Magellan SAC meeting: March 21-22, 2008

Attending:
SAC members: Andy Szentgyorgyi (Chair) Paul Schechter, Ian Thompson, Eric Persson, Mario Mateo, Laird Close, Alan Dressler (secretary)
Others: Alan Uomoto, Frank Perez, Steve Shectman. Victor Gasho, Mark Phillips, Povilas Palunas on the Polycom from Chile.

Mark Phillips Associate Director's Report

Mark welcomes Povilas Palunas, who in February began as the Magellan Telescope Engineer Scientist. Charlie Hull will be transitioning to GMT full-time on July 1. He remains interested in staying involved in Magellan. Regrettably, Jose Miguel Soto, our most experienced DOS programmer (Magellan control system) is leaving in mid-April to take a job with Gemini South. We have some coverage by other personnel, but losing Jose is a concern. Mark says that there is a very competitive environment in Chile for technical people (competing with ALMA development, for example), which is a challenge for Magellan.

The Observing statistics show the first use of MagIC on Baade, and an increase in PANIC nights at the expense of IMACS. On Clay, MIKE usage decreased somewhat, with LDSS3 rising and MagE making its first appearance. Weather statistics: 88% open, 11% lost to weather, 1-2% downtime averaged for both telescope, 2:1 Baade/Clay, twice mostly due to IMACS --- but very low in any case. Dressler suggests that we start adding "photometric night fraction" to these statistics. Downtime had declined since 2003, leveling off at the present 1-2% level. Mark says we are trying to implement a "shutter-open-fraction" statistic; Ian suggests we post these good numbers on the web.

Reports on Commissioning: IMACS and MIKE are fully commissioned. PANIC will remain uncommissioned until replaced by FourStar. MagIC is "almost commissioned" – see Mark's report for the list of remaining tasks. Some issues with the frame-transfer CCD, support documents, support agreement, etc.

MagE had two successful engineering runs, has been used for science -– final requirements for commissioning will be discussed by Thompson.

LDSS3 is an uncommissioned Magellan instrument, supported at present by Thompson, Mulchaey, and Uomoto. The agreement with Durham is ending; a new agreement is needed to keep the instrument at Magellan (as far as we know). Uomoto thinks Durham might renew at less than the 8 nights/yr cost we now pay. We need a PI for this instrument, an institution to take responsibility for maintenance, and a support agreement. Paul posed the possibility of asking the Council to disqualify LDSS3 because it has these issues; Mateo asks about what the level of resources would likely to be, within the context of contributions by Consortium members – Michigan would be willing to consider contributing to the support of LDSS3.

Wendy Freedman has said that Carnegie will not assume this responsibility (by which we think she means the broad responsibilities listed above). Shec says he would like to convince Wendy otherwise. Dressler defends Wendy's position, which he says is based on the belief that Carnegie has already assumed the responsibility for enough of the instruments. Mario and Ian discussed the possibility of Carnegie retaining the responsibility but being compensated by the Consortium. Paul points out that, according to the statistics, LDSS3 requires a fair amount of attention, according to the statistics. Who, he asks, is the scientist who will take principal responsibility for the instrument? Mario says that the responsibility could remain at Carnegie but the other partners could provide the financial support. Shec wonders if Wendy would rather have 4 of the 8 Durham nights assigned to Carnegie in compensation for continuing the responsibility for LDSS3.

Ian asks Mark to elaborate further (in writing) about the issues that need to be solved for LDSS3. Andy: "Where there is no solution, there is no problem." No one understood this, but we liked this quote. Shec suggests Edo Berger would be a good PI – soon to take up residence at CfA. Dressler is concerned that he has not had an adequate background in instrumentation to take on this relatively complicated instrument. That is more-or-less the situation with John Mulchaey doing the job, who --- although he generously gave of his time --- was not really involved in the technical problems, which have been a matter of concern and have affected the science.

The SAC seems favorably disposed to renewing the deal with Durham to keep LDSS3 (note half of CfA's observing proposals are for this instrument) and accepts the idea that the responsibility for supporting it rests with the entire Consortium rather than just within Carnegie. The question of how much of a burden LDSS3 will be depends on whether it can and should be moved to a folded port, which should be reconsidered after the upcoming discussion of folded ports. The question of LDSS3's future depends at least partly on whether it is fitted with a new CCD with high red sensitivity.

Frank Perez: Site Manager's Report

The Clay primary and tertiary were re-coated in January. New measurements of instrument throughput have been made, but these are not yet available for comparison.

The Baade primary and tertiary mirrors were washed in February, and the ADC was acetone bathed. Frank says that ADC was very dusty. Andy started off a discussion about whether the Sol-gel coating on the ADC has a finite lifetime, in the sense that -– in his experience -– each subsequent cleaning is less effective than the last. Frank thought that the ADC had been cleaned a small enough times that it seemed to be recovering completely, but there are no measurements precise enough to quantify this. He thought there might be signs of slow deterioration. Dressler volunteered that the IMACS field lens –- a quartz optic coated with Sol-gel --- had appeared to return to near-pristine after the 3 acetone flushings it has had over the last 6 years. Frank said that the Magellan group is considering the possibility of setting up a Sol-gel coating facility on-site.

Frank took reflectivity measurements that would imply, for example, a ~30% improvement in performance at Baade, however, as can be found in Dressler's present IMACS presentation, the throughput gain measured with IMACS – which is available – implies an 11% gain in throughput. Shec provided apocryphal data that this was about the same order gain seen with MagE before and after the Clay re-coating. Dressler believes he has only seen improvements of 10-15% in past washing/coating cycles, never anything near as large as 30%. The difference may rest in the difference between measuring with a reflectometer at an angle as opposed to near-perpendicular incidence --- this question will be pursued.

New baffles have been added to all ports. MagE was successfully transported to Magellan and installed on a folded port. It was thoroughly tested and is now being used for science observations. Commissioning is not quite finished.

There has been considerable work by the IMACS team --- many improvements and progress on the optics (oil couplings) and GISMO. The rotator bearing on the IMACS port was successfully replaced –- a major undertaking. The friction in the rotator had become very high --- it will be rebuilt. Mechanical upgrades were made to folded port guiders and there is new software.

Frank attended Earthquake conference. Now underway are a series of upgrades (for example, remove suspended ceilings) to minimize damage (downtime) after an earthquake. New supports are being installed for glycol tanks and the like; fold-up doors are being replaced by roll-ups.

Frank and his team are about halfway through rebuilding the 256 mirror-support actuators. Software upgrades underway in control system in preparation for f/5. Frank reports progress in using 2-probe to re-collimate the telescopes; presently a hybrid system of old system + 2 probe, with a goal of using 2-probe for the whole process. Dressler asks about whether this could make a big difference, eventually, in the difficulty of maintaining 8 or 10 ports. Perez sees light at the end of the baffle, so to speak.

Frank and his team have made major improvements on performance and durability of the Laser slitmask cutter. There is concern about the long-term survivability of this critical item, which is not an off-the-shelf product. A new laser cartridge and spare electronics has been ordered, but there is concern about obsolescence of the computer control and software. Cryo-tiger systems renewed. Schechter asks whose responsibility is the provision and support of the cryo systems. More clarification is needed.

<u>Alan Uomoto: Technical Manager's Support</u>

Uomoto reports on upgrades to LDSS3. The pesky shutter problem has been fixed, and multiple grisms can now be installed in the disperser wheel.

There are major issues in maintaining the Laser Mask cutter system: not a production item, but a one-off machine. Uomoto presented the breakdown of costs in making the masks, which total to ~$200 per mask. Frank is concerned that in 2-3 years there will need to be a major upgrade or replacement; Schechter says that the Council will address the question of how to fund the next machine. He suggests raising the per-mask price in order to pay of the next machine. Mateo again raises the issue of charging different amounts for masks of different difficulty. This issue remained unresolved.

Uomoto has with the help of Carnegie librarian John Grula compiled a bibliography of Magellan publications: 323 for Magellan compared to 372 for Gemini. This was done with ADS, over a date range that began with the completion of Magellan 2. The basic criterion was the use of Magellan data. The present level, over the last two years, is about 80 papers per year. Shec says it should be normalized per dollar – Magellan would look good! Paul points out that MagIC is very productive for the small amount of time it is on the telescope. Dressler says he needs to use some of these statistics at an upcoming TMT/GMT Public Participation Workshop in June, and that it would be interesting to compare the number of authors on these papers who are at Magellan partner institutions to those who are not, with the expectation of showing that public participation in Magellan is significant even without counting TSIP nights.

Two TSIP proposals have been funded in the last round: AO (22 Magellan nights) and MMIRS (10 Harvard nights).

Ian Thompson: Report on MagE

MagE was commissioned in Fall 2008 on a folded port of Clay, which well suited for this mounting, Ian says. Because of the restricted access to an auxiliary port, Ian chose to use an ion pump, for the first time on any of the LCO detector dewars. This should significantly reduce the need to pump the dewar. The lifetime of an ion pump is expected to be 2-3 years. It was necessary to baffle to shield glow of the discharge.

MagE uses an E2V 42-30 2048 x 1024, 13.5 micron pixel detector; the read noise ~ 3 e-, is somewhat larger with a faster readout speed. The dark count measured on the telescope is 2 e-/pix/hour dark. A key feature of MagE is the f/1.4 Schmidt camera with embedded CCD (mounted on an invar plug that inserts into the quartz corrector, run at -110C; the camera is part of the dewar. The camera produces pristine optical images (less than 2 pixels), but the sampling is not all that fine --- about 3 pixels per arcsecond. Before the recoating of the Clay M1 and M3 mirrors, MagE efficiency with the telescope included peaked at ~22% near 5000 angstroms. From pre-coating measurements, instrument throughput by itself estimated to peak at about 40%. Birk's software includes a tool to move the cursor on the displayed image and report the order number and wavelength.

The Cryo-tiger cooler can be replaced or serviced without disturbing all the electrical and thermal connections to the CCD. Pato Jones came to Pasadena for a month to work with

the team on the electronics. Reassembly and installation at Magellan went very smoothly. Already 39 nights of science observations were scheduled in the present semester, shared half-in-half between MagE only or as part of a multiple instrument request.

Future work includes replacing cracked (but okay) CaF2 corrector. The data reduction pipeline is working, but the method of taking optimal flat fields is still being worked out. The Xe flash lamp may be replaced.

Andy Szentgyorgyi: Report on PISCO

Tony Stark's report on PISCO, a P.I. instrument for the Clay, was delivered by Andy. PISCO now consists of a redesign of multi-band camera by Stark with Shectman's help. A major change is that the dichroics that split the light into the four bands are now combined with the prisms that divide the light. Four 3K x 6K CCDs will read out in 25 sec with 4e- read noise. The dichroic cubes are to be fabricated by Barr (claimed manufacture time is 8 months – some skepticism expressed here) at cost of $125k for the lot. John Tonry is collaborating on the detectors; software has been adapted from the SuperMacho/Essence programs. The South Pole Telescope is beginning to deliver candidate rich clusters (found through the SZ effect); PISCO will be used to obtain photometric redshifts for cosmological tests. The estimated efficiency for the program is 4 hours for 100 clusters to z=1.

Mateo is concerned that this instrument is quite specific for this application, and worries that there is interest in taking this to a facility instrument – would this be justified?

Andy Szentgyorgyi: Utilization of Magellan Instrument ports

In August 2006 report to the Council, the SAC recommended the development of 6 ports on Magellan (four Nasymth + 2 auxilliary). In addition to the first 6-port plan, Mark Phillips provided an alternative 6-port plan which moved instruments around to provide somewhat better, but still limited access to the full instrument suite that will come available over the next few years.

Summary: The SAC has now concluded, based on its survey of instrument use, that a six-port plan will significantly constrict the scientific capability of the Magellan telescopes. An 8-port plan would "significantly enrich" this capability. Going from a 6 to 8 port plan would require an increase operations cost of as much as 10%. The SAC believes that the gain in scientific capability would be important enough to the sacrifice a small number of observing nights to raise the money.

In discussion, the baseline 6-port plan made up by Phillips for 2009B- 2011B was reviewed -- it shows significant limitations. The SAC also notes that even keeping instruments off the telescopes for periods of time does not completely eliminate their

support costs. In the 6-port plan, access to instruments on Baade works out reasonably well, but Clay requires a lot of instrument swapping. The alternate 6-port plan mitigates this. In the alternate plan, FIRE goes to Baade FP and the Clay east platform would be shared by MIKE, MIKE-fibers, PFS, PISCO, and MagIC. The f/5 configuration and f/16 (AO) are not included in this analysis. With greater scientific capability (more instruments), the 8-port plan requires the same number of "swaps" as the 6-port plan. In Ian's opinion it is nonsense to equate a focus change (f/11 to f/5 or f/16) to an instrument change such as PFS to MIKE.

None of these plans include LDSS3 in the long term. Can LDSS3 be used conveniently at a folded port? – opinions differ. MIRAC + AO will basically take up a platform, so there it is important to know what the cadence of its use will be.

Andy's presents a model that shows that what is really different about an 8-port plan compared to the 6-port plans is the flexibility of scheduling: instruments are available a substantially greater fraction of the time, by about 40%.

An interesting discussion ensued about how easy it will be to re-align all the ports on one of the telescope when various components are removed and replaced. Dressler argues that it would be better to adopt a success-oriented strategy that we can systematize these alignments (with a collective process, not just done one at a time), using the improved methodology of telescope collimation using "2-probe" (which analyzes images from the guiders as the port is rotated). A robust method for checking/resetting the tertiary mirror settings for each port would be needed. Shectman agrees with Ian – he says that the problem of switching secondaries dwarfs the level of complexity that is associated with instrument changes and ports. MIRAC and LDSS3 are the two instruments that least suited to being swapped around, because of their unique guider/rotator issues.

Mario strongly believes that the f/5 aspirations are too optimistic, that it will be too difficult to ship MMIRS and MegaCam back and forth and maintain the 3 times per two-year cadence that is envisioned in the plan. Is it too ambitious to ship these instruments every 8 months?

Schechter suggests sending the two 6-port plans to the Council, since this seems to be all that members of the SAC can agree to. Ian states, and several SAC members seem to agree, that the 8-port plan clearly is advantages from the scientific point of view, as Szentgyorgyi has shown in his "availability" numbers. Perez says that he needs additional resources just to support more instruments, even with the 6-port plan. Shec agrees that more instruments and especially new instruments with dedicated secondaries (AO, f/5) is the big reason for the need for more support, and that increased numbers of ports and instrument changes are just tools to help deal with the change. What is needed in the long term is to know the combination of more ports and instrument swaps that will be most efficient and most productive scientifically. This needs to be weighed by both the efficiency/ease of operations and the scientific capability; this is hard to predict accurately and will require some experience.

Szentgyorgyi will take forward the Port report to the Council will a new "foreword" which will emphasize that we need more support just to operate the 6-port plans with the additional instruments and secondaries. At this point in the discussion, many SAC members seemed to believe that increasing to 8 ports would not significantly change the operating cost, but rather that the greater number of instruments that are going to be supported has already built in an increased cost. However, adding ports certainly would increase the science capability significantly, especially the availability of instruments and the ability to schedule observers with what they want, when they want it. This increase could be funded by selling nights at the telescope, which the SAC agreed was an acceptable scientific tradeoff.

Mark Phillips had a somewhat different slant on things. He reminded us that the plan assumes continuing the Magellan fellows. Phillip's position was that we can cope with present staffing (and Magellan fellows) with the new instruments and secondaries. He believes that it is the increase in ports that will require more resources, in contrast to Shec's belief that we've already bought into a larger operation than we can handle, regardless of the number of ports). If we return to Phillip's point of view, which is where we were when this SAC discussion started, the Executive Summary of the present document is correct as it was presented to the SAC today. Shectman qualifies that this summary did not capture that it is the combination of additional ports and instrument changes that will significantly enhance scientific capability.

Eventually, people agree that it is hard to know the effect of the secondary changes – will they bog down the system or not? We'll probably not know for sure until we enter this phase. Andy took this discussion as a basis for rewriting the Executive Summary of the "Port Report" to the Council, which was discussed, and wording agreed to, on the following day.

Alan Dressler: IMACS

Alan reported on progress with IMACS: the addition of the second Mosaic CCD camera, dedicated to the f/2 focus, the cleaning and measurement of IMACS optics that have resulted in a 10-15% gain in throughput since the Commissioning of IMACS, and the progress on the IMACS accessory units, GISMO, MMTF, and MOE.

The biggest news is the upcoming commissioning of the new Mosaic2 CCD camera, which has eight 2k x 4k E2V chips with better performance characteristics than the SITe chips of the original dewar. Ian Thompson and Greg Burley, along with the technical group at OCIW, have done a remarkable job building a camera that is technically superior in every important way to Mosaic1, and they worked hard to get the camera done by March. The camera is one its way to Chile and Ian, Greg, Alan, Tyson, and Christoph Birk will be leaving in the next few days to begin Mosaic2 commissioning.

In January, Tyson Hare, Dave Osip, and Dressler completed inspecting, cleaning, measuring, the optics for the IMACS collimator, f/2 camera, and f/4 cameras, a project

that had taken three engineering runs over the course of a year. One of the most important aspects of this activity was the draining of the Cargille immersion oil that had yellowed over the last 4 years, apparently from its contact with polypropylene parts of the volume compensators. This has decreased the blue performance of the f/2 camera by about 30%, something noticed first by Scott Burles after his installation of the low-dispersion prism. With the oil changed, and new parts of polystyrene, this problem has been eliminated, we hope for good. The general cleaning of the lenses (18 air-to-glass surfaces in each of the f/2 and f/4 optical trains), and the washing of M1, M3, and the ADC/corrector, resulted in a ~10% increase in throughput, with the peak of the 150-l/mm and 200-l/mm reaching about 22%. It is hoped that the new Mosaic2 camera will raise the peak to around 30%.

Work has continued on improving images of the f/2 camera, which, up until 2005, produced a substantially tilted focal plane. After this was corrected by shimming the Mosaic1 CCD camera, Shectman and Kelson worked to measure and provide recommended solutions for coma and astigmatism, which were each contributing to image degradation at the 0.4" level. This last January Tyson Hare installed a new mounting for moving the S09 field flattener in the f/2 camera. Alan, Dave Osip, and Tyson were able to substantially decrease the coma, as Shectman had predicted, by moving the S09 element along the z-axis toward the S01-S08 lenses. Further work is upcoming to explore the effect of translating this element and refining the piston adjustment, but the improvement in the images over the f/2 field is quite noticeable.

Another important addition to IMACS has been the Low Dispersion Prism built by Scott Burles. With this compromise between imaging and spectroscopy, it has been possible to determine "spectrophotometric redshifts" accurate to about 1% for ~2000 galaxies per field, a tremendous tool for large galaxy surveys and distinguishing between field and cluster galaxies at intermediate redshift. Dan Kelson has written some remarkable processing and analysis software. A second low dispersion prism has been designed by Shec which uses multiple glass wedges to produce a more even dispersion than the LDP. A large group of astronomers at OCIW is hoping to use the new prism this Fall, in conjunction with the new Mosaic2 camera, to conduct a very large z~1 galaxy survey based on a Spitzer sample.

The Maryland-Magellan Tunable filter, P.I. Sylvain Veilleux, is not in regular use at IMACS, in a campaign mode supported by the MMTF team. GISMO will be ready for general use in the 2008B semester. Final tweaks will be done by Mike Gladders in the April engineering run on Baade. A website has been established with basic information that will help the writing of observing proposals, with more specific documentation on how to use GISMO to soon follow. Andy McWilliam, and Alan and Tyson, have verified that Newport Richardson supplied a grating for MOE, the multi-object echelle, with a blaze significantly different from specifications. Negotiations are underway with the vendor to see what can be done to restore MOE to its original, more efficient design.

New Magellan Telescope Scientist Povilas Polunas will be looking into the problem of inaccurate rotator guiding that is seen at all foci of the Magellan telescopes, in particular,

the inability to track the rotator successfully when rates go up crossing the meridian. Other problems that once hampered IMACS, like a proper, stable SH correction, have been solved by work done on the Magellan telescope.

The availability of Mosaic1 on the f/4 focus and Mosaic2 on the f/2 focus completes the original plan to make all of the many modes of IMACS available at any time. This should open up many new possibilities for observers and make it possible to take better advantage of changing observing conditions. The Magellan staff is looking forward to no more swapping of the Mosaic1 camera between foci, which took considerable resources and was somewhat risky. The IMACS team is grateful to Consortium members for their support of the Mosaic2 project.

March 22, 2008

Eric Persson: FourStar

Collaborators at SBS are Jennifer Marshall, Dave Murphy, Christoph Birk, Alan Uomoto

Eric Persson gave a tour of the hardware in the lab, then returned to a slide show that started with the mechanics and electronics of the detectors, which are derivatives of the JWST MgCdTe arrays, produced by Teledyne. There are a number of electronic/mechanical issues having to do with the thermal cycle. Marcus Loose is the "genius" at Teledyne who is responsible for these detectors, Eric says. An H-band picture taken in the lab of Jennifer Marshall was shown, apparently, in infra-red black and white.

Eric presented details of the present schedule; his presentation is posted on the web. Eric expects a mid-2009 delivery; he believes redo of Teledyne software by Birk is the pacing item.

Jeff Crane: Planet Finding Spectrograph

Planet Finding Spectrograph is a PI instrument (Paul Butler) designed by Steve Shectman, largely built by Jeff Crane at the SBS shops. Its goal is to improve sensitivity for planet hunting by reaching 1 m/s or better precision. This is achieved by higher resolution than MIKE (R4 grating vs. R2), better optical quality, active thermal control, very high quality flat fielding, and care taken with respect to slit and pupil illumination.

Complete wavelength coverage is 3900 to 6200 angstroms, R=38,000 per arcsec; 0.09"/pixel scale, discrete slits, 3.7" long slits, 0.2-3.0" wide

Detector is 4k x 4k from Mike Lesser's lab. Active thermal control is achieved in the enclosure by circulating water or glycol at 25C through aluminum tubes. The plan is to

hold the box at 25C; the radiation to the outside world, despite the large delta-T expected in the Winter, is only on the order of tens of watts, because of the excellent insulation of the box panels. The instrument is moved on jacked-down wheels and rests on a three point kinematic mount. "Spherolator" plates mounted to the platform maintain the alignment. PFS takes up a good deal of the platform, and was sized to fit on the elevator --- just barely. Attention has been paid to making the installation/de-installation as straightforward as possible. The dewar can be filled (LN2), and the vacuum pumped without opening the box. There is no ion pump on the dewar, but this could be retrofitted, on the dewar or even outside, as pointed out by Andy.

Fore-optics were needed to convert from the f/11 telescope input to the f/5 needed for instrument; the fore-optics also include a beamsplitter for guiding on the image and a flip mirror for ThAr & QTH calibration lamps. Some compromises were made for precision, stability, and cost (for example, a single, underfilled grating) that do have a small impact on planet finding, but will limit to some extent the ability to use PFS for fainter targets. An interesting innovation is that the grating is kept in a vacuum (not the whole instrument, as is the plan for VLT-HARPS).

The optical elements are all fabricated; the multiplets are being glued. There was some discussion about whether different thermal set points for the different seasons would be necessary to achieve the "tens of watts" thermal dump into the dome.

Andy Szentgyorgyi: MMIRS (MMT & Magellan Infrared Spectgrograph)

Brian McCleod is the PI.

Pictures were shown of hardware: the instrument is being assembled; electronics are being finished.

A new TSIP grant (with observing time to come out of Harvard share) will provide enough money to finish MMIRS. Plan is to get MMIRS to MMT in Feb '09.

Paul asks about commissioning MMIRS and MegaCAM together to limit the number of top-end swaps. The CfA group is small, Andy says, and would rather do the commissionings serially. Ian points out that both instruments would have already been brought to working order on the MMT before they come to Magellan. Mark Phillips suggests we take this as a suggestion for now and let the MMIRS instrument team and the Magellan staff consider the options as more is learned about the f/5 operation, down the road.

Paul also points out that Brian McLeod has been experimenting with using out-of-focus images to measure collimation of the MMT; one result, Brian believes, is that the secondary tilt for the MMT may not be the optimal one.

Paul Schechter: FIRE

2 full-time Mech Engineers (Matt Smith, Jason Fishner) began in Dec 2007
Bernstein and Bigelow (UCSC) are also still working on FIRE
2 MIT postdocs arrive in Fall 2008
Other personnel: MIT Simcoe, Burgasser, Schechter, Smith, Fishner
UCSC: Bernstein, Bigelow
Rochester Pipher, Forest, McMurphy

Some design changes have been made: one fewer ZnSe prism, slightly smaller prisms, Offner folds behind the spectrograph. The mechanical design is at advanced stage; FEA has been carried out, in response to the PDR. Opto-mechanical designs are nearing completion; they are somewhat below CDR level. Mini-review for opto-mech assemblies is planned.

HgCdTe detectors, sidecars delivered, are being tested. An engineering grade detector for the acquisition camera should be delivered in July. Quotes are coming in on the optics, with 8 months to delivery expected. The detector dewar is near completion. Assembly is scheduled for in late-2008/early-2009, with testing and integration in 2009, delivery in 2009B.

Laird Close: AO Commissioning Plan

Magellan TS1 (thin shell 1) to be called ASM (Adaptive Secondary Mirror)
Major milestones: new TSIP award 2/10/08 for wavefront sensor funding and commissioning labor --- about $1M. More than $2M has been raised for the project to this point.

Generation of the 0.87-m shell is complete. 08/01/07: There is a signed MOU with LBT for TS1 and the Reference Body. 08/27/07: Electromechanical test: closed loop l~450 at 1 kHz.

2/15/08: Started MOU for WFS unit with Arcetri (~$700K). Long lead time items (for example, optical pyramids for wave front sensor) have been started.

Starting this Spring, there will be AO closed-loop opto-mechanical test in tower in Italy with TS3 and LBT unit #1 (ASM, WFS, turbulence, etc.)

A meeting will be held to draft the WFS contract at the SPIE in June. The PDR for the Magellan telescope interface is scheduled for 10/08.

Spring ’09 is the target date for finishing the commissioning of AO#1 on LBT. Fall ’09 for AO#2 on tower, on telescope in Spring 2010. Summer 2010 is the target for beginning the calibration of the Magellan ASM system at the test tower. Fall 2010 is the

target for the final “end-to-end” acceptance tests for Magellan AO system and Optical Science camera in the test tower. The Preship review in Italy will follow.

Close emphasizes that, before the Magellan system leaves Italy, a complete AO system will have been tested on LBT --- ASM will benefit completely from LBT experience.

Schedule at present calls for Feb 2011 for first light of Magellan AO (ASM & WFS). Spring 2011 for Magellan AO and MIRAC4 and an AO science CCD commissioned. (CCD test camera – 6” – should deliver ~10% Strehl at 0.8-micron – runs in “real-time.”) First science in Fall 2011 and Spring 2012 is target for acceptance of the Magellan AO system as a facility instrument.

Impact on the Magellan operation includes f/16 storage area, day test support (fit check team, similar to f/11 change, about 2-3 normal daytime Magellan staff). The commissioning team is forecast to be Laird and 3 opto/mech people, Arcetri support, and Instrument scientist. Also an AO night operator and 1 or 2 day crew Magellan support will be needed.

In campaign mode, the operations day team would be UA Instrument Scientist plus (usually) Laird and/or graduate student. The plan would be for an afternoon check out and early night hand off to Magellan AO night operator for observing.

Laird wants to use a “clean tent” in the auxiliary building; he prefers this to the proposed clean room down the hill in the ASB. The tent should be easily assembled/disassembled, to be erected during commissioning and (later) observing runs. Space would be ~ 11’ x 11’ x 9’ (LxWxH). Will need 3-15 phase 208V 15 amp power, and chiller lines.

Close presented a draft commissioning plan, starting in 2010 with the fit up of top end and handling fixtures. The ASM and WFS would be shipped at the end of 2010 for 2 commissioning runs in 2011, a third in reserve. Each would span ~1 week with an engineering day & night on each end. Commissioning starts with use of daytime calibrator (artificial source), alignment of WFS on day 2, closing the loop on the laser. Night 3 would be used to close the loop on a star using the Vis AO CCD. Nights 4-7 would be used to calibrate the system (servo speeds, flexure maps, airmass look-up tables, system sensitivity, etc. The second Commissioning run would be to integrate Mirac4 into the AO system, including nodding and chopping.

Draft operation plan: Starting late in 2011, AO would be ready for some science operations. Data would be obtained in queue mode. Close is not counting on a resident AO expert hired by Magellan. Three campaigns of 20 nights per year might be considered.

Magellan staff support, from 2012 on, would be one TO and one AO-trained Instrument Specialist. There would be an AO Instrument Scientist, provided by the Center for Astronomical Adaptive Optics (CAAO, at Arizona). Because of Chilean labor laws, the cost for the TO and AO totals to a $37k/yr. The system would be handed off in evening

to one special AO operator on Magellan staff, trained and paid at the TO level to run the system for the rest of the night. This would be an additional $37k/yr for 2 AO ops. This means that 5/6 of their time ($243k$/yr) these TOs would work on other things. For AO secondary/instrument change, 2 trained current Magellan staff and the AO instrument scientist are needed. The total is therefore $72k/yr, but the total for the year is ~$243k/yr, so these people need to be paid for and fully integrated into the Magellan staff. How well this all works may depend on whether running the AO system is comparable in complexity to running the telescope itself. This proposal for staffing described by Laird has yet to be endorsed or recommended by the Magellan SAC.

Close showed picture of the shell, the reference plate, the cold plate, the support frame, the hexapods, the electronics, etc., showing that the hardware and components now mostly exist. Results of some dynamic tests on the shell were also shown.

Close talked about the possibility of 10-20% Strehl optical AO imaging, and the need for an ADC corrector for the system. A 2-triplet design was presented.

A single-probe Magellan guider will be constructed for the AO system, which would be used to tune up the primary from time-to-time. Paul suggested that all the WF correction could be done with the AO system, including the M1 correction, if these could be communicated in Zernike modes. Laird argued that it is advantageous to have an externally collimated telescope to start with, but Paul says this could be done well enough even with the direct image on the AO CCD camera. Given the potential savings of $100K or more, this is worth considering --- a dialog on this will continue.

Laird showed some 10-micron images of T Tauri from the MMT with 100% Strehls and an extremely stable psf, which show the faint disk occulting the light from the most massive component of T Tauri (which is a triplet).

After lunch, the Executive Summary of the “Port Report” was edited by the SAC to incorporate the previous day’s presentations and discussions.

Next SAC telecon on July 8, 2008, 11:00 PDT.

Next SAC meeting March 21, 22, 2009 in Pasadena.

Meeting adjourned at 1:30 PDT.