Technical Manager's Report

Magellan SAC Meeting, November 9-10, 2003, Pasadena, CA

Introduction

In early October I saw the Magellan telescopes in action and was impressed with the quality and performance of the hardware, software, and operations. The motion controls, active optics, user interfaces, and instrumentation show design and execution characteristics that result only from considerable observatory experience while the system architecture was appealingly free of overpowering and limiting design constraints.

Operational problems are minor and while there is room for improvement, routine operations are under control and effective. Less encouraging is the long to-do list of remaining construction tasks, improvements, and design changes. During the next few months we will prioritize and work on these tasks systematically.

Construction Updates

Matt Johns reported progress at the September 2003 Magellan Council Meeting. These are updates.

F/5 Secondary Mirror

We received a proposal in September 2003 from the Steward Observatory Mirror Lab (SOML) to grind, polish, and figure an existing mirror blank to the same prescription as the MMT F/5 secondary mirror. Because they have a good record of producing quality telescope optics, and because they have the MMT experience, we intend for SOML to do the work. A draft contract is being reviewed by CIW and SOML and will be submitted to U of A as soon as it's ready.

Because of existing work at SOML, our mirror will not enter the shop until September 2004. The projected finish date is the end of October 2005.

A high priority job at OCIW is building the mirror cell and mounting hardware so we can install the mirror immediately after it's finished.

F/5 Corrector and Instruments

SAO held an internal Preliminary Design Review for wide field instruments at the Magellan 2 F/5 focus on September 23, 2003. I received the presentation package and engineering reports on courtesy.

The SAO wide-field corrector optics will provide two options:

1. A curved 1 degree diameter field with an Atmospheric Dispersion Compensator (ADC) for spectroscopy.
2. A flat 0.5 degree diameter flat field for imaging.

The optics are being made at Goodrich Electro-Optical Systems (Danbury, CT, http://www.oss.goodrich.com/VeryLargeLenses.shtml). One lens is finished, three others are to be done. The ADC prisms are finished.

Ed Hertz, Mark Ordway (at SAO), and I have started work on interface control procedures and documentation transfer.

SAO personnel visited Las Campanas in late October 2003 to meet with site staff,

inspect the telescopes, examine the mounting interfaces for the wide field corrector and instrument adapter, and study the Magellan 2 tertiary mirror cart and lift.

Magellan 1 Atmospheric Dispersion Compensator

These lenses are at Denton Vacuum waiting for an antireflection coating. Scheduling delays at Denton have prompted us to begin inquires into other options.

The Atmospheric Dispersion Compensator (ADC) lenses are a pair of doublets, each with an intentional wedge, designed to correct wide-field aberrations and atmospheric dispersion. These lenses are particularly important for IMACS, which was designed assuming these lenses were part of the telescope.

The doublets were bonded with optical epoxy before figuring because the required prescription could not be put onto the thinner individual elements. Since the two glasses and the epoxy all have different thermal expansion coefficients, applying an evaporated antireflection coating is risky because a temperature ~80 C is needed. Denton Vacuum has developed techniques to keep the lens temperature at or below 50 C, which had been determined to be safe from engineering analysis and experiments. However, scheduling the vacuum tank at Denton has been a problem.

Sol-gel is an alternative coating scheme. A liquid suspension of an interesting material is put onto the lens surface and allowed to dry. The remaining material acts an antireflection coating. This can be done at a low temperature, reducing the danger of lens separation. This process has been used successfully on the MMT F/5 wide field correctors. The disadvantage is that the coating is fragile and difficult to clean.

Other evaporated coating vendors have, or will soon have, proposals for us to examine.

After coating, the lenses will go to Brashear LP for mounting in the lens cells (this takes a month) and then to Chile.

Improvements

Magellan 1 Tertiary Positioner

In early October 2003, Charlie Hull installed a new tertiary positioner locking system on Magellan 1 to improve positioning repeatability. Both hardware and software are installed and working; testing and commissioning are in progress.

Magellan 2 Tertiary Positioner

A similar locking system for the Magellan 2 tertiary is being prepared. Possible installation time is January 2004.

Magellan 1 Dome Trucks

Additional dome trucks are being installed on Magellan 1. At this time, all truck platforms on the dome sill are in place and alignment fixturing is being designed and built to position the trucks. Installation will begin this month.

Guiders

We are ordering three new CCDs and electronics for guider cameras, intending to build two new cameras and repair one. This will give us a total of four spare cameras on-site.

Problems

Rotators

Chronic instrument rotator failures cause a large fraction of Magellan downtime. The worst offender is an undetermined situation that blows fuses on the drive amplifiers. After chasing some unlikely possibilities, an overheated motor and blown fuse on the Magellan 2 Cass rotator provided new clues that are being pursued aggressively.

Guiders

Intermittent noisy guider images are another cause of lost time. We have begun analysis to isolate the noise source.

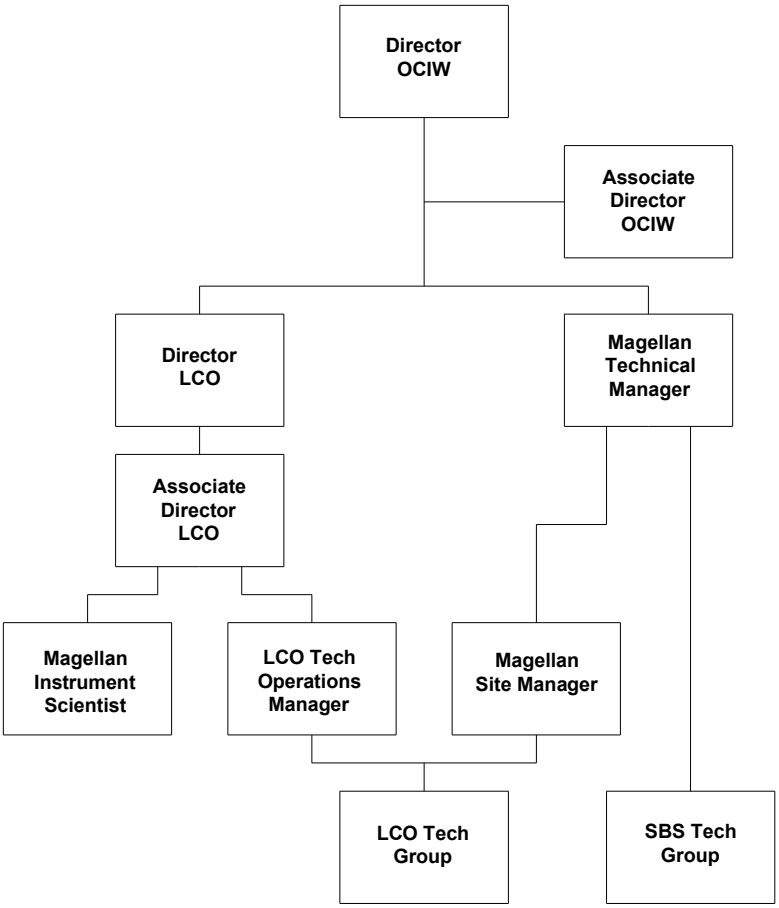
IMACS Focus

The telescope does not maintain focus lock at IMACS. The IMACS off-axis Shack-Hartmann sensor system reports an erroneous out-of-focus error after operating for a short time (minutes). The workaround is to use the center field system to focus and adjust between exposures, running without active updates while the shutter is open.

Unfortunately, there are many suspects. The telescope without the ADC has poor images at the off axis sensor location and they change rapidly with field radius. The off-axis Shack-Hartmann field is severely and variably vignetted by a part of the tertiary baffle that would not be in place if the ADC were installed. Engineering time has been created later this month to work on this problem.

Magellan Organization

Following is a suggested organization chart for Magellan operations. Missing are boxes for the Council and SAC, which might be reasonably be advisers to the Director.



Title	Magellan Responsibilities
Director OCIW	Overall vision for Magellan, particularly in the context of LCO, the small telescopes, and GMT; chairs Magellan Council (Freedman)
Associate Director OCIW	Advice and information store for Magellan; interface with GMT experiments affecting Magellan (mostly AO; Johns)
Director LCO	LCO administration affecting Magellan (Roth)
Magellan Technical Manager	Specific vision for Magellan telescopes and instrumentation, operations management, new instrument development (Uomoto)
Associate Director LCO	Scientific analysis and management of telescope and instrument performance, technical approval for new instruments (Phillips)
Magellan Instrument Scientist	Information store and support for Magellan instruments (Osip)
LCO Tech Operations Manager	Manage LCO Tech Group work on Magellan and small telescopes (Perez)
Magellan Site Manager	Manage on-site Magellan-specific work, operations approval for new instruments (Perez)
LCO Tech Group	Technical staff stationed at LCO (many)
SBS Tech Group	Technical staff stationed in Pasadena (many)

From Construction to Operations

Introduction

The transition from construction to operations will continue for many months. We expect the most visible changes to be in how new technical problems are prioritized and managed. To avoid LCO staff burn-out, it will be necessary to pace and prioritize on-site work, minimize the impact of arriving instrumentation and upgrades, increase participation by Pasadena technical staff, and increase technical staffing at LCO. Specifically, we would like to:

- Add a telescope scientist/engineer at LCO to work specifically on telescope problems.
- Add an electronics engineer at LCO to meet the demand for parts fabrication and repair.
- Receive priorities from the SAC for both telescope and instruments.
- Improve problem management and tracking; improve configuration control.
- Increase participation by Pasadena staff on telescope problems.

New staff requirements

The SAC has been asked by the Magellan Council to define staffing requirements for LCO operations. An assumed staffing baseline is listed in Appendix A of document 03PM0004 bound at tab B in the minutes of the September 28, 2003, Magellan Council Meeting. Consulting with LCO management and SBS staff, the following short term recommendations arise. Longer term requirements depend on science priorities and schedule, but may be derived given that information.

Overall management during Magellan construction came from off-site because delivery schedules and assembly and testing plans necessarily funneled through Pasadena. Routine operations, however, require more autonomous management to respond quickly to changing local situations and to allocate resources consistently with observatory priorities.

Specifically, we need an additional telescope scientist/engineer to prioritize, troubleshoot, and solve problems. These analysis and management responsibilities currently fall entirely on the Magellan Site Manager, Frank Perez, who also manages daily operations, budgets, hiring, Windows systems management, and optics care and cleaning. An additional engineer or scientist with good analytic skills and hands-on expertise devoted to telescope problems is the single best way to improve progress on telescope tasks.

This person cannot be someone on the current LCO technical staff unless that person is promoted and removed from the shift schedule (and replaced). Technical staff do not allocate their own time to projects and their shift schedule is not suitable for management.

Growing the technical staff is also needed and we recommend an additional electronics technician at LCO for new Magellan work.[1] Although telescope construction is essentially finished, there is a frighteningly large convoy of new things on the horizon that will overwhelm the observatory unless deliberate action is taken soon. The MIT Echellete spectrograph, F/5 secondary mirror, F/5 wide field corrector and ADC, the F/11 ADC, MMIRS, Megacam, tip-tilt secondary control, IMACS Maryland Fabry-Perot, faster IMACS setup, the LDSS upgrade, and an F/11 adaptive secondary come immediately to mind. All of these will require electronics interfacing, software modifications, maintenance, and documentation.

1 In practice, this means hiring a new Instrument Specialist since the loss of one Instrument Specialist at Magellan (Oscar Duhalde returned to small telescope work) was made up with an electronics technician (Marc Leroy).

Priorities

There will always be more telescope work (see Appendix) so policies to control the rate and assign priorities are used to maintain morale and effectiveness. This rating scheme is proposed for setting work priorities:

1. Human safety
2. Instrument and telescope safety
3. Things that prevent observing
4. Other

There are no arguments against 1 and 2 in those positions. Items 3 and 4 are also in the correct order but the details are murky, contentious, and a primary SAC responsibility. High level rules such as "minimize downtime" or "maximize science data" work on the short run but beyond that is image quality (high strehl, or constant psf?) a top priority? Or a wide field? Or accurate area photometry (baffling)? Is mid-IR performance a concern? Fast instrument changes? Queue observing, surveys, key projects, service observing, remote observing? "All of the above" is not the correct answer.

I would like the SAC to provide telescope performance guidelines for prioritizing work. With limited resources, selecting the correct problem to work on is important.

Work Management

Adding a telescope scientist/engineer and electronics engineer at LCO enhances work throughput by increasing the number of tasks that can be simultaneously worked on or "owned." Ensuring that incoming instruments and upgrades need minimal "finish-up" work also helps. The *Facilities Instruments Policy* is one example of how to control this workload. We are formalizing other areas such as Interface Control Documentation (ICD) and the user instrument policy. Other management enhancements being considered include more formal problem tracking and reporting, staff telecons, and regular telescope performance reviews.

Some operational changes can reduce the workload, although at a scientific cost:

- Increase telescope engineering time (but there's a limit because people need breaks)
- Remove low-priority tasks, new instruments, and upgrades from consideration
- Have fewer instrument changes
- Decommission instruments
- Reduce the rate of incoming instruments and upgrades

Related to the above request for telescope performance priorities is an additional request for priorities on incoming instrumentation: **What are the scientific and schedule priorities for incoming instrumentation and upgrades?**

Pasadena participation

A consistent request from LCO is for help from Pasadena technical staff. We are regrouping and adding support in Pasadena and expect this situation to improve.

Summary

Magellan needs additional staff, particularly in technical management and electronics, to meet reasonable goals for telescope efficiency. A telescope scientist/engineer and an electronics engineer are short-term needs. The SAC should provide guidance and priorities for telescope

performance. The SAC should also provide guidance and priorities for incoming instrumentation and improvements. Management changes and additional application of Pasadena talent will enable more efficient problem solving

Long Term Issues

Some telescope control subsystems have orphaned or soon-to-be discontinued components. The telescope main drives, for example, have computer parts that are no longer manufactured and have no plug-compatible replacements. The instrument rotator drive amplifiers are ancient and contain parts that are no longer made. The disaster potential is low, but a major event, such as a lightning strike, could put is into an “insufficient spares” situation. During the next few years we would like to upgrade systems whose loss would cost significant telescope downtime.

There are also some low-probability but high-cost failure situations in the primary mirror mounting system. The U of A reports that long-term degradation of the adhesive used to hold the mirror in the cell may be a future problem and there are some questions about the safety of the force actuators on the primary. Both of these problems deserve detailed study.

Alan Uomoto
November 6, 2003

Appendix

This is a list of pending work compiled by Frank Perez. The intent is not to present a schedule or report, but to aid, perhaps, in understanding expectations and how to set SAC priorities. The current work rate suggests significant progress on this list in a three year time frame. Omitted are most of the planned new instrumentation and upgrades.

Baade

- Install and commission ADC. This requires removal of the M1 mirror and cell and M3 turret assembly.
- Install new M3 turret detent system, revise M3 controls and software.
- Install new dome trucks, fab mounting bases, install, grout, install trucks and align.
- Commission FP#3, align drive, tune servo, install guider/test, collimate M3
- IMACS installation and commissioning.
- Commission PANIC at FP#3, Design and fab mounting hardware, install and test
- Wind screen revision (solve panel/drive issues)
- Commission Cass rotator, install drive/align, tune servo.
- Commission folded port #2, align drive, tune servo, install guider/test, collimate M3

Clay

- Solve Cass rotator problems, port swap issues, encoder index points
- Install LDSS-II thermal controls
- Design, fabricate, and install M2 and M3 baffle
- Small ADC lens and actuator

Both

- Address rotator problems (Glenteks, Galils, motors, capstans)
- Remote flat field lamps
- Review NIR & folded port rotators, bearings, Renishaw encoders and index points
- Install fire suppression for lift hydraulics
- HVAC controls installations and commissioning
- Telescope TCS upgrades for interlock system
- Commission lift automated control system
- M2 piezo tip and tilt controls and software
- Azimuth oil system covers
- Install Iodine cell actuator at NIR east
- Revise louver seals, louver actuators and limits
- Revise rotating dome seal
- Revise data system PC rack and connections at equipment room
- Upgrade TCS computer hardware
- Revise telescope to fixed floor rotating seal
- Replace lift access doors
- Revise aluminum tape issues on dome

Software

- ADC control program
- Guide probe control for non-sideral/MIRAC tracking
- M3 turret control in Clay telescope
- Telescope TCS upgrades for interlock system
- Rotator guiding
- Video switch control
- Error logging and tracking
- M2 piezo tip and tilt controls and software
- Engineering Data Stream tools