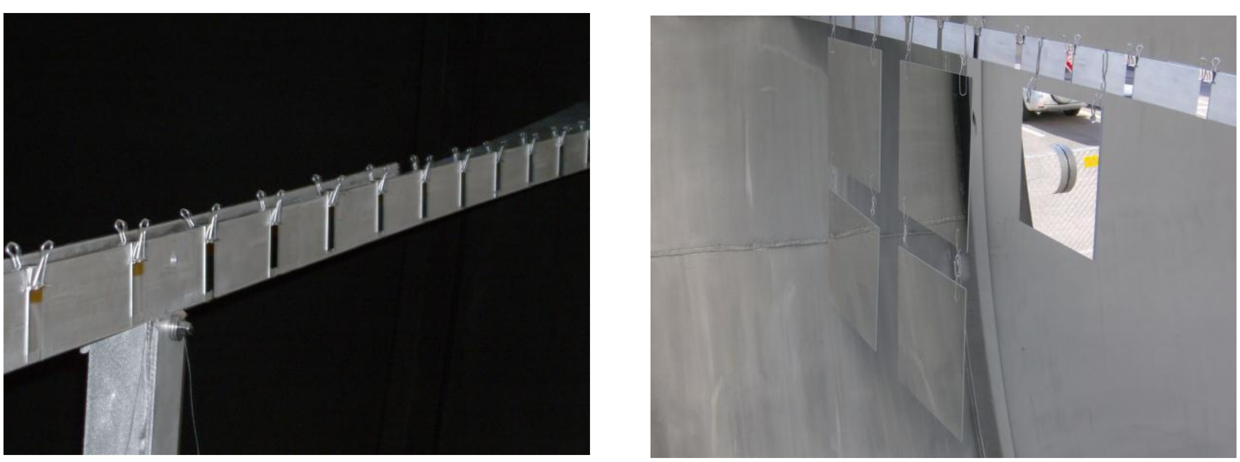

Figure 3: Forty-five microscope slides mounted on radial arms for measurement of aluminum thickness distribution (left). A Borofloat glass plate with 4” diameter dummy Hartman mirror (right).

Software is being developed in conjunction with the LOTIS project for primary mirror aluminization. Rate of aluminization deposition and pressures within the bell jar are obtained from an Agilent data acquisition unit. Voltages and currents from the bank of 10 welder power supplies are acquired through a PCI card that is mounted in the "aluminization" Windows PC. Data acquisition and visualization are handled through a set of new LabVIEW GUIs or "virtual instruments." Data logging is done by a Perl script that interacts with a MySQL database. Webcam images from inside the bell jar are available for display in a web browser and in the main LabVIEW GUI. Images are collected and stored to disk every second so that a movie can be constructed for the aluminization process. Engineering web pages have also been developed for remote monitoring of data collection.

General Facility

Chamber Floor Replacement

All f/9 and f/5 instruments located in the chamber and on the second floor were lowered into the pit for storage during installation of the new chamber floor. All instruments were covered in plastic. Hecto, the correctors, and the SAO electronics rack were not moved from the observing floor, but were covered for dust protection. The primary mirror was also covered.

To provide clearance for the new floor, Bill Stangret and Creighton Chute cut off the old building shutter steel bearing block pads. The MMT staff spent significant time removing the old floor from the chamber and both instrument labs on the second floor. The flooring contractors, TBR, began installation of the fiberglass subfloor.

Instrument Repair Facility

The Smithsonian Project Office asked M3 Engineering to redefine the concept of the instrument repair facility to meet our original construction budget.

Roof Repairs

The new roof is to be contracted by TBR. They will subcontract the fabrication of the membrane to a company called Rain-Tite.

Gaurd Rails

Sierrita Mining & Ranching was awarded a contract to repair the guardrails on the Mt. Hopkins Road and to add a new section near kilometer 4.5.

Weather and Environmental Monitoring

Work continued on the installation of a Vaisala WXT-510 weather station on the west side of the main building. The electronics were mounted in the metal enclosures at the bottom of the weather pole with a two port Lantronix being used for communication to the network. A fiber-to-fiber Ethernet setup provides lightning protection to the internal network. The final plan is to connect the

RM Young weather instrument to the second Lantronix port, which will allow wind information to be logged.

Other Facility Improvements and Repairs

Extra jacketing was added to the cable going from the Carrier into the RUPS room to help guard it against animals chewing on it. Cable strain reliefs for the rotator and the SAO baffle light source were also reinforced.

Extension cords, used to supply power to the drive arcs, were replaced with heavy-gauge jacketed cables with in-line Hubble connectors for quick lightning disconnects. Wiring on both drive arcs was sorted and reorganized; unused cables were removed, damaged cabling was replaced, and existing cabling was re-routed. A connector panel for the laser guide star (LGS) cabling is in development to be placed in the bottom of the existing Megacam/Hecto panel on the west drive arc. The TempTrax modules have all been removed from the drive arcs and relocated elsewhere to remove any contribution of heat and light to the chamber. Cory Knop relocated the TempTrax2 cabling into TempTrax3 control module, and removed the Temp-Trax2 from service.

The air cabinet design prototype project was put on hold, giving priority to completion of the ADS280 test tool. The purpose of the test tool is for function verification of the ADS280 converter when and/or if lightning should hit the MMT. The original test tool boards were determined to be faulty and therefore needed to be redesigned. The schematics were checked for errors and then the test board for the ADS280 was wire wrapped.

The loft Neslab hoses were serviced, and everything is working properly for the upcoming AO run. The filter was cleaned and rerouted to reduce strain in the fittings.

The lighting circuit for the east side of the yoke room was modified to move the fluorescent lamps onto the external switch.

Tom Gerl modified another of the network switches to leave the LEDs off unless a momentary switch is turned on, per Brian Comisso's instruction.

Dennis Smith and Bill Stangret replaced a leaking hydraulic cylinder on the Air Technical Industries instrument lift with a new unit. Bill is rebuilding the old cylinder using the manufacturer's repair kit so that we will have a spare. All the zerks on the lift were greased.

Dennis Smith and Bill Stangret removed the light lock on the chamber floor. They removed the walls after Tom Welsh (FLWO) and Tom Gerl relocated the fire alarm and light switches. There is still some finish work on the ceiling frame work. Now with the wall removed, a little more room is provided to raise and lower instruments through the hatch. Bill also installed a safety chain on the north end of the hatch since this is an area that people now access.

The Hydra-Set hand control cables were replaced. The Hydra-Set is used to lower or pump up instruments in small moves.

Bill Stangret serviced the blower coupling shaft assembly, and measured and documented the motor shaft so a spare could be purchased. He also replaced the damaged end plate at the telescope ventilation aftercooler. The ABS end plate had cracked and was replaced with steel. The damaged piece was found during shutdown testing and adjustment.

The instrument dry air and methanol cooling lines were extended on the west drive arc to follow the cable tray.

Multiple telephones have been repaired or spared out, and we now have three spare sets remaining.

The mount alignment telescope was completed and installed on the telescope. It has not been tested on the sky yet.

Visitors

July 5 and 7: Elizabeth Alvarez (Steward) accompanied *Arizona Daily Star* photographer Jeff Scott to the MMT to take photographs for a feature on UA astronomy being written by reporters Dan Sorensen and Eric Swedlund (see MMTO in the Media below). Unfortunately, inclement weather prevented any photography.

Publications

MMTO Internal Technical Memoranda

None

MMTO Technical Memoranda

None

MMTO Technical Reports

None

Scientific Publications

07-14 The Discovery of 1000 km s^{-1} Outflows in Massive Poststarburst Galaxies at $z = 0.6$
C. A. Tremonti, J. Moustakas, A. M. Diamond-Stanic
ApJ, **663**, L77

07-15 Terrestrial Zone Debris Disk Candidates in h and χ Persei
T. Currie, S. J. Kenyon, G. Rieke, Z. Balog, B. C. Bromley
ApJ, **663**, L105

07-16 The Local Galaxy 8 µm Luminosity Function
J.-S. Huang, M. L. N. Ashby, P. Barmby, M. Brodwin, M. J. I. Brown, N. Caldwell, R. J. Cool, P. Eisenhardt, D. Eisenstein, G. G. Fazio, E. Le Floc'h, P. Green, C. S. Kochanek, N. Lu, M. A. Pahre, D. Rigopoulou, J. L. Rosenberg, H. A. Smith, Z. Wang, C. N. A. Willmer, S. P. Willner
ApJ, **664**, 840

07-17 The Discovery of a Companion to the Lowest Mass White Dwarf
M. Kilic, W. R. Brown, C. Allende Prieto, M. H. Pinsonneault, S. J. Kenyon
ApJ, **664**, 1088

07-18 MMT Observations of New Extremely Metal-Poor Emission-Line Galaxies in the Sloan Digital Sky Survey
Y. I. Izotov, T. X. Thuan
ApJ, **665**, 1115

07-19 An Extremely Massive Dry Galaxy Merger in a Moderate Redshift Cluster
K. Rines, R. Finn, A. Vikhlinin
ApJ, **665**, L9

07-20 Stellar Velocity Dispersion of the Leo A Dwarf Galaxy
W. R. Brown, M. J. Geller, S. J. Kenyon, M. J. Kurtz
ApJ, **666**, 231

Non MMT Scientific Publications by MMT Staff

Highly Polarized Optically Selected BL Lacertae Objects
P. S. Smith, G. G. Williams, G. D. Schmidt, A. M. Diamond-Stanic, D. L .Means
ApJ, **663**, 118

SPITZER Observations of Low-Luminosity Isolated and Low Surface Brightness Galaxies
J. L. Hinz, M. J. Rieke, G. H. Rieke, C. N. A. Willmer, K. Misselt, C. W. Engelbracht, M. Blaylock, T. E. Pickering
ApJ, **663**, 895

Exploring the Asteroid Belt with Ion Propulsion: Dawn Mission History, Status and Plans
C. T. Russell et al., F. Vilas
Advances in Space Research, **40**, 193

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

The *Arizona Daily Star* featured an in-depth profile of UA astronomy. Stories ran over three days at the end of July, and are posted at *http://www.azstarnet.com/special/spaceu*.

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:

- What's New at MMTO.
- General information about the MMT and Mt. Hopkins.
- Telescope schedule.
- User documentation, including instrument manuals, detector specifications, and observer's almanac.
- Scientific and technical publications
- A photo gallery of the Conversion Project as well as specifications related to the Conversion.
- Information for visiting astronomers, including maps to the site.
- 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.

And beginning June 2005, a new category, environment, was added to account for time lost to natural, uncontrollable, non-weather events such as flying insects melting in laser beams and forest fires.

Use of MMT Scientific Observing Time

July 1 - 30, 2007

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	*Lost to Telescope	Lost to Gen'l Facility	Lost to Environment	Total Lost
MMT SG	4.00	31.60	26.20	0.00	0.00	0.00	0.00	26.20
PI Instr	23.00	183.50	124.90	1.50	0.25	0.00	0.00	126.65
Engr	3.00	24.60	16.40	0.00	0.00	0.00	0.00	16.40
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**30.00**	**239.70**	**167.50**	**1.50**	**0.25**	**0.00**	**0.00**	**169.25**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	89.7
Percentage of time scheduled for engineering	10.3
Percentage of time scheduled for secondary change	0.0
Percentage of time lost to weather	69.9
Percentage of time lost to instrument	0.6
Percentage of time lost to telescope	0.1
Percentage of time lost to general facility	0.0
Percentage of time lost to environment	0.0
Percentage of time lost	70.6

* Breakdown of hours lost to telescope
  wavefront sensor computer 0.25

Year to Date July 30, 2007

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	Lost to Telescope	Lost to Gen'l Facility	Lost to Environment	Total Lost
MMT SG	45.00	429.60	162.90	0.00	4.35	0.00	2.50	169.75
PI Instr	155.00	1462.25	499.80	22.90	8.05	2.00	2.00	534.75
Engr	11.00	108.75	41.85	0.00	0.00	0.00	0.00	41.85
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**211.00**	**2000.60**	**704.55**	**22.90**	**12.40**	**2.00**	**4.50**	**746.35**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	94.6
Percentage of time scheduled for engineering	5.4
Percentage of time scheduled for secondary change	0.0
Percentage of time lost to weather	35.2
Percentage of time lost to instrument	1.1
Percentage of time lost to telescope	0.6
Percentage of time lost to general facility	0.1
Percentage of time lost to environment	0.2
Percentage of time lost	37.3