

End of Trimester Summary

September - December 2012



MMT Staff from left: M. Guengerich, D. Porter, G. Williams, D. Smith, J. Di Miceli, R. Ortiz, T. Trebisky, B. Russ, D. Clark, E. Martin, T. Gerl, C. Chang, D. Gibson, T. Oldham, M. Lacasse, B. Kunk, J. Hinz, M. Alegria, D. Gerber, K. Powell, B. Comisso.
(*Missing:* R. Cool, S. Gottilla, C. Knop, A. Milone, S. Schaller, J.T. Williams, X. Zhu, graduate research assistant.)

Personnel

Richard Cool was hired as an Assistant Staff Scientist and started on September 3.

John McAfee retired on October 3 after 30 years as a Telescope Operator, Sr. for the MMTO.

The annual staff meeting and photo took place at the summit on November 14. Lunch was provided, followed by the "State of the MMTO" address by Director G. Williams.

Talks and Conferences

G. Williams gave a guest lecture on polarimetry to a graduate level instrumentation class on October 25.

G. Williams gave a presentation entitled "MMT Observatory Status Update" at the Steward Observatory Observer's Lunch at on October 30.

J. Hinz gave an update on the status of the MMTO for the Whipple Observatory Volunteers Appreciation Lunch held in Green Valley on December 12.

J. Hinz attended a KINGFISH Team Meeting in Florence, Italy on October 15-19 to discuss results of observations of nearby galaxies with the Herschel Space Observatory.

Primary Mirror Systems

Telescope Air Systems

A technician from Arizona Pneumatic Systems troubleshot the low sump pressure error on one of the Gardner Denver compressors. A new solenoid was installed.

On December 28, after a series of very cold and humid days, the primary mirror failed to raise because of water contamination in the dry air system. The water froze preventing air flow to the primary mirror support actuators. The water was purged from the clean air supply line using heaters and dry nitrogen gas cylinders. Several actuators were subsequently removed from the cell for inspection. The air transducers for these actuators were all dry, but some showed evidence of past water contamination. A new clean air supply line for the primary mirror was purchased and installed. The old line will remain in place as a backup. In an attempt to avoid this type of contamination in the future, an additional air dryer has been ordered and will be installed between the compressor and the main dryer. The telescope operators will also avoid raising the primary during high humidity conditions when observing is not otherwise possible.

Primary Mirror Support

At the end of December, some actuators began randomly failing bump tests. Mountain staff replaced several actuator cards with spare cards. The replaced cards were brought to the campus electronic shop for inspection and testing. All cards were tested on the bench and determined to be

operational. It is unclear whether the water contamination impacted the performance of those actuators.

Optics

The primary mirror was CO₂ cleaned on September 14.

Thermal System

In anticipation of the eventual replacement of several old TempTrax units with a wireless digital I/O interface using a Roving Networks WiFi RN-XV module, we studied the thermistor probes used with the TempTrax units. A sample thermistor was placed under varying temperature conditions using a Peltier cooler; five different temperatures (-10, 0, 10, 21, and 25 C°, converted to Kelvin) were used. Once completed, calculations were done to obtain the A, B, C Steinhart-Hart coefficients necessary to accurately identify the thermistor temperature measurements. This will enable buying off-the-shelf replacement thermistors, which are much cheaper than purchasing them from TempTrax, as they continue to keep thermistor data proprietary. Note also that TempTrax units are no longer manufactured.

Work has been temporarily suspended on the installation of the final two T-series thermocouple electronics enclosures while noise levels in the electronics are being evaluated.

Data-mining efforts are continuing to compare the performance of the T-series thermocouples to the E-series currently used to drive the ventilation system set points. Preliminary studies indicate relatively high levels of noise in the T-series data. Data logging for the existing T-series electronics is continuing.

Aluminizing

Dallan Porter, Ricardo Ortiz, John Di Miceli, and Dusty Clark visited the Kitt Peak National Observatory on November 15 to learn more about their two coating chambers.

Ongoing aluminization testing at the Sunnyside testing facility required the preparation of some test filaments. Thirty-five filaments were loaded using our historical wrapping method with 1g of aluminum wire. More filaments will be prepared as needed.

A project was initiated to replace the slow and non-coherent aluminization data sampling from the HP data acquisition unit (DAU) located in the aluminization display/control cabinet. We designed a new interface that uses another PCI data acquisition board similar to the type used for getting the welder supply data in the newly rebuilt aluminization PC, along with a small PC board that galvanically isolates the acquisition signals. This will keep the system grounds and signal integrity from having crosstalk and pickup issues.

Three small isolation cards were manufactured to evaluate the new design. After evaluation, one card was re-spun with modifications to component footprints and connector style for ease of maintenance, and is now being assembled into a chassis. Chassis fabrication was started, with the installation of connectors and wiring.

A new 10X buffer card for the temperature displays on the Aluminization Monitor Cabinet has been populated and calibrated. This card has been tested and is ready for implementation during the upcoming aluminization run.

With the new aluminization PC, software changes, and the new data acquisition hardware, we expect to be able to collect fast, fully coherent samples of all the relevant data during the upcoming primary mirror coating.

Secondary Mirror Systems

f/9-f/15 Hexapod

A service request was opened stating that the f/9 hexapod pod E position error appeared to increase while tracking. Review of the data indicated the issue was impacting several pods for both hexapods. Armed with a plethora of data and charts indicating that pod E was slipping, testing was initiated. The telescope was slewed to 15 degrees, and the hexapod was zeroed out and set to a Z position of 10000. Synching offsets was disabled. The hexapod was powered up and monitored. No error was noted on any pod. Synching was then turned on. With each sync there was an error of up to 6 microns in pod E. The brake relay on the hexapod controller analog card was swapped with the pod B relay. The same testing was initiated with pod B and it then showed the same error. Both relays were replaced, and testing showed less than 0.6 microns error. The relays we are using have a limited lifespan and have been in the system for over 10 years. New relays were installed, and the system was tested and found to be operational. New spare relays were ordered and put into the spares inventory.

A service request was opened stating pod C in the f/9 hexapod did not respond to commands. It was found that pod C would move in one direction but not the other. Numerous tests and restarts did not fix the problem. The f/5 hexapod was connected to the test harness and the hexapod controller in order to determine if the cabling or the controller was bad. The system worked, so the problem was determined to be in the wiring. The f/9 hexapod was then connected to the test harness; pod C worked. Each cable was then swapped with the real cables to isolate the problem to a specific cable. The bad cable was the J308 cable. The test cable was run up the OSS and connected to the hexapod connector J308. Tests showed all pods worked. A new flat ribbon cable was installed, and the service report was cleared.

Another service report was opened for the f/9 hexapod stating that it was not responding properly, causing a red alert from the annunciator. The hexapod would move but did not display any transducer values to indicate the movement. Troubleshooting found that the power supply for the transducers had failed. Additionally, the UMAC ACC-28E analog to digital card had a red fault light. Both the power supply and the ACC-28E were swapped with spare units. To upgrade the system, the power supplies for the transducers were upgraded to DIN rail-mounted supplies that can be easily swapped. The input/output wiring was also streamlined, removing excessive cables from the area. Spare power supplies were also ordered and added to the spares inventory. The failed ACC-28E was sent back to Delta Tau for repair.

Again, f/9 required maintenance when a transducer signal conditioner unit failed. The pod D transducer signal conditioner zero point was found 5.7 mm away from true mechanical zero. A spare unit was piggy-backed onto the bad unit and connected. When the secondary was removed, the inoperative unit was removed and the new one installed. All transducer signal conditioner units were realigned to mechanical and electrical zero. We will add adhesive rulers to the f/9 hexapod struts to make visual confirmation of the actual position easier to compare to the electronic one.

Due to the poor time and temperature drift performance of the existing signal conditioner circuits, a new one using digitally-adjusted zero and span pots and low-drift, low-offset components was designed, and the preliminary circuit board layout completed. We expect to repackage this new board into a slightly larger enclosure for direct replacement of the existing hardware. We are also looking into a redundant or replacement transducer, since the Honeywell units currently used are quite expensive and not completely parallel to the pod axis, giving an apparent scale error at the ends of the travel.

We have begun to monitor the elevation-dependent corrections (elcoll) to the hexapod position and rotation in order to understand any changes over time in the correction terms for the f/9 and f/5 secondary mirrors. With a perfect system, one would expect the gravitational translation in the x direction and tilt along the y-axis to be zero as the telescope moves in elevation. In early elcoll data (from 2003-2005), the corrections in these directions were very small. After fall of 2005, however, we find significant power in these terms. The current hexapod system allows us to measure and correct these terms, so the increased correction strengths in these terms do not degrade observing performance.

The strong change in the elcoll behavior seems to have happened around the same time as when the spider arms were damaged in 2005. It's possible that the damage to the spider arms has introduced slight movement modes in the hexapod as a function of elevation in the x translation and y rotation terms. Another possibility is that the neutral members are providing slightly non-neutral forces on the hexapod, which are then being corrected by these new more powerful elcoll terms. In order to understand the stability of the system, we have used M&E time to make elcoll measurements as other engineering activities allowed.

f/15 Secondary

Several f/15 adaptive optics (AO) actuators were brought to the campus electronic shop for testing. A testing procedure was drawn up, and each actuator was put on the actuator test-stand to develop a pattern (seen in the response) of the actuator to determine whether they are functioning properly. Testing continues on the actuators, with results to be analyzed after conclusion of tests. We will repair any actuators deemed repairable and return them to the AO spares.

Detailed design of the new deformable mirror (DM) power supply chassis continued. A series of small interface boards were necessary within the chassis to support remote sensing, front-panel access for voltage adjustments, smart-card I/O, and display of the voltage and supply output currents. We now have in hand enough parts, except for the interface boards, to begin mechanical layout and construction of the first supply chassis. The complete supply will have 3 1U-height (1.75") chassis for the power supplies and smart card. This design will make swapping or servicing the supplies much easier than with the currently existing bulky supply enclosure.

The final interface board layouts were completed for the supplies and will be released for manufacture. We also expect to complete the detail design for the smart card chassis soon.

Telescope Tracking and Pointing

Servos

Development of an upgraded version of the elevation controller continues. There have been issues with the low-frequency response in the rigid-body telescope model that have slowed things down in the sense that the model has much larger gain below approximately 0.5Hz than measured on the telescope. This behavior needs to be clearly understood before moving forward; lower than expected hardware acceleration has consequences later in the form of a) lower practical gains in the control loop, and b) a lower limit on ultimate disturbance rejection.

In order to more closely unify the efforts of servo design and validation, work was done to make 64-bit Matlab work properly under a Fedora virtual machine (VM). The automated tools are available in a semi-deprecated 32-bit version that is now outdated in the Mathworks Linux releases, but do not work correctly under 64-bit Matlab when using a vanilla Fedora installation. This problem is mostly due to the Java Virtual Machine (JVM) shipped with Fedora: Matlab depends on the Sun JVM, while Fedora uses the open-source OpenJDK.

To make automatic target generation and validation of the control design possible, a used Shuttle box was re-constructed with a RT-Linux patched Fedora installation using the Planet CCRMA RPM packages (a system for sound and video production and distribution). We will report more on this effort in the next reporting period as work continues.

The existing blocks of the Matlab Simulink elevation servo model have been converted to hand-coded C. Using Simulink, nearly all Simulink blocks and equivalent C code in the current model have been tested and validated.

Computers and Software

Operating System (OS) Updates

The MMTO website was updated to the current version of Drupal.

At the beginning of this reporting period, the backup host for the virtualized “hacksaw” was configured, and backup procedures were instituted. This now completes the hacksaw recovery plan; it is no longer a possible single point of failure. If it fails during the night, we can quickly restore service on the backup. This was a major task and accomplishment. For details, refer to the May-August Trimester Summary, pp. 11-15.

The rest of this period was spent working on ccdacq, the data acquisition software for the Blue and Red Channel spectrographs. First, ccdacq was made to work with the latest version of the Image

Reduction and Analysis Facility (IRAF). Then it was modified to be able to cross-compile a working 32-bit version on a 64-bit platform. This was a major milestone - we no longer need to maintain a 32-bit Fedora computer just to make changes in ccdacq. Next, a native 64-bit version was developed and tested. This will make porting to other platforms easier. Lengthy testing was done with both Blue and Red Channel spectrographs to ensure that everything worked as expected. Finally, a new packaging and deployment scheme was designed. Everything is ready to be installed and tested at night on mountain computers during the next reporting period.

Operator Paddle

In preparation for the retirement of the telescope operator's old "hoseclamp" desktop PC, a new operator paddle was developed to replace the parallel port paddle. The new operator paddle is network-based and requires no host PC. It contains an Arduino Ethernet controller with an integrated Power over Ethernet (PoE) module so it only requires a single Ethernet input. Arduino was used because it has a versatile electronic prototyping platform and open source code. The handheld paddle portion is a highly modified Kensington PowerPoint laser pointer with a transplanted Sparkfun 4-button keypad. Code was completed to allow the up, down, left, and right controls to function correctly. D. Porter and D. Gerber collaborated on the software and hardware to create the new paddle. It has been deployed with general success, although a few minor issues arose. Work continues on improving its reliability.

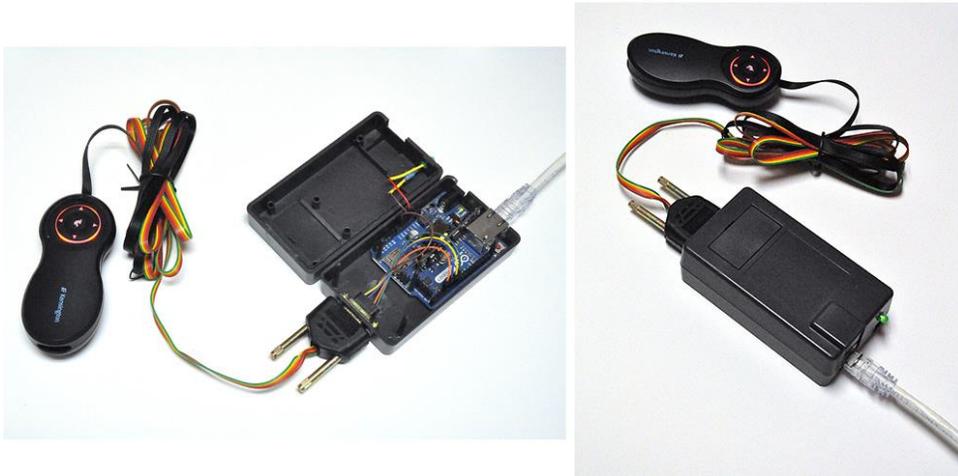


Figure 1. New telescope operator paddle.

Adaptive Optics (AO) software support

The RAID array failed on the ao-pcr computer. V. Vaitheeswaran and the MMT software group restored the computer's operating system and adaptive optics software from backup archives.

Work was initiated by MMTO to obtain and configure a new "production-level" ao-pcr computer for the adaptive f/15 secondary. This computer would allow the current ao-pcr computer to be dedicated to software development. The technical requirements for a new ao-pcr computer are currently being compiled. The second computer would also serve as a spare for the current ao-pcr.

Related to a “production-level” ao-pcr is overall AO software management and revision control. Work has begun on identifying what software is required for natural guide star (NGS) AO operations, and placing this software under software version control. As new code is developed, software changes will be merged into the production branch of the software in a manner that allows sufficient testing of the new code.

Additional work is underway on AO telemetry data management and archival. AO telemetry produces the most data of any of the MMT’s configurations. Data are transferred from the AO server computers to external USB drives after each run. Organizing and archiving this data will continue into the next trimester.

A portion of the AO documentation was migrated to the Documentation database.

Wavefront Sensing (WFS) software

T. Trebisky made changes to the cell software in late September to include additional logging related to partial application of measured WFS corrections. The code is in place for partial corrections, but testing has not yet been completed.

Work has continued on the f/5 WFS GUIs and has included making changes to accommodate the new science camera (a new Apogee using a USB interface). This is, in part, a learning curve with the collection of GUIs written by T. Pickering in Ruby/Glade, and by J. Roll in Tcl. Modifying the Ruby/Glade GUIs involves converting from the old Glade format to the new GTK/builder format. A script automates most of this. Callback routines in the Ruby code then require names and API changes to be made. Most of the GUIs have been converted. Finishing the remainder should be straightforward, after having learned with the first few.

Work continues on investigating and implementing improvements in the efficiency of wavefront sensing, although specific improvements have not been identified. Work proceeds in at least two areas: 1) improved spot recognition under marginal observing conditions, and 2) comparison of the seeing to continued WFS efforts under marginal seeing conditions.

Mobile website

Work was started on developing a mobile website (<http://m.mmt.org>) for staff use. It is currently not yet ready for general use. The programming approach tentatively adopted uses Twitter’s Bootstrap CSS approach, which is responsive to the size of the display: mobile, laptop, or desktop.

New telstat displays – control room computers

Extensive work was done on creating a framework for the new telescope status (telstat) displays. A new web page has been created that users can configure as desired. Approximately 50 new widgets, each of which can be viewed as a separate web page, have been created. Many of these widgets are using new web technologies, such as scalable vector graphics (SVG) charts. Users can save their displays as “profiles” for later retrieval. Standard profiles have been created for the telescope operators and observers. Profiles have also been created for specific conditions, such as high wind

or high dewpoint/relative humidity. Some telstat displays for individual observers have also been created.

Memory leaks in the new telstat display web pages were addressed. These were related to the manner in which images and SVG charts were being updated. Software changes were made on all affected files and, to the best of our knowledge, there are no longer memory leaks in the new telstat widgets.

Checkboxes were added to all SVG-chart based telstat widgets to show or hide the legend. This allows the charts to be displayed in a smaller desktop area for users that are familiar with the charts.

Critical Software Under Version Control

A /mmt/repos/ directory was set up on “hacksaw,” using the network file system (NFS) mounted network attached storage (NAS) devices (nas1, nas2, and nas3) for the /mmt directory. No limitation was made on the version software, (e.g., git, svn), although git is preferred for new projects. New or existing repositories include: cell.cvs, mount.svn, mount.git, shwfs.git, engineering.git, and telstat-new.git.

Miscellaneous software tasks

- The software group addressed timing issues related to soguider software, specifically related to taking short (<2 seconds) images in rapid succession. This issue may be related to slightly longer latency of the Network Filing System (NFS)-mounted /mmt directory on network-attached storage (nas) 1 as opposed to the RAID array on the former “hacksaw” server.
- “Hoseclamp,” a telescope operator PC, has been replaced with a new Dell 27-inch all-in-one, named “pipewrench.” Several weeks were spent testing “pipewrench” before final deployment in the control room.
- The old “hoseclamp” was moved to the Common Building library for use there, including during AO runs or during adverse weather conditions that require leaving the summit. It will be maintained if it continues to be used in the future.
- The f/9-f/15 hexapod required replacement of cables related to faulty transducer values. Visual calibration of the transducers and testing of software was done after cable replacement.
- Improvements were made to the annunciator system, including new sound alerts for warning and error level alerts. In addition, the annunciator’s warning level for the AO system’s TSS total current has been set to 29.5 amps (previously 30 amps), and the error level for TSS total current set to 28.5 amps (previously 30 amps).
- Windows documents under the /electronics and /mechanical directories on the campus Windows 2003 server, “vault,” were moved to the campus NAS device, nas3. This was required because of lack of disk space on the existing “vault” computer.

- Software support was provided to the MMTPol group in porting their network devices and control/GUI software from the Mac OS X platform to a Linux platform to be run on the Linux-based MMT observer's computers, "alewife" and "homer."
- Software support was provided within SPOL software for correct formatting of airmass values obtained from the MMT telescope control system (TCS) telemetry, specifically to the "telstat.cl" script.
- Analysis of e-series thermocouple data showed systematic colder temperatures in the NE quadrant of the primary mirror during early September, specifically around thermocouple #16 (SR #942). Visual inspection of the ventilation system showed kinked tubing and an improperly centered ejector nozzle. These particular conditions were corrected. The NE quadrant of the primary mirror appears to remain consistently colder than the other quadrants. Additional work is needed to evaluate what further remedial action is needed.
- Additional work was done by the software group to improve the reliability of movies from the Skycam system. Additional work in this area is planned for FY14.
- Much debugging of the f/5-f/9 hexapods showed that Pod E was showing abnormal behavior during tracking in early October (SR#978). This work resulted in replacing all relays in the hexapod controller analog card with new relays. The system has behaved correctly since.
- A Samsung 40" class HDMI television was purchased for the campus MMT conference room, similar to the two Samsung televisions recently purchased as telstat monitors. The television, a new Mac mini named "pluto," and a moveable stand have been installed in the conference room. This setup is used daily for teleconferencing between the campus office and the summit for 11:30AM "tagup" meetings. It is also used for other MMT teleconferencing requirements.
- In anticipation of upgrade of the Linux control room computers to more current hardware, a compilation of GUIs required for MMT operations was made. This listing was used to test the "hoseclamp" replacement, "pipewrench." This document has been added to the Documentation database.
- The orange loop air pressure "send" failed within the primary mirror cell in late December. An incorrect value had prevented the cell crate from booting.
- Signal conditioner for the f/9 hexapod Pod D was swapped with a spare (12-31-12). The Pod E transducer also showed erroneous readings during this period (SR #995). All of the signal conditions for the hexapod may need to be re-zeroed and rescaled.
- A script issue with the difference between Universal Time and Coordinated Universal Time was resolved by completely rewriting it to be more robust. The script now parses the information from the Naval Observatory web site (IERS bulletin) in a more robust manner and with additional sanity checks.

Summary of Service Request (SR) Activity

The MMT Service Request (SR) system is an online tool to track ongoing issues that arise primarily during telescope operations, although the system can be used throughout the day and night by the entire staff. Once an SR has been created, one or more responses are created by staff members to

address and, eventually, to close the SR. These SRs and associated responses are logged into a relational database for later reference.

Figure 2 presents the distribution of responses by priority during the period of September through December 2012. As seen in the figure, the highest percentage (49%) of responses were “Important” priority, 20% were “Low” priority, while 16% of the responses were “Critical” priority. The remaining are “Information Only” (10%) or “Near-Critical” (4%). “Critical” SRs address issues that are preventing telescope operation, while “Near-Critical” SRs relate to concerns that pose an imminent threat to continued telescope operation. There were a total of 118 responses during this four-month period. This number averages approximately one response per day by the MMT staff during the period, including weekends.

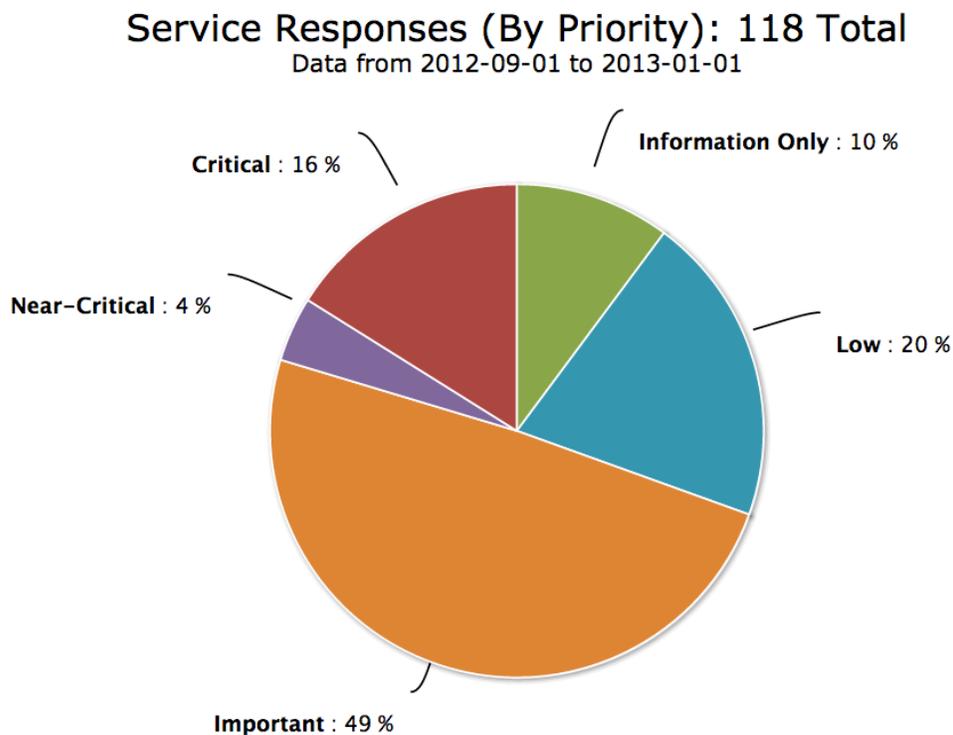


Figure 2. Service Request responses by Priority, September through December 2012. The majority (49%) of the responses are related to SRs of “Important” priority, while “Low” and “Critical” priority responses are 20% and 16%, respectively, of all responses.

Figure 3 presents the same 118 responses grouped by category. These categories are further divided into subcategories for more detailed tracking of issues. The majority of the responses from September through December 2012 were related to the “Building” (*i.e.*, the MMT telescope enclosure) and “Telescope” categories. Many of the “Weather Systems” responses were directly related to winter storms. An approximately equal number of responses occurred for “Cell,” “Computers/Network,” “Software,” and “Support Building” which includes the Instrument Repair Facility (IRF) and adjacent equipment.

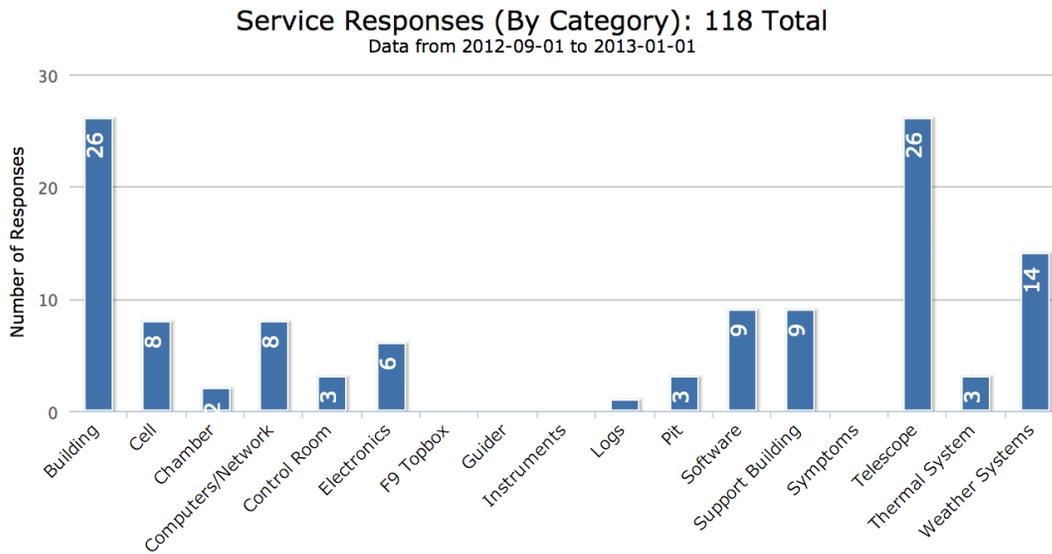


Figure 3. Service Request responses by category, September through December 2012. The majority of responses were within the “Building” and “Telescope” categories.

Several SRs were created during this reporting period that merited a “Critical” priority:

- (SR #963, under “Building” > “Quiet Power”) A burnt electrical smell was reported on the third floor of the MMT building on 09-04-12. Further investigation revealed that the bus bar connection in the Q3 power panel was glowing red hot. A new panel was installed. This SR is closed.
- (SR #966, under “Telescope” > “f/9-f/15 Hexapod”) Pod C of the f/9-f/15 hexapod failed to respond to commands on 09-08-12. The cable that connects the hexapod UMAC controller to the hexapod electronics was found to be bad. A new cable was fabricated and installed. This SR is closed.
- (SR #974, under “Telescope” > “f/15 Secondary”) The f/15 adaptive optics (AO) deformable mirror power supply was found to have a drifting VCCA voltage on 09-27-12, preventing its operation. The defective power supply was replaced with an on-site spare and adjusted to the proper output voltages. This SR is closed.
- (SR #986, under “Pit” > “Building Wheels”) On 11-26-12, the northeast (NE) building wheel began to make a loud noise in its upper section within the wheel housing. The copper grounding brush that rides on top of this wheel was vibrating and making excessive noise. The brush assembly was removed, thoroughly cleaned, and re-installed. The SR was closed.
- (SR #990, under “Software” > “Mount/Mount Crate”) At the beginning of the night of 11-12-12, the telescope operator was unable to point the telescope correctly. It was found that the local sidereal time (LST) in the mount computer was off by approximately 13 hours. A script that obtains the DUT (Universal Time correction) from the Naval Observatory had obtained an

erroneous value. The script has been entirely rewritten with additional checks for valid DUT values. The SR is closed.

- (SR #991, under “Computers and Network” > “Network”) Around noon on 12-13-12, the University of Arizona Information Technology Services (UTIS) group mistakenly re-assigned the Cisco network switch interface for our campus office server, mmto.org, to the Steward Observatory subnets. This made connection impossible to and from the MMT and prevented user login on various computers (via LDAP authentication) within the MMT. This issue was resolved by mid-afternoon of the same day, and the SR is closed. No telescope observing time was lost.
- (SR #998, under “Cell”) Contamination was found within the clean air system of the primary mirror support system. The primary mirror could not be raised on 12-29-12 as the cell loops were unable to be properly pressured. A large effort began immediately to clean actuators and to improve the quality of the clean air system. Actuators will be scheduled for servicing and testing during the first half of 2013. This SR remains open into 2013.

Three “Near-Critical” SRs were responded to during the same reporting period:

- (SR #937, under “Support/Shop Building”) Two Gardner-Denver air compressors are located behind the Support building at the MMT. On 11-29-12, an existing SR (SR #937) was reopened regarding these compressors. Error messages related to “high reservoir pressure” and “low sump pressure” occurred on the two compressors. New parts were ordered. (The SR was closed in early January 2013, after the new parts arrived and were installed.)
- (SR #992, under “Building” > Undefined/Other) The front-door keypad to the MMT building had completely frozen and become covered with ice from a winter storm on 12-14-12. The telescope operator was unable to access the MMT. Heated water was used to thaw the keypad. Modifications are proposed for the keypad. This SR is closed.
- (SR #995, under “Telescope” > “f/9-f/15 Hexapod”) On 12-21-12, the Pod D transducer for the f/9-f/15 hexapod was reporting a position about 5.7 mm away from the true mechanical zero for the transducer zero position. In addition, this transducer was reporting larger displacements than the associated incremental encoder by a factor of around 4. A spare transducer signal conditioner was installed on the hexapod. (This SR was closed in January 2013.)

Instruments

f/15 Instrumentation

Natural Guide Star (NGS)

During two nights of f/15 engineering time in early September, rain and high humidity prevented the telescope from opening and conducting a full end-to-end test of the NGS-AO system. However, significant testing was still performed and much was learned about the behavior of the

system. The deformable mirror (DM) was tested thoroughly during the two-night run. The replaced digital signal processor (DSP) electronics boards performed with no issues. In addition, the thin shell safety (TSS) system worked well and is back to running at the nominal 32 amp current, indicating all coil drivers are operating normally. Prior to the science run, the cooling line connectors were replaced, and a leak test was conducted to ensure there would be no liquid contamination in the DM.

Work continues on commissioning new instrumentation related to the AO secondary system, particularly MMTPol. Figure 4 shows a portion of the MMTPol research group from the University of Minnesota working in the chamber during its September observing run at the MMT.



Figure 4. Dinesh Shenoy (right), Enrique López Rodríguez (center), and David Kasper (left) from the University of Minnesota during an AO/MMTPol observing run at the MMT in late September.

In general, the NGS-AO system performed quite well. MMTPol was used for three nights, and the ARIES spectrograph and imager were used for six nights in late September and early October. Although the weather was not particularly good, MMTPol was able to work out a number of issues with their software, and also obtain good science data.

During the ARIES portion of the run and under good seeing conditions ($\sim 0.6''$), we were able to acquire and track targets with magnitude $V \sim 15.2$ (Kepler) and could have gone fainter if required. Most of the time was spent collecting data on targets between 13.5 and 14.5 magnitude. Throughout the run both the DM and closed loop operation were very stable. For two consecutive nights the loop was opened on only three occasions throughout each night. During the last night of the run we observed 29 targets in a half night.

Throughout the nine-night run, approximately five hours total were lost due to problems with the AO system. Three hours were lost due to problems with the power supply voltage. Another hour was lost due to WFS camera and PCR issues as well as network issues that occurred during the same time, and one hour was lost due to miscellaneous factors.

Another nine-night NGS-ARIES AO run was conducted December 21-29. In general, the DM and power supply performed well throughout the run and good science data were obtained when we were able to get on-sky. Approximately 2.5 nights were lost to weather. Another combined night (two half-nights) was lost due to pointing and alignment issues with the f/9-f/15 hexapod. Two different transducers were eventually replaced on pods D and E on the hexapod. Once hexapod pointing was no longer an issue, we observed a variety of targets from magnitude $V=4$ to $V=15$, and from 550 Hz to 50 Hz, with the system performing quite well.

Some camera noise issues were seen in the lower right quadrant of the WFS camera. These issues were investigated on the first night and did not cause any problems throughout the remainder of the run. One issue of contamination in the mirror gap occurred at the beginning of the fifth night. The AO operator performed the standard “push and wiggle” exercise and was eventually able to get the DM back to an operable condition. The contamination caused approximately 2.5 hours of lost time. Issues with the WFS camera syncing with the PCR continued to be a problem and are being investigated.

The final two nights of this science run were lost due to water contamination in the primary mirror support system. Although the water contamination was drained from the cell actuators, it was unclear whether it was safe to operate the telescope, so the decision was made to cancel the last five nights of the run (two science, three engineering) and allow the mirror support system to be cleared out.

AO remaining issues

There are several issues that need to be addressed:

- The power supply for VCCA needs adjustment. Although the new power supply cable helps, adjustment is still needed. Approximately three hours were lost due to this issue during the nine-day September-October run. This was the most significant loss of time throughout the run.
- The communications error between PCR and WFS camera needs to be understood and solved. This problem seemed to occur most frequently when the WFS camera and PCR were run at 550 Hz. Although the WFS camera can be reset to an operating state through some manipulation of the AO GUI, it takes some time to complete, and resulted in the second greatest loss of observing time.
- A software issue still exists of a possible bogus mirror gap of 239 microns, which can prevent operation of the DM. Although we did not see this issue during the engineering nights, it can still occur. The cause of the software issue is currently unknown.
- The DM still suffers some reliability issues with the voice coil actuator capacitive sensors when the humidity is high. This problem needs investigation, as well as ways to keep the DM dry during periods of high humidity.

AO Webpage Updates for Observers

New ARIES log sheets were generated for use by observers. The ARIES wiki underwent several updates, including the creation of a “Publications” section and an “Observing Software” page with screenshots of current software GUIs. Details on preparing for an AO run were updated on the “Observing Notes” webpage, including overhead estimates, off-axis corrections, and guides to observing during increased wind-speeds.

f/9 Instrumentation

Blue Channel and Red Channel Spectrographs

Using the large quantity of data stored over time as a backup of the “alewife” observing computer, we have been measuring the throughput of Red and Blue Channel spectrographs over the last five years. These throughput curves will allow us to update the figures provided on the instrument websites to help observers more accurately plan their programs (the current throughput measurements on the website are often from pre-conversion). To supplement the existing data, we have also acquired wide-slit (5”) observations of standard stars when time has allowed during engineering activities.

In an effort to update the documentation for Red and Blue Channel and help observers make efficient use of their time, we have updated a significant amount of the documentation and figures on our website for these spectrographs. Following is a list of updates made:

- New figures showing the positions of prominent comparison lines for a wide variety of Red and Blue Channel gratings have been added to the website. The previous figures were of poor quality, and the relative strengths of the emission lines had changed considerably in that time. These updated figures should aid observers with calibrations. Currently, HeNeAr lines have been identified; we plan to supplement this with HgCd in the future.
- The Blue Channel echellette mode was documented with more details of the orders that can be reached with the system. R. Cool wrote a technical memo investigating the possibility of pushing the wavelength coverage of the Blue Channel echellette further into the red (see MMTO Technical Memoranda #12-2, p. 23). Following is an example of a test that was tried in order to get more spectral coverage at the red end: the instrument was configured in the normal echellette mode, i.e., with the prism in the beam. We then removed the Blue Channel camera and physically rotated it 180 degrees. The camera was mounted successfully in this rotation, but the CCD location was not centered as we had hoped. We were not able to get to the “orders” that the observer requested.
- Using the archive of data from the past several years, we constructed approximate trends of focus versus temperature for both Red and Blue Channel. Currently, these temperature-dependent focus corrections in the spectrograph are not automated, but we provided documentation in the instrument manuals for observers with the magnitude of the effect.
- Online observer cheat sheets for the spectrographs were revised and updated.

- Availability and use of comparison lamps were explored during the J. Hinz November observing run. The information was added to the cheat sheets and “Top Box Comparison Lamp Spectra” webpage.

We have identified a composite UV LED system that may allow for significantly more counts in flat field spectra taken blueward of 4000 angstroms (and blue echellette orders). We plan to obtain the needed parts and integrate this LED into the f/9 topbox in order to greatly reduce the time needed to obtain high-quality calibrations in the extreme blue.

An intermittent problem was reported for the Blue Channel Spectrograph by two observers (Brown on November 12 and Milisavljevic on December 19). For some exposures, dark horizontal lines appeared on the image, especially near the upper edge, on the order of a few counts (5-10) compared to the bias level (1950). While the percentage affect was small, the appearance was dramatic and obvious to experienced observers. The camera power was cycled and cables were reseated in both instances, temporarily halting the appearances of the streaks. It is unclear what caused the problem. Due to its nature, it appears unlikely to be an astronomical phenomenon, but rather an electrical problem. It was not found in previous archival Blue Channel data and has not been reported again in subsequent observing runs.

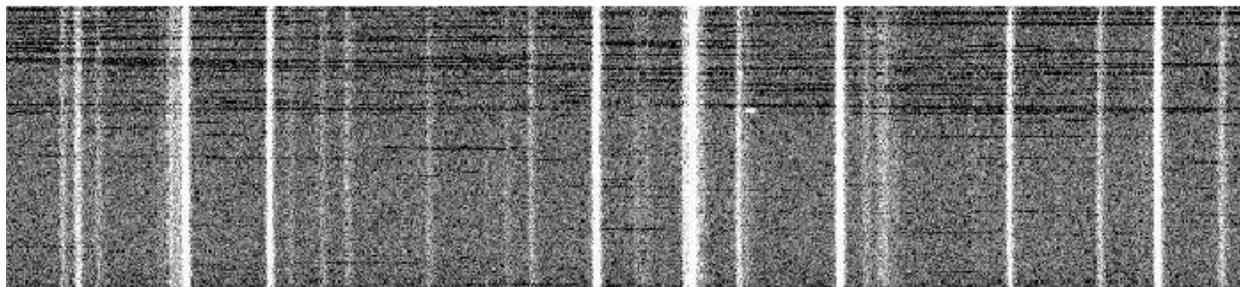


Figure 5. An example of the Blue Channel dark streak problem from data taken November 12 by W. Brown.

Remote observing

Remote observing was offered as an option to experienced Blue/Red Channel Spectrograph observers beginning in September. The MMTO supported 14 nights of remote observing with the Blue/Red Channel Spectrograph. Twelve of these nights were spread among four CfA observers, while two nights were for two UofA observers. Science topics were mostly supernova or transient related. The information for “Remote Observing” located on the MMTO webpage was revised and updated, including links to telstat and guider cam viewing and information on connecting to the control room iPad via Skype.

f/5 Instrumentation

Hectospec

It was a relatively good trimester for f/5 operations until the last couple of days. Of the 439 hours scheduled to f/5 instruments, about 41 hours were lost to weather. There were a few

instrument/facility problems that caused the loss of 11 additional hours. Over the 36 nights of observations, a total of 777 Hecto exposures were taken of 208 fields.

The Hectochelle dewar ran out of LN2 during the night in early September, resulting in the loss of about an hour of observing time as the dewar was filled and the detector started to cool. A half hour was lost to a power failure in late November, and a quarter hour was lost in early December when the WFS had to be re-started/re-homed after work on the power grid that day.

Three hours were lost on the next to last day of Hectospec observing when the guide camera failed late in the night. The problem was eventually found to be in the high voltage power supply of the intensifier tube, but the failure also caused the control circuit power supply and another component in the control circuitry, to fail. We were unable to operate Hectospec the next night, which was split between observing and engineering. Work on replacing the two power supplies and troubleshooting the other problems continued into early January 2013.

The WFS focus stage had a problem with a limit in early October. We operated Hectospec one night without the WFS installed so that work on the WFS stage could be done in the lab during day. M. Lacasse, D. Clark, and others worked on it. After putting the stage in the proper range and slightly adjusting the limit sensor, the axis resumed homing properly.

Warren Brown's commissioning run for the new instrument, MMTCam, was relatively successful. Offsets in position and focus were established, and many good images were taken. Some initial issues with connections and cables were quickly resolved. There were also some issues with using the WFS interface in an unfamiliar way, but these too were quickly resolved. The camera is controlled by the commercial software, MaxIm DL, which did not properly interface to the telescope and, thus, the header files did not have the correct telescope position and focus. This format issue also prevented the software from commanding offsets for a dither pattern. The SAO programming group has since been working on addressing these issues. They have also been working on treating the data taken by MMTCam in the same way that SWIRC and Hecto data are processed: copied to the SAO trio data areas, loaded into a DS9 window, and transferred back to Cambridge. There is a low level infrared light contamination problem visible by MMTCam z band images. Some shielding was added in the WFS but the source for this has yet to be identified.

With the MMTCam connection added to the wavefront sensor, a new connector bracket was built and installed in the cone by B. Kunk, T. Gerl, J. Di Miceli, and others.

A new webpage under "Instrument Suite" was created for the MMTCam, announcing its arrival, testing, and specifications.

W. Brown and M. Lacasse opened up the SWIRC dewar for the first time in years to change the getter contents. The instrument was later tested to verify that it had been properly reassembled.

Seeing

The seeing for this time period was extraordinarily good. Weather and atmospheric conditions were consistently good for many weeks which resulted in overall good seeing. Median f/5 WFS seeing

for the four month period was 0.77 arcsec with a mean value of 0.82 arcsec. Median f/9 WFS seeing for the same period was 0.64 arcsec with a mean value of 0.69 arcsec. The f/5 data set includes 2131 samples and 1564 samples are included in the f/9 data set. The combined f/5 and f/9 WFS median seeing for this period was 0.71 arcsec, better than the historical median seeing.

Figure 6 shows the time-series seeing data for September through December, 2012. Blue circles represent f/5 seeing measurements; green triangles represent f/9 WFS seeing measurements. Data points alternate through time between these two WFS systems as the telescope configuration and observing programs change. Overall seeing values for the two WFS systems are similar, although the median f/9 seeing value is lower than the f/5, as shown in Figure 7. Note that there is a bias against poor seeing because the MMT WFSers cannot make measurements when seeing conditions are poor.

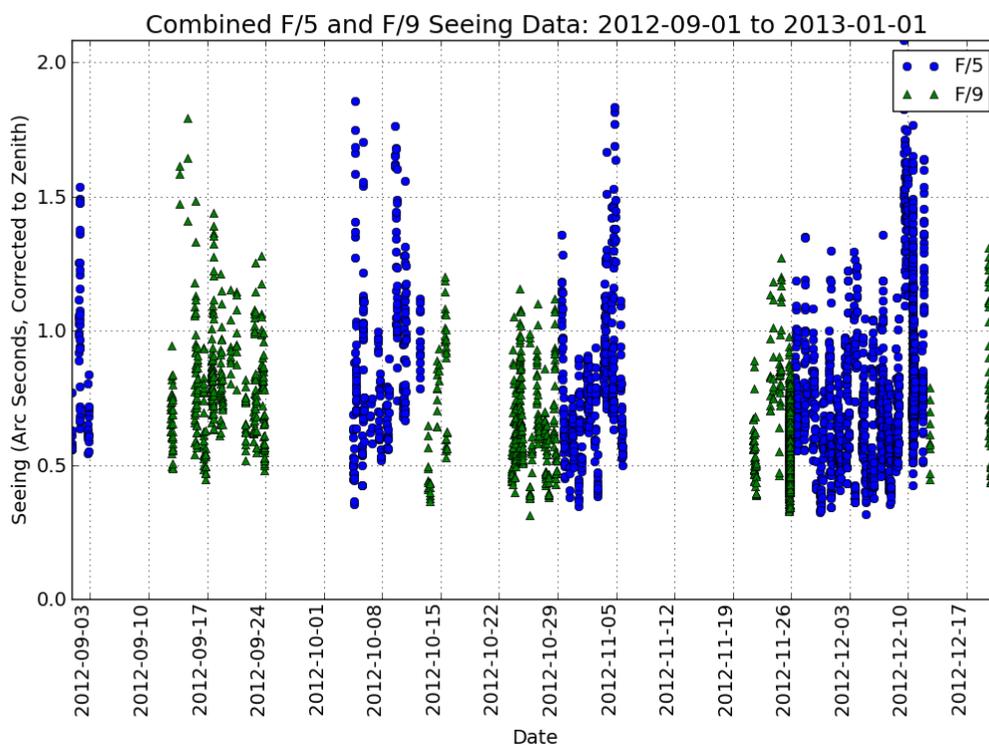


Figure 6. Combined f/5 and f/9 wavefront-sensor (WFS) seeing values. See text for more details.

Figure 6 shows combined f/5 and f/9 WFS seeing values, corrected to zenith, plotted against time from September 1, 2012 to January 1, 2013. Figure 7 shows a histogram of f/5, f/9, and combined f/5 and f/9 WFS seeing values, corrected to zenith, plotted against time from September 1, 2012 to January 1, 2013, with 0.1 arcsec bins.

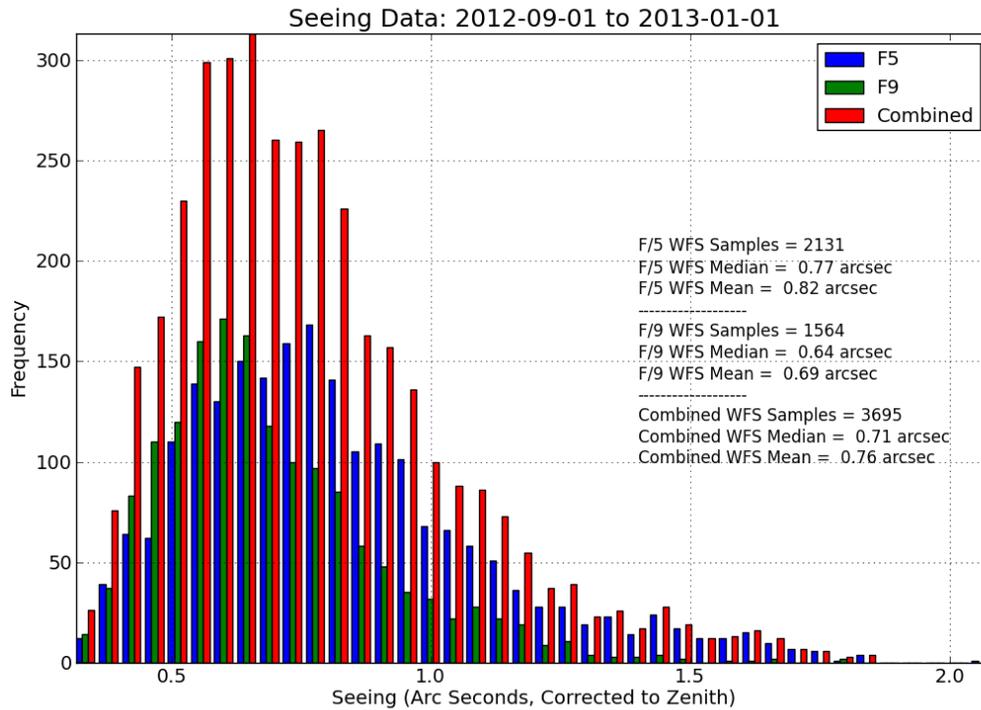


Figure 7. Histogram of combined f/5 and f/9 WFS seeing values with 0.1 arcsec bins. See text for details.

Safety

In November, an Automated External Defibrillator (AED) was installed in the MMT building in the front passageway across from the Mountain Operations Manager’s office door. This emergency equipment expands our capability to handle/treat heart-related emergencies. Personnel have received training on how to use the AED during CPR classes.

D. Porter and C. Knop created and implemented a new feature in the web interface for arranging and recording equipment training.

General Facility

The controller and solenoid for the quiet power transfer switch were replaced with a 208V version. Operational testing of the new unit showed that the unit automatically transferred power when its input power failed. The desired operation is that the unit transfer power in the manual mode only. The DIP switches on the controller were changed to enable the manual mode of power transfer. It has been decided to leave the switch in manual transfer until a more in-depth discussion about automatic transfer has occurred.

The MGE Uninterrupted Power Supply for the summit quiet power was serviced by company technicians. All the batteries, as well as input and output capacitors, were replaced. The system was tested successfully.

The elevator emergency phone wiring was repaired and installed in a conduit in Room 2E. That section of wire was cut during the renovation of 2E, which rendered the phone inoperative. The elevator phone is on a copper line and will be maintained until another phone system is installed in the elevator.

The webcam 4 enclosure was modified to include a resistive heater to the front glass window to prevent ice/snow build-up during inclement weather. The heater section is controlled by a bi-metal disc thermostat installed on the enclosure circuit card. An initial test had nominal results. Using this webcam we are able to evaluate the condition of the roof and roof heater operation after snowfall.

A revision to the roof heaters is being undertaken by Smithsonian Institution (SI) facilities to double the amount of heating elements and improve conductance in the membrane roof.

Road maintenance was done from late October through early November from the Ridge to the heated road portion at the summit.



Figure 8. Pump station damaged by a concrete block.

On December 22, a 3'x3'x2' concrete block rolled down the hillside behind the water storage tanks and pump station at the aspen grove area between the Ridge and Summit. The block entered the pump house through the rear wall and stopped after pushing open the front door. The water supply at the Bowl dorm and summit was interrupted for nearly a week.

Wireless Access

SI will finish installing additional wireless access points (AP) at the summit and in the Bowl dorm in 2013.

Weather and Environmental Monitoring

The Vaisala 3 (east wind sensor) was determined to have a defective wind sensor. It was repaired under warranty and reinstalled. The system was realigned to north.

The Young 2 (east wind sensor) serial interface card was sent back to the factory for repairs. It was found to be in a diagnostic mode and was generating only half the required pulses for wind speed. It was returned to normal mode and reinstalled. The system was aligned and is operational. In late December an ice storm caused heavy build-up of ice on the east flagpole. The R.M. Young mounting bracket was severely bent by the excessive load. A new mounting bracket was fabricated and installed.

Other

Due to the recent number of projects and new technology, there has been an influx of surface mount components. All surface mount components were added to the campus electronic shop inventory sheet and are stored in labeled electrostatic discharge (ESD) containers. With the evolving rapid-prototyping market, it's now more cost effective to construct surface-mount technology (SMT) prototype boards for testing and deployment rather than build a wire-wrap board, as has been done in the past.

Visitors

9/18/12 - 9/20/12 - Alex Griswold (CfA) did some filming at the MMT that will be used in making an updated video for the F. L. Whipple Visitors Center.

12/3/12 – 12/6/12 – Dr. Charles Alcock, Director of the Smithsonian Astrophysical Observatory, visited the MMTO offices on campus and also mountain operations at the observatory on Mt. Hopkins.

MMTO in the Media

None

Publications

MMTO Internal Technical Memoranda

None

MMTO Technical Memoranda

- 12-2 Blue Channel Echellette Trace Positions
R. Cool, December 2012
<http://www.mmt.org/node/245>

MMTO Technical Reports

None

Scientific Publications

(An online publication list can be found in the MMTO ADS library at <http://www.mmt.org/node/244>)

- 12-65 The Missing Weak Lensing Mass in A781
R.I. Cook and I.P. Dell'Antonio
ApJ, **750**, 153
- 12-66 *Spitzer* Observations of NGC 2264: The Nature of the Disk Population
P.S. Teixeira, et al.
A&A, **540**, A83
- 12-67 Quasi-stellar Objects in the ALHAMBRA Survey I. Photometric Redshift Accuracy Based on 23 Optical-NIR Filter Photometry
I. Matute, et al.
A&A, **542**, A20
- 12-68 Mid-infrared Selection of Active Galactic Nuclei with the *Wide-Field Infrared Survey Explorer*. I. Characterizing *WISE*-selected Active Galactic Nuclei in COSMOS
D. Stern, et al.
ApJ, **753**, 30
- 12-69 A Fully Identified Sample of AEGIS20 Microjansky Radio Sources
S.P. Willner, et al.
ApJ, **756**, 72
- 12-70 Submillimeter Follow-up of WISE-selected Hyperluminous Galaxies
J. Wu, et al.
ApJ, **756**, 96
- 12-71 CLASH: Precise New Constraints on the Mass Profile of the Galaxy Cluster A2261
D. Coe, et al.
ApJ, **757**, 22
- 12-72 The Stellar Population and Star Formation Rates of $z \approx 1.5-1.6$ [O II]-emitting Galaxies Selected from Narrowband Emission-line Surveys
C. Ly, et al.
ApJ, **757**, 63

- 12-73 The Sloan Digital Sky Survey Quasar Lens Search. V. Final Catalog from the Seventh Data Release
N. Inada, et al.
AJ, **143**, 119
- 12-74 Discovery of Six High-Redshift Quasars with the Lijiang 2.4 m Telescope and the Multiple Mirror Telescope
X.-B. Wu, et al.
RAA, **12**.1185
- 12-75 The 400d Galaxy Cluster Survey Weak Lensing Programme. II. Weak Lensing Study of Seven Clusters with MMT/MegaCam
H. Israel, et al.
A&A, **546**, 79
- 12-76 Hunting for Extremely Metal-poor Emission-line Galaxies in the Sloan Digital Sky Survey: MMT and 3.5 m APO Observations
Y.I. Izotov, T.X. Thuan, N.G. Guseva
A&A, **546**, 122
- 12-77 An Ultraviolet Ultra-luminous Lyman Break Galaxy at $Z = 2.78$ in NDWFS Boötes Field
F. Bian, et al.
ApJ, **757**, 139
- 12-78 Rapid Orbital Decay in the 12.75-minute Binary White Dwarf J0651+2844
J.J. Hermes, et al.
ApJ, **757**, 21
- 12-79 SHELS: Optical Spectral Properties of WISE 22 μm Selected Galaxies
H.S. Hwang, et al.
ApJ, **758**, 25
- 12-80 A Spectroscopic Study of Type Ibc Supernova Host Galaxies from Untargeted Surveys
N.E. Sanders, et al.
ApJ, **758**, 132
- 12-81 The Metallicity Profile of M31 from Spectroscopy of Hundreds of H II Regions and PNe
N.E. Sanders, et al.
ApJ, **758**, 133
- 12-82 The Properties and Prevalence of Galactic Outflows at $z \sim 1$ in the Extended Groth Strip
K.A. Kornei, et al.
ApJ, **758**, 135
- 12-83 HAT-P-39b-HAT-P-41b: Three Highly Inflated Transiting Hot Jupiters
J.D. Hartman, et al.
AJ, **144**, 139

- 12-84 Absolute Properties of the Triple Star CF Tauri
C.H. Sandberg Lacey, G. Torres, A. Claret
AJ, **144**, 167
- 12-85 Spectral Energy Distributions of Type 1 Active Galactic Nuclei in the COSMOS Survey. I. The XMM-COSMOS Sample
M. Elvis, et al.
ApJ, **759**, 6
- 12-86 The Wolf-Rayet Content of M31
K.F. Neugent, P. Massey, C. Georgy
ApJ, **759**, 11
- 12-87 Spectral Variability of FIRST Bright QSOs with Sloan Digital Sky Survey Observations
W.-H. Bian, et al.
ApJ, **759**, 88
- 12-88 A Metal-strong and Dust-rich Damped Ly α Absorption System toward the Quasar SDSS J115705.52+615521.7
J.-G. Wu, et al.
ApJ, **760**, 42
- 12-89 The Unusual Temporal and Spectral Evolution of SN2011ht. II. Peculiar Type II_n or Imposter?
R.M. Humphreys, et al.
ApJ, **760**, 93
- 12-90 Spectroscopic Follow-up of Ultraviolet-excess Objects Selected from the UVEX Survey
K. Verbeek, et al.
MNRAS, **426**, 1235
- 12-91 SN 2011hw: Helium-rich Circumstellar Gas and the Luminous Blue Variable to Wolf-Rayet Transition in Supernova Progenitors
N. Smith, et al.
MNRAS, **426**, 1905
- 12-92 The Detection of [Ne V] Emission in Five Blue Compact Dwarf Galaxies
Y.I. Izotov, T.X. Thuan, G. Privon
MNRAS, **427**, 1229
- 12-93 Composite Reverberation Mapping
S. Fine, et al.
MNRAS, **427**, 2701
- 12-94 Accreting Supermassive Black Holes in the COSMOS Field and the Connection to their Host Galaxies
A. Bongiorno, et al.
MNRAS, **427**, 3103

- 12-95 MMT and Magellan Infrared Spectrograph
B. McLeod, et al.
PASP, **124**, 1318
- 12-96 The Orbits of Subdwarf B + Main-Sequence Binaries. I. The sdB+G0 System PG 1104+243
J. Vos, et al.
A&A, **548**, 6
- 12-97 Seeing Trends from Deployable Shack-Hartmann Wavefront Sensors, MMT Observatory,
Arizona, USA
J.D. Gibson, G.G. Williams, T. Trebisky
Proc. SPIE, **8444**, 844432
- 12-98 An Integrated Scheduling and Program Management System
D. Porter, J.D. Gibson, G.G. Williams
Proc. SPIE, **8448**, 844824
- 12-99 An Updated T-series Thermocouple Measurement System for High-Accuracy Temperature
Measurements of the MMT Primary Mirror
D. Clark and J.D. Gibson
Proc. SPIE, **8444**, 844433
- 12-100 Upgrading the MMT Primary Mirror Actuator Test Stand: A Unique Vehicle for Evaluating
EtherCAT as a Future I/O Standard for Systems
D. Clark and S. Schaller
Proc. SPIE, **8444**, 84445P
- 12-101 MMT Nightly Tracking Logs: A Web-Based Database for Continuous Evaluation of
Tracking Performance
D. Clark, J.D. Gibson, D. Porter, T. Trebisky
Proc. SPIE, **8444**, 84445Q
- 12-102 Laboratory Demonstration and Characterization of Phase-sorting Interferometry
G.P. Otten, M.A. Kenworthy, J.L. Codona
Proc. SPIE, **8446**, 84469F
- 12-103 Commissioning Results of MMT-Pol: The 1-5 μ m Imaging Polarimeter Leveraged from the
AO Secondary of the 6.5m MMT
C. Packham, et al.
Proc. SPIE, **8446**, 84463R
- 12-104 Lunar Scintillometer to Validate GLAO Turbulence Distribution Measurements
K. Newman, et al.
Proc. SPIE, **8447**, 84471A

Non-MMT Scientific Publications by MMT Staff

Cool Dust in the Outer Ring of NGC 1291

Hinz, J. L., Engelbracht, C. W., Skibba, R., et al.

ApJ, **756**, 75

H-alpha Kinematics of S4G Spiral Galaxies - I. NGC 864

Erroz-Ferrer, S., Knapen, J. H., Font, J., et al. (J.L. Hinz)

MNRAS, **427**, 2938

A Unified Picture of Breaks and Truncations in Spiral Galaxies from SDSS and S4G Imaging

Martin-Navarro, I., Bakos, J., Trujillo, I., et al. (J.L. Hinz)

MNRAS, **427**, 1102

Breaks in Thin and Thick Disks of Edge-On Galaxies Imaged in S4G

Comerón, S., Elmegreen, B. G., Salo, H., et al. (J.L. Hinz)

ApJ, **759**, 98

Mapping the Cold Dust Temperatures and Masses of Nearby KINGFISH Galaxies with Herschel

Galametz, M., Kennicutt, R. C., Albrecht, M., et al. (J.L. Hinz)

MNRAS, **425**, 763

Modeling Dust and Starlight in Galaxies Observed by Spitzer and Herschel: NGC 628 and NGC 6046

Aniano, G., Draine, B. T., Calzetti, D., et al. (J.L. Hinz)

ApJ, **756**, 138

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 mguengerich@mmt.org or to the following address:

MMT Observatory

P.O. Box 210065

University of Arizona

Tucson, AZ 85721-0065

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

September 2012

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>*Lost to Instrument</u>	<u>**Lost to Telescope</u>	<u>***Lost to Gen'l Facility</u>	<u>****Lost to Environment</u>	<u>Total Lost</u>
MMT SG	11.00	107.40	65.10	0.00	2.00	0.00	0.00	67.10
PI Instr	17.00	170.00	57.00	1.75	4.50	0.00	0.00	63.25
Engr	2.00	19.10	4.00	0.00	0.00	0.00	0.00	4.00
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	30.00	296.50	126.10	1.75	6.50	0.00	0.00	134.35

Time Summary

Percentage of time scheduled for observing	93.6
Percentage of time scheduled for engineering	6.4
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	42.5
Percentage of time lost to instrument	0.6
Percentage of time lost to telescope	2.2
Percentage of time lost to general facility	0.0
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	45.3

* Breakdown of hours lost to instrument

- 1.25 Ion pump unplugged for lightning shutdown caused CCD to warm up (Hectochelle)
- 0.50 Camera software/hardware issue (MMTPol)

** Breakdown of hours lost to telescope

- 2.00 Hexapod Pod C problems
- 3.50 AO camera & DM336 power supply failure
- 0.50 AO M2
- 0.50 AO WFS camera issue

October 2012

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>*Lost to Instrument</u>	<u>** Lost to Telescope</u>	<u>***Lost to Gen'l Facility</u>	<u>****Lost to Environment</u>	<u>Total Lost</u>
MMT SG	16.00	176.20	14.50	0.00	5.25	0.00	0.00	19.75
PI Instr	15.00	160.20	14.70	0.00	3.00	0.00	0.00	17.70
Engr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	31.00	336.40	29.20	0.00	8.25	0.00	0.00	37.45

Time Summary

Percentage of time scheduled for observing	100.0
Percentage of time scheduled for engineering	0.0
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	8.7
Percentage of time lost to instrument	0.0
Percentage of time lost to telescope	2.5
Percentage of time lost to general facility	0.0
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	11.1

** Breakdown of hours lost to telescope

- 1.00 AO WFS camera issues
- 2.00 AO WFS camera failure
- 0.25 M1 panic
- 5.00 Hexapod power supply problem

Year to Date October 2012

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>Lost to Instrument</u>	<u>Lost to Telescope</u>	<u>Lost to Gen'l Facility</u>	<u>Lost to Environment</u>	<u>Total Lost</u>
MMT SG	120.00	1155.30	326.35	4.75	8.00	0.00	0.00	339.10
PI Instr	142.00	1385.30	331.25	34.05	44.23	3.68	3.00	416.21
Engr	15.00	145.80	27.10	0.00	0.00	0.00	0.00	27.10
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	277.00	2686.40	684.70	38.80	52.23	3.68	3.00	782.41

Time Summary Exclusive of Summer Shutdown

Percentage of time scheduled for observing	94.6
Percentage of time scheduled for engineering	5.4
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	25.5
Percentage of time lost to instrument	1.4
Percentage of time lost to telescope	1.9
Percentage of time lost to general facility	0.1
Percentage of time lost to environment (non-weather)	0.1
Percentage of time lost	29.1

Use of MMT Scientific Observing Time

November 2012

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>*Lost to Instrument</u>	<u>**Lost to Telescope</u>	<u>***Lost to Gen'l Facility</u>	<u>****Lost to Environment</u>	<u>Total Lost</u>
MMT SG	17.00	198.30	86.30	0.00	0.00	0.00	0.00	86.30
PI Instr	12.00	138.50	6.25	0.00	0.00	0.50	0.00	6.75
Engr	1.00	11.80	0.00	0.00	0.00	0.00	0.00	0.00
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	30.00	348.60	92.55	0.00	0.00	0.50	0.00	93.05

Time Summary

Percentage of time scheduled for observing	96.6
Percentage of time scheduled for engineering	3.4
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	26.5
Percentage of time lost to instrument	0.0
Percentage of time lost to telescope	0.0
Percentage of time lost to general facility	0.1
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	26.7

*** Breakdown of hours lost to facility

0.50 Power failure

December 2012

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>*Lost to Instrument</u>	<u>** Lost to Telescope</u>	<u>***Lost to Gen'l Facility</u>	<u>****Lost to Environment</u>	<u>Total Lost</u>
MMT SG	9.00	108.00	78.00	0.25	2.00	0.00	0.00	80.25
PI Instr	19.00	227.30	36.00	9.00	18.25	24.00	0.00	87.25
Engr	2.00	24.00	0.00	0.00	0.00	0.00	0.00	0.00
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	30.00	359.30	114.00	9.25	20.25	24.00	0.00	167.50

Time Summary

Percentage of time scheduled for observing	93.3
Percentage of time scheduled for engineering	6.7
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	31.7
Percentage of time lost to instrument	2.6
Percentage of time lost to telescope	5.6
Percentage of time lost to general facility	6.7
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	46.6

* Breakdown of hours lost to instrument

0.25 Streaks in Blue Channel readout
9.00 Hecto guide camera issues

** Breakdown of hours lost to telescope

0.50 M1 panic
0.25 WFS computer
0.50 WFS not stowed
2.00 Code parsing problem for mount crate LST
12.00 Hexapod issues
5.00 DM issues

*** Breakdown of hours lost to facility

24.00 Moisture in dry-air system

Year to Date December 2012

<u>Instrument</u>	<u>Nights Scheduled</u>	<u>Hours Scheduled</u>	<u>Lost to Weather</u>	<u>Lost to Instrument</u>	<u>Lost to Telescope</u>	<u>Lost to Gen'l Facility</u>	<u>Lost to Environment</u>	<u>Total Lost</u>
MMT SG	146.00	1461.60	490.65	5.00	10.00	0.00	0.00	505.65
PI Instr	173.00	1751.10	373.50	43.05	62.48	28.18	3.00	510.21
Engr	18.00	181.60	27.10	0.00	0.00	0.00	0.00	27.10
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	337.00	3394.30	891.25	48.05	72.48	28.18	3.00	1042.96

Time Summary Exclusive of Summer Shutdown

Percentage of time scheduled for observing	94.6
Percentage of time scheduled for engineering	5.4
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	26.3
Percentage of time lost to instrument	1.4
Percentage of time lost to telescope	2.1
Percentage of time lost to general facility	0.8
Percentage of time lost to environment (non-weather)	0.1
Percentage of time lost	30.7

