8-M Telescopes Project
NEWSLETTER
June 1995 Number 10

Progress and Change

When you have stood on your first Gemini primary mirror blank, looking around at the 50 square meter expanse of Ultra Low Expansion™ glass beneath your feet, it is difficult to escape the conclusion that undertaking to use this 23 ton blank to focus the energy from the nucleus of a distant galaxy into a spot about the size of the point of a needle (40 microns), is quite a responsibility. Suddenly the Gemini Project has become very real. We have our first mirror blank sitting in the Corning factory at Canton, New York (see Figures 1-4). We have broken ground in Hawaii, laid the first foundation stone on Cerro Pachon, and all our international partners have formally signed the International Gemini Agreement.

Not everything has gone according to plan. An early winter on Mauna Kea has meant we have had to push back the Gemini North schedule for first light five months to December 1998 - however, work on Mauna Kea is now vigorously underway. Secondly, very high bids for the Mauna Kea construction meant we had to descope the support building. This was accomplished without sacrificing the performance of the enclosure and its thermal control system. As shown in Figure 5, the schedule for first light at Cerro Pachon and the overall construction project duration are not affected by the delay at Mauna Kea. Site preparation at Cerro Pachon is proceeding on schedule.

Despite these hiccups, first light for the Mauna Kea Telescope is now a little over three and a half years away. The computer models are becoming glass, steel, and lines of code, and our walls here in the project office in Tucson are becoming festooned with a myriad of interface diagrams and commissioning

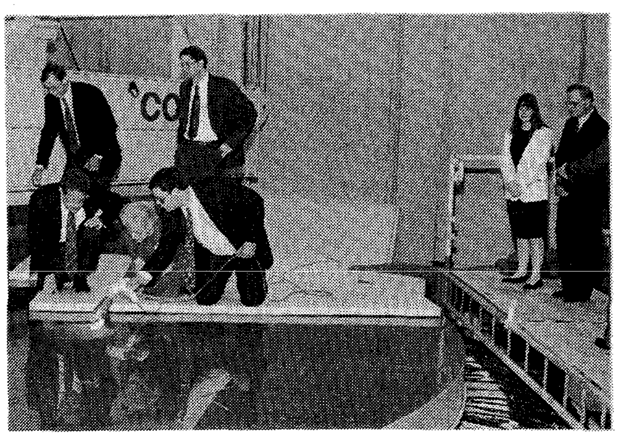

Figure 1. Members of the Gemini and Corning Teams inspecting, at close quarters, the quality of the first Gemini Blank.

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schedules. The character of the of the Gemini Project is changing.
A key part of this change is the growing realization that the Gemini Telescopes will have to be used in new and novels ways if our astronomical communities are to fully exploit Gemini's unique scientific capabilities in the variable environments of the sites (see Figure 6).

The Gemini Science Committee at its October 1994 meeting in Chile passed the following resolution, which was subsequently endorsed by the Gemini Board.

"The GSC recognizes that observing time will be at a premium on the Gemini telescopes, and that every effort must be taken to obtain observations in a highly efficient manner that exploits the unique characteristics of the telescopes and sites. Although it is recognized that some programs will be carried out in classical observing modes, the GSC also believes that to exploit the best conditions scientifically, be they of seeing, atmospheric emissivity, or conditions suitable for AO, it will be necessary to allocate at least 50% of telescope time on average as queue scheduled observing during the operations phase. To realize effective and reliable queue scheduling, the GSC further recognized that:

(1) Alternative observing modes, such as remote observing and remote monitoring, will need to be investigated;

(2) The time accounting schemes for queue and classical observing modes will have to be different, with time for queue observing based on hours actually used, and time for classical observing based on the total allocated hours;

(3) Observing time will have to be allocated internationally, involving both telescopes, to allow the operations team maximum flexibility in optimizing the scientific return of the Gemini Partnership."

This of course opens up a whole raft of questions, such as:

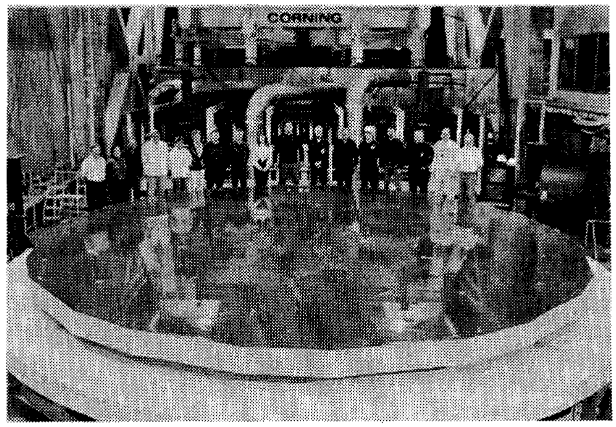

Figure 2. The first Gemini blank after fusing.

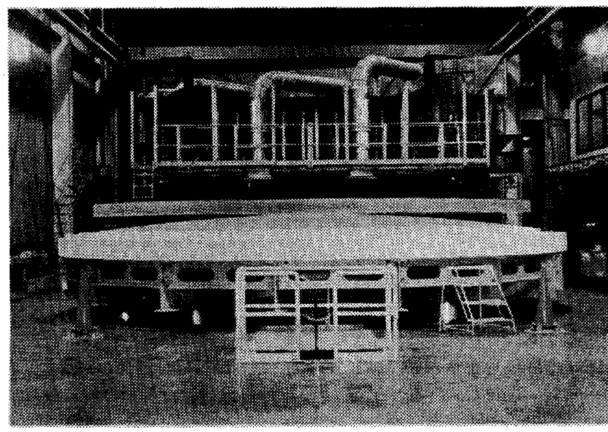

Figure 3. The fused blank balancing on the slumping form. This is the point of maximum stress in the life of this mirror blank, and shows the natural strength and stiffness of this type of mirror.

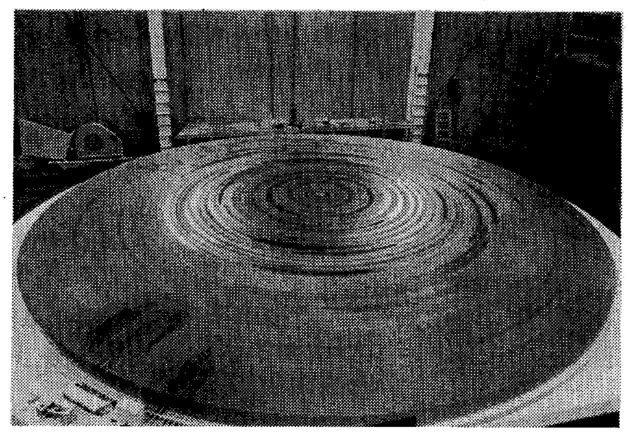

Figure 4. The ULE blank after being heated to 1400 C and slumped over the slumping form. This photograph was taken 4 days after the high fire, the rings on the blank result from natural gas jets 'polishing' the surface as the blank rotates during the high fire.

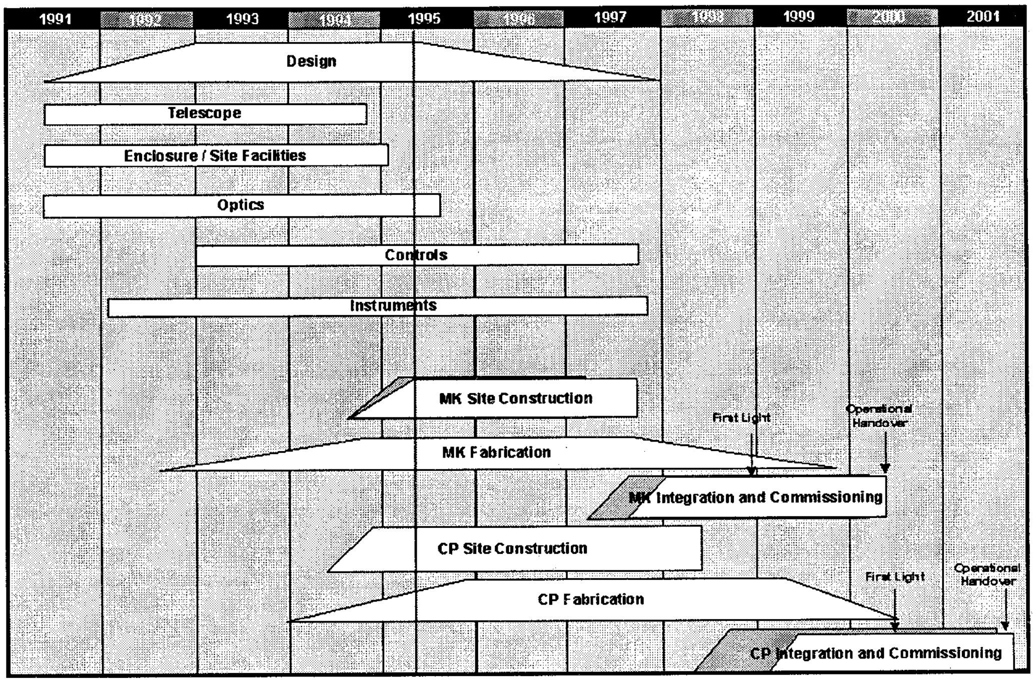

Figure 5. Top-level Gemini schedule with the changes due to delays in Mauna Kea site construction.

- Who decides when a given observation gets done?
- How should time be allocated, as allotted time or time to achieve a given signal to noise level?
- Who is responsible for the observations and data, the staff astronomer or the principal investigator?
- What is the role of remote observing in 21st century ground-based astronomy?
- What can we learn from the experiences in other fields such as radio and space astronomy?

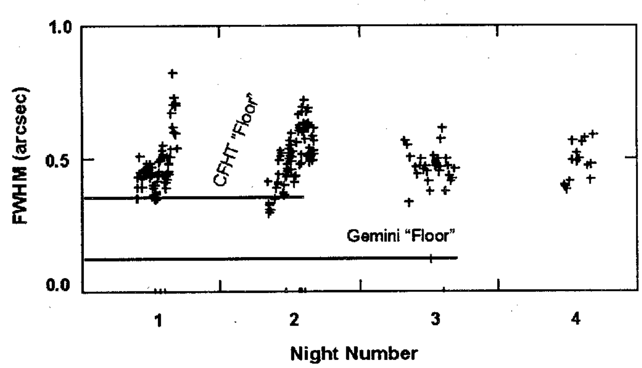

Figure 6. Several nights of seeing on Mauna Kea, as measured by the CFHT. The seeing can change by factors of 3 and essentially bottoms out at approximately 0.3 arcseconds. With Gemini, our special emphasis on image quality means that this seeing floor will be substantially lower, resulting in a far larger dynamic range of possible delivered image sizes. For point-like sources, integration times to reach a given signal to noise can vary by an order of magnitude depending on conditions.

To try and answer these and other questions, Gemini, along with ESO, the Joint Astronomy Center in Hawaii, and the US Gemini Project Office of NOAO, is sponsoring an international workshop to consider innovative observing and scheduling strategies for modern large optical and infrared telescopes. It will be held at the University of Hawaii, Hilo on the Big Island of Hawaii, from July 6 - July 8, and is called **New Observing Modes for the Next Century**. Full details can be found on Gemini's World Wide Web page.

Finally, the Gemini Project owes an incalculable debt to Sidney Wolff, the first Gemini Director, for getting us this far. The US National Science Foundation awarded Sidney their "Meritorious Public Service Award"; please read the citation which follows.

-Matt Mountain
Director

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OFFICE OF THE DIRECTOR

MERITORIOUS PUBLIC SERVICE AWARD

SIDNEY C. WOLFF

When Sidney C. Wolff stepped into the Gemini twin 8-meter telescope Project as Acting Director in June 1992, she accepted a daunting task. The Gemini Project was gravely troubled by considerable contention about the primary mirror design and complaints about uneven management. That the Project is flourishing today, only 2 years later, is due in large part to her efforts.

Her immediate actions on assuming the position were to strengthen the management operations by reorganizing the staff and promptly hiring a very able Project Manager and bringing him up to speed. This improved the morale of the Project staff, and enabled the Project to respond strongly at the Primary Mirror Preliminary Design Review.

The success of the Preliminary Design Review of the primary mirror can be attributed to Dr. Wolff's perspective, perspicuity, perseverance, and persuasiveness. Her courage in the face of considerable skepticism on the part of the US astronomical community, her open-mindedness (with a close eye on restraining costs) in considering alternative technologies, her thoroughness in preparing and presenting the defense of the thin meniscus design decision, with the help of the excellent staff she motivated, all contributed to winning the approval of the mirror design. Dr. Wolff's leadership and tact in this very controversial situation have earned the respect and trust of her management and support staff, and of the Gemini Board members, representing the six international partners. Without the consensus she obtained, the Gemini Project would probably have died.

Dr. Wolff has moved the Project forward while keeping within the strict budgetary limitations. She has maintained a well-planned construction and commissioning schedule, fairly distributed among the international partners. Despite the difficulty of acting as director of Gemini on top of her ongoing NOAO directorship, her extensive efforts have kept the Gemini priorities clearly in view.

The National Science Foundation presents this Meritorious Public Service Award to Gemini Acting Project Director Sidney C. Wolff in recognition of:

- her outstanding support of the Gemini Project and her success in revitalizing it;
- her efforts in establishing the validity of the Gemini thin meniscus mirror approach;
- her care to produce a viable project plan within the limits of a stringent cost ceiling;
- and her ability to manage an international program to the satisfaction of all parties.

November 17, 1994

Neal Lane
Neal F. Lane
Director

Project Scientist's OUTLOOK

In May 1994, the Gemini Board approved the following instrumentation program for the Gemini telescopes (Gemini Newsletter, June 1994).

Mauna Kea	Cerro Pachon
Optical Acquisition Camera	Optical Acquisition Camera
1-5µm Imager	Multi-Object Spectrograph
1-5µm Spectrograph	High Resolution Optical Spectrograph
Multi-Object Spectrograph	Shared Instrumentation with CTIO
8-30µm Imager ←--------	--------→ (May be shared between Gemini North and South)
CFHT Fiber Feed	

The Gemini Science Committee (GSC) has established the following requirements, options, and goals for each of these instruments.

The 1-5µm imager will be used for commissioning the Mauna Kea telescope, as well as for scientific observations, and will have the following capabilities:

- **1-5.5µm wavelength coverage**
- **Array**: 1024x1024 InSb array, 27µm pixels
- **High Throughput**
- **Internal Instrument Background:**
  - < 1/2 telescope emissivity for wavelength >2.2µm
  - < 0.5 e/s/pix at shorter wavelengths
- **Three Plate Scales:**

Pixel Size	Field of View
0.02"	20"
0.04"	43"
0.1"	100"

- **Filter Requirements**: two wheels of 20-30 slots for filters, grisms, and polarizers
- **Goals**:
  - Design for 2048 x 2048 arrays
  - Grism capability; R~700, 1-2.5µm
  - Coronagraphic mode
  - Pupil viewing

The 1-5µm Spectrograph for Mauna Kea is planned to be the second instrument available on the telescope, and its capabilities will be:

- **Wavelength coverage**: 0.9-5.5µm
- **Array**: 1024x1024, InSb array, 27µm pixels
- **High Throughput**
- **Spectral Resolution**: R ~ 2,000, R >= 8,000
- **Pixel Scale**: 0."05 / pixel
- **Slit Width:** 0."1 to 0."2
- **Slit Length**: >= 50 arcsec
- **Polarizing Prism**: Yes
- **Desirable Options**:
  - Integral Field Mode
  - Cross Dispersion or Simultaneous Wavelength Coverage
  - Multi-Slit
  - Slit Length of 150 arcsec, with a pixel scale of 0.15 arcsec/pixel
  - Spectral resolutions of 15,000 - 30,000

There will be two Multi-Object Spectrographs (MOS), one for Mauna Kea, optimized for performance in the 0.5µm to 1.1µm range, and one for Cerro Pachon, optimized for performance in the 0.3 to 0.5µm range. Their other capabilities will be:

- **Arrays**: 4096x4096 CCD, 15µm pixels
- **Image Scale**: 0.08-0.10 arcsec/pixel
- **Slit Sampling**: 2.5 times the image pixel scale
- **Imaging Mode**: Supports MOS mask production
- **Spectral Resolution**: up to 10,000
- **Integral Field Mode**: Sub-apertures with dia. 2.5 times the pixel scale, 8 arcsec FOV
- **Optional/Desirable Features**:
  - Extension of Wavelength Coverage to UV atmospheric cutoff and to 1.8µm
  - A high spatial resolution integral field mode at >0.7µm

The 8-30µm imager will initially be deployed at Mauna Kea and will be available for use at first light on Cerro Pachon. Its capabilities will be:

- **Wavelength Range**: 5 to 25 µm
- **Array**: ~256x256 Si:As IBC
- **High Throughput**
- **Plate Scale**: ≤ 0.13 arcsec/pixel
- **Instrument Background**: < 1% effective emissivity

- **Filter Requirements**: 20-30 cold filters
- **Desirable Options:**
  - Dichroic feed to InSb array for NIR guiding/simultaneous imaging
  - Optical design consistent with x2 upgrade in array size

The High Resolution Optical Spectrograph (HROS) will be the second optical instrument installed at Cerro Pachon and will include the following capabilities:

- **Array**: 4096x4096 CCD, 15μm pixels
- **Throughput is Highest Scientific Priority, particularly in UV**
  - –Requirement: >10% at R=50,000 and 500nm; goal 15%
- **Resolution**: in the range of 30,000 to 80,000, resolution >120,000 is a second priority
- **Stability**:
  - –Cassegrain - Maximum Motion of 2μm per Hour of Tracking (1/20th of a Resolution Element Per Hour)
  - –Fiber Fed - Stability of 30 m/s in the High Stability Lab
- **Slit**:
  - –Width 0.6"@R=50,000, 0.24"@R=120,000
  - –Length Up to 1'
- **Sampling**: 2.5 Pixels per Resolution Element

The commissioning instrument for the Cerro Pachon telescope will be a 1-5μm imager borrowed from CTIO. This instrument is expected to be the Cryogenic Optical Bench detector (COB), currently in use on the KPNO telescopes. NOAO plans to upgrade the array in COB to 1024x1024 InSb and make it available at CTIO in 1996. When mounted on the Gemini telescope, the expected capability will be:

- **Wavelength range: 1-5.5μm**
- **Array:1024x1024 InSb**
- **Pixel size: 0.05"**
- **Internal optical/IR dichroic for acquisition/guiding**
- **Two filter wheels with 40 filter positions**
  - –Broad bandpass imaging
  - –Narrow bandpass imaging
- **Long slit grism spectroscopy; resolution ~500 in the J, H, and K bands**
- **Polarimetry**
- **Closed cycle cooler operation**

The Optical Acquisition Cameras listed are not scientific instruments, but provide basic acquisition capabilities and are considered to be part of the Acquisition and Guiding unit. The only scientific optical imaging capability available will be that provided in the MOS instruments.

The Mauna Kea telescope will be equipped with a natural guide star adaptive optics (AO) capability as part of the initial facility. The GSC requirements for this system are:

- Delivered strehl ratio >0.5 at 1.6μm in median seeing conditions. This requirement is expected to deliver a Strehl ratio of ~0.2 at 0.7μm in the best tenth percentile conditions;
- Maximizing image concentration and sky coverage for 0.7μm to 5μm;
- Emissivity less than 15% for wavelengths between 2.2 and 5μm, with a goal of less than 10%;
- Throughput should be maximized in the 0.5μm to 5μm band and should not be less than 50% in this band;
- The natural guide star AO system should be designed in such a way that it can be upgraded to a laser guide star system with the priority of increasing the system's sky coverage at the above performance levels.

Because of the limited budget available for the initial instrumentation, the GSC is planning on sharing instrumentation with UKIRT, CFHT and CTIO.

Royal Observatory Edinburgh's Mid-IR Spectrometer (Michelle)

- **Based on ~256x256 Si:As IBC Array**
- **Long slit spectroscopy, 8-25μm range**
  - –R~200: 8-13μm window in a single exposure
  - –R~1000: Optimum detectivity of narrow ionic and molecular emission lines
  - –R~30,000: Velocity resolved observations of narrow emission lines
  - –Pixel scale: 0.18"
  - –Slit width: 0.36"
- **Diffraction limited imaging**
  - –Pixel scale: 0.10"
- **Background limited sensitivity under all of the above conditions**

NOAO's High Resolution IR Echelle Spectrometer (Phoenix)

- **1024x512 InSb array**
- **1-5μm**
  - –Resolution: R~100,000 (2 pixel) or 67,000 (3 pixel)
  - –Pixel scale: 0.09 arcsecond
  - –Slit width: 0.17 arcsecond (2 pixel) or 0.26 arcsecond (3 pixel)
  - –Slit length: 14 arcseconds
  - –Spectral format: Single echelle order displayed, band pass = 1500 km/s
- **Guiding - visible light sent to port for tip/tilt sensor**

- **Infrared direct imaging and pupil imaging**
- **Closed cycle cooler operation**

The spectral and spatial resolution coverage provided by this instrumentation program is summarized in Figures 7 and 8. Despite the limited resources, the initial complement of instrumentation provides quite good coverage of O/IR parameter space for the Gemini telescopes, with the exception of IR spectroscopic capability at Cerro Pachon.

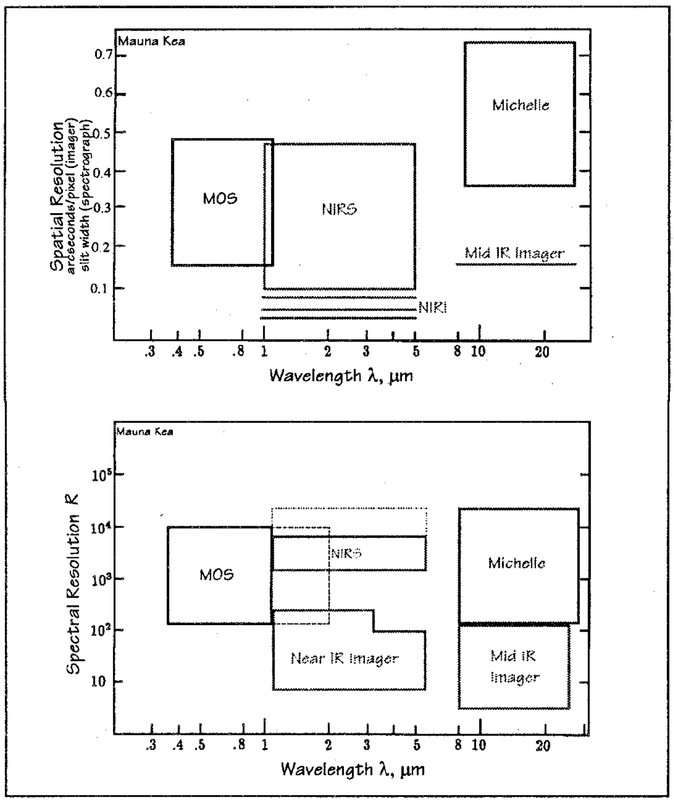

Figure 7. Initial Instrument Complement - Mauna Kea.

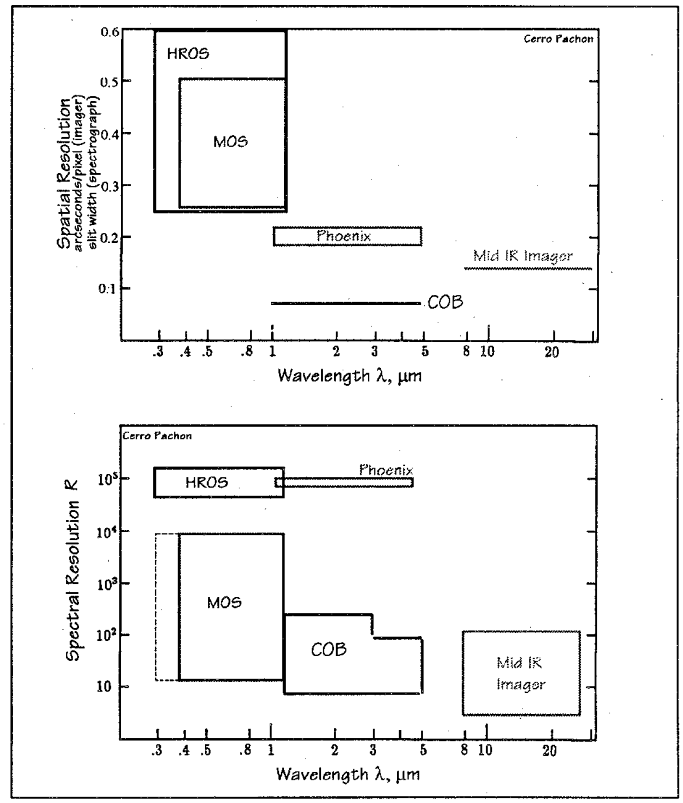

Figure 8. Initial Instrument Complement - Cerro Pachon.

-Fred Gillett
Project Scientist

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Systems Engineering

Several major accomplishments have been made in the systems engineering area:

- Organization of interfaces;
- Implementation of databases for tracking ICDs, other documents, and drawings;
- Continued planning for the system integration and test (I&T) phase of Gemini;
- System Review No. 2;
- Hiring a new electronic system engineer.

Interface Control. Gemini system and subsystem interfaces have now been organized through use of what is known as a modified N^2 diagram. An example of part of this diagram is given below. This is a method which helps to identify interfaces which should be defined and tracked from an overall system perspective.

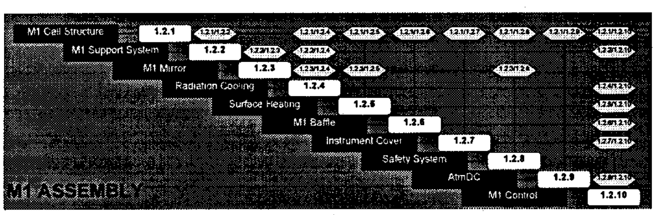

Figure 9. N^2 diagram example - Mirror Cell Assembly

The diagonal of the chart represents all subsystems based upon subcontract or workpackage boundaries. Scanning from any subsystem up or to the right gives the identified interfaces which need to be defined and formally tracked. These were identified through several people in each of the groups in Gemini. Once this was iterated with systems engineering and all of the groups, a database was set up by Ruth Kneale and Dan Ecklund to help track these Interface Control Documents (ICDs). It does electronically what scanning this graphical chart by eye does and includes information on whether a particular ICD is in work, under control, what is the current version, and other relevant information. We are currently in process of 'filling in' the information on this database. A standard form for the actual ICDs has been identified and the currently controlled ICDs are in the process of being revised to conform to this format and new organization.

A similar database for drawing control has been in place for awhile. Ruth has also generated a first version of a general document database to ease tracking of all project documents. She is also in the process of adding a list of releasable Gemini Documents to Gemini's area on the World Wide Web. Ruth has the overall responsibility for document control and also is the individual who maintains the Gemini information shown on the Web.

Susan Wieland has been working on the first set of ICDs for the instrumentation areas. Drafts of these should be available in the next few weeks. Gordon Pentland is currently revising the telescope structure ICDs, which are under formal control, to conform with the new organization and format.

System Integration and Test Planning. An overview of our system I&T plans was generated in December and January in the form of a flow diagram. This diagram begins with a 'box' for each subsystem as identified in the ICD organization process. The flow is carried to the level needed to show the 'path' of how each subsystem or component is integrated through a series of subsystem I&T activities at various locations throughout the world, sea level I&T activities in Hawaii and Chile, to preparation and installation into the 'system' on the mountain top. From here, various system test activities are highlighted as the various subsystems become integrated to the overall observatory. This plan has been iterated with all of the groups, scientific staff and chief engineer. It serves as an outline. Each identified area will have further details developed into specific I&T plans (some already have preliminary descriptions in various workpackage descriptions). Dan Ecklund and I are currently in the process of generating a specific system

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I&T schedule which corresponds to this chart. This will provide the next level of detail from what is currently in our master schedule and will be used to fill out our overall commissioning plans through to handover to operations.

System Review No. 2. Gemini's second system level review was held in March. Most of the original committee from the first review were present. The review was chaired by Bob Fugate of the Starfire Optical Range. The other committee members were:

- Antony Abraham -NOAO
- Jack Baldwin - CTIO
- Tim Hawarden - JAC
- Matt Johns - OCIW
- Rick Murowinski - DAO
- Ethan Schreier - STScI
- Bob Shannon - UofA Optical Sciences Center
- Keith Shortridge - AAT
- Richard Wade - DRAL
- Manfred Ziebell - ESO

The concentration of this review was on the primary mirror cell assembly progress, all systems related to the mirror (coating, cleaning, handling, etc.), and the preliminary system integration and test plans (described above).

The review went well. Quoting from the report, "In general the committee thought this review very useful. We think having less formal material to present and more time for discussion is an improvement over the first review. We look forward to future reviews." Most of the 63 actions and general concerns from System Review No. 1 had been adequately covered in the material prepared for this review and/or in the presentations. In the few areas not yet covered adequately, a new action or suggestion was generated.

Though no 'show-stoppers' were found, the committee produced a seven-page report and a list of 31 actions/concerns/suggestions on a large variety of topics. The project will be working on addressing these items over the next few months and should have a first draft response to these items in the next few weeks outlining our plans for each of these suggestions.

New Staff. We are pleased to welcome John Horne to our staff as an electronic systems engineer. John has an extensive electronics background including 5 years at the CFHT on Mauna Kea. John is responsible for Gemini's overall electronic interfaces, from understanding how everything will play together as a 'system' to the details of system cabling and services.

-Jim Oschmann
Systems Engineer

Telescope Structure, Building/Enclosure

As the TSBEG is completing the design tasks and is rapidly moving into construction and fabrication, the size of the TSBEG group has reduced together with a reassignment of responsibilities. There are now only five engineers in the group, with the equivalent of two engineers working on the telescope. Mark Warner works full time on the telescope. Gordon Pentland works principally for the TSBEG group, but is also involved with interface control work for the Systems Group. Mike Sheehan works part time on the telescope and is now the enclosure engineer, since Steve Hardash moved to Hawaii to become the Mauna Kea site engineer. In the southern hemisphere, Paul Gillett continues as the Cerro Pachon site engineer. Ruth Kneale has transferred to the Systems Group, and Naomi Libby has transferred to central project administration.

Telescope Structure. The telescope RFP was released in February 1994 as an international bid with firms invited to bid from partner countries and from other countries where contractors possessed special

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expertise and facilities. After many months of intense proposal evaluation, discussions, and negotiations a contract for the fabrication, test assembly, and shipping of the telescope structure has been awarded to a firm in France, G.I.E. Telas. The kickoff meeting for the contract was held 18-21 April. Mark Warner from the TSBEG group relocated to Lyon, France, on 10 April to be the site engineer for this contract.

A significant level of effort over the last few months was expended on the contract negotiations so technical work has been limited to:

- Developing telescope site-assembly alignment requirements and procedures;
- Analyzing machinery vibration transmission from the equipment mounts to the telescope pier;
- Updating interfaces to the telescope structure;
- Testing the disk guided friction driven encoder.

Enclosure. An 80% design review was held in Tucson on October 11-12, 1994. Coast Steel Fabricators (CSF) presented the enclosure design and analysis. As the design information presented was not at the 80% design level, approval of the CSF fabrication drawings was postponed until the design had developed adequately and a further review had been held in March. The first fabrication submittals have been approved, and fabrication of the enclosure started at the end of April.

Mauna Kea Site. Access road construction started in October 1994 after bidding and placing a contract with San Juan Construction Company. Within a few weeks of starting work at the site, 18 inches of snow fell on the construction area. As the construction equipment was not safe to operate in snow, the contractor was forced to abandon the site till the weather improved. In mid- January, San Juan remobilized and resumed construction of the road. Progress was slow as the construction was severely hampered for the next 2 months by winds exceeding 100 mph and freezing fog. Despite these problems, the road was completed by the end of April, which will allow another contractor, Keauhou Kona Resort Company, to start relocating the utilities that cross our site and demolishing the 24-inch telescope that currently occupies our site.

A request for proposals for the Mauna Kea site, foundation, telescope pier, electrical, mechanical and architectural work was issued in September 1994. Only two companies responded and both of the proposal costs were unacceptably high. Consequently, we performed value engineering on the design and restructured the bidding process. Between November 1994 and March 1995, design tradeoffs were performed to reduce the construction cost, approval was sought and obtained from the Gemini Science Committee for the new design. M3 Engineering produced a complete set of construction drawings and specifications for the site and foundation work and the steel fabrication work, an IFB was written for the foundation work and issued to contractors, bids were prepared by contractors and delivered to Gemini, a contractor was selected, contractual terms were agreed, and a contract signed with San Juan Construction. Construction of the foundations and telescope pier will start later this year after the access road has been constructed and the utilities relocated.

Cerro Pachon Site. Work on the southern Gemini site is progressing rapidly, with a significant level of achievement on the road construction, power line installation, excavation and dormitory construction. Much of this work is due to the efforts of Paul Gillett and Enrique Figueroa and his team at CTIO.

M3 Engineering completed the foundation package and the steel fabrication package drawings and specifications in January 1995. The foundation work and the steel site erection work was then bid in Chile, and the steel fabrication bid in Chile, Argentina and Brazil. Bids have been received and are currently being evaluated.

M3 will soon start the design of the Enclosure Base and Support Facility architectural, mechanical and electrical systems.

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CTIO have completed the excavation for the telescope pier, which is located 6 meters below grade level to reach good quality rock. They have now started excavation for the enclosure base and support facility foundations. The excavation work will be completed by the end of May, ready to start pouring concrete.

Dimetel has completed the installation of 17 km of power lines through the Elqui valley and up the east face of Cerro Pachon. The work has been tested and formally accepted by AURA and the power utility company.

The road construction being performed by CTIO is progressing well. They have completed 3 km of new road and have started drilling and blasting on the existing road between Cerro Pachon and Cerro Tololo to improve the road to allow transport of 10-m wide loads. The new road has been constructed to a very high level of quality.

The 20-unit dorm has now been relocated to Pachon. Pena, a local contractor, is now completing the interior of the building.

Plans have been finalized in preparation for the move of a 52,000 gallon steel water tank from the Tololo road to a location on Cerro Pachon.

Coating Plant, In-Situ Cleaning, Protected Silver Coatings. On November 1-2 the coating plant, protected silver coating, and in-situ primary mirror cleaning PDR was held in Tucson. Brian Mack presented the work being performed by the Royal Observatories on the design of the coating plant and the sputtering development he and his team have been undertaking using the 4.2-m WHT coating chamber. Mike Jacobson presented the results of the protected silver coating program, and Wayne Kimura presented the results of the excimer laser cleaning program. The CDR for the coating plant was held in Tucson on April 27, prior to bidding the fabrication of the coating plant and the vacuum pumping systems.

The Royal Observatory performed three sputtering test runs in the WHT 4.2-m coating plant on La Palma. Results for sputtered aluminum were excellent, achieving emissivities at 3.8 microns, between 2.0% and 2.1%. The tests were performed to optimize the hardware and parameters necessary to deposit high quality, low emissivity aluminum coatings. Preliminary results for sputtered silver also look very promising.

The protected silver coating program, being co-ordinated by Mike Jacobson at Optical Data Associates, has now been completed. Both the silicon nitride overcoated silver being developed by ACT and the hafnia overcoated silver being developed by DSI are achieving emissivities at 3.8 microns of 1%.

Further tests are being performed to compare the performance of 308nm and 351nm excimer laser cleaning systems. The 351nm Excimer laser is being tested because its wavelength is more suitable for protected silver coatings than 308nm, where silver has high absorption.

-Keith Raybould
Telescope Structure, Building, and Enclosure Manager

Optics

Optics Group activities are ramping up in a number of areas, thanks to increasing support from partner institutions and subcontractors.

Primary Mirror (M1) Blanks. The project passed a major milestone with the successful slumping of the first primary mirror blank in early March. Prior to slumping, the mirror blank had been a flat disk. It is now curved to its final shape with a spherical radius of 28.8 meters. In the slumping process the blank was

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subjected to the highest stress it will see during its entire lifetime without encountering any difficulty. It was remarkable to see the blank sitting on the slumping form, with all its weight supported on a one-meter diameter spot in the center (see Figure 3). However, to the Corning personnel it was a well-established operation, since this is the second blank they have produced larger than 8 meters.

Corning is doing an excellent job of keeping the work on schedule. Generation of the first blank to net shape is in process. All surfaces of the blank will be generated, and the back and edges will be acid etched prior to delivery, which is scheduled for November 1995.

Work on the second mirror blank is still slightly ahead of schedule. All the necessary boules of ULE™ have been produced and have passed inspection. The boules have all been sealed together into two-boule stacks of the correct thickness, and more than 80% of the stacks have been cut into hexagonal pieces in preparation for fusing into the monolithic blank this December.

Primary Mirror Polishing. REOSC is in the process of developing detailed plans for transporting the mirror blanks from the Corning plant in Canton, New York, to the REOSC facility south of Paris. They have begun fabrication of the special shipping container they will use to transport the Gemini mirrors. It will be completed and fully tested prior to its use transporting the first mirror blank to France in November. Other preparations, including tooling development and handling fixture modifications, are also progressing well.

M1 Cell Assembly. The M1 cell assembly supports the primary mirror. It consists of a steel structure into which are mounted the mirror support, the mirror thermal control system, and other associated equipment.

The M1 cell assembly is being developed in a collaboration between the Optics Group in Tucson and the Royal Greenwich Observatory (RGO) in Cambridge, England. RGO is responsible for the support system and all of its associated equipment, electronics and control systems. The Optics Group is developing the cell structure, the thermal control system, and ancillary equipment such as stray light baffles.

RGO is making good progress on the design of the support system, which will have active optics capabilities. Prototypes of the support mechanisms have been built, and a test rig has been constructed to test the performance of interconnected axial and lateral support mechanisms along with their control systems.

The design of the cell structure has been completed, and a request for proposals is being prepared for the steel fabrication work.

The thermal management system for the primary mirror consists of two subsystems. A radiation plate mounted behind the mirror will control the bulk temperature of the mirror substrate, and a surface heating subsystem will make rapid adjustments to the mirror front surface temperature in order to avoid "mirror seeing" effects as environmental conditions change.

The system-level design work for the radiation plate system has been completed by Optics Group staff, and a request for proposals has been issued for detailed design and fabrication of the hardware. We are currently in the final stages of evaluating the proposals.

Developmental testing is in progress on small scale prototypes of the surface heating system. Dr. David Hagelbarger of NOAO and the Gemini Chief Engineer, Dr. Earl Pearson, have been leading the experimental work. We have received excellent support from NOAO, and they have worked with us to keep the developmental costs low, letting us borrow lab space, prototype mirrors and test equipment, and providing technician support and mirror coating services at modest cost. Our thanks to Larry Daggert

GEMINI GROUP UPDATES

and the NOAO engineering staff. These experiments are expected to result in a mature design by the time of the Critical Design Review for the M1 Cell Assembly this summer.

M1 Lifting Fixture. The M1 lifting fixture will be used to lift the primary mirror out of the M1 cell assembly and place it into the vacuum chamber for recoating. The preliminary design has been developed by Optics Group staff members. The detailed design is being completed by the Optomechanical Engineering Group at the Optical Sciences Center of the University of Arizona, under subcontract to Gemini.

Secondary Mirror (M2) Tilt System. A contract has recently been issued to the Palo Alto Research Laboratories of the Lockheed Missiles and Space Company for design and fabrication of the M2 tilt mechanism. These articulation systems will provide fast focus and tip-tilt motion of the F/16 secondary mirrors for image stabilization, and will accomplish the mirror "chopping" motion required for background subtraction in the thermal infrared.

The F/16 secondary mirrors will be 1.02 meters in diameter. These are larger than any secondary mirrors previously used for chopping or fast tip-tilt applications, although the European Southern Observatory plans to use even larger chopping secondaries in their VLT. The large size, combined with tight positioning specifications, poses a challenge to the tilt mechanism design.

Lockheed's design is based on their previous experience designing large mirror tilting systems. For example, they designed and fabricated the chopping system for the Keck I telescope as well as the more advanced chopping / fast tip-tilt system for Keck II. The Keck chopping secondaries are more than half a meter in diameter. The Lockheed design avoids vibration input to the telescope structure by a combination of passive momentum cancellation using a counterbalance mass, along with active cancellation using electrodynamic actuators with load cell feedback. Proprietary Lockheed adaptive algorithms will be used to "tune" the system to take into account the flexural properties of the as-built secondary mirrors and mounting hardware.

Secondary Mirrors. A number of excellent proposals have been received in response to the request for proposals to fabricate and finish the F/16 secondary mirrors. These mirrors will be made of silicon carbide, taking advantage of its excellent material properties. Silicon carbide is tough and durable, and is resistant to most solvents and chemicals. It is light weight and extremely stiff, which is important because the mirror will be supported at only three points, and will be subjected to fast tilting motions. Silicon carbide also has a low coefficient of thermal expansion and excellent thermal conductivity, which will help prevent distortion of the mirror shape from changing ambient temperatures. We expect to select the vendor for the secondary mirrors in the next few months.

-Larry Stepp
Optics Manager

Controls

Software System Design Passes CDR. The Gemini software design description (SDD) underwent critical design review in late September of last year and was accepted by the review committee. The design presented provides an overall view of the control system. Since the review, individual work package development teams have been assigned the task of completing the design for each subsystem. The current version of the SDD is available via anonymous ftp from:

gemini.tuc.noao.edu:
~ftp/gemini/Controls_Group/Postscript_Docs

Be forewarned that it isn't small and should be printed during off-hours!

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Interface Control Documents. The Interface Control Documents (ICDs) for Gemini software were reviewed along with the SDD and were accepted by the review committee. These documents describe the protocols for all interfaces either between two different work packages or common to two or more work packages. Although accepted, the ICDs are considered living documents that will evolve as the development progresses. As with the SDD, the ICDs have been assigned to individual work packages for further refinement. Current versions of the ICDs are available at the same location as the SDD.

Principal Systems Meeting. The work package responsibles for the principal systems:

- Core Instrument Control System - Steven Beard, ROE
- Data Handling System - Severin Gaudet, DAO
- Observatory Control System - Kim Gillies, NOAO
- Telescope Control System - Chris Mayer, RGO

met with the Controls Group in Tucson early this year. The meeting was to make sure that the work package developers are aware of the interfaces with other systems and their planned development schedules, so that scheduling dependencies and potential conflicts could be identified.

Standard Instrument Controller (SIC). While most of the Gemini software development work may be still in the early stages, the SIC work package is coming to a close and will be finished before the end of May this year. This means that EPICS drivers are available for all the VME hardware which forms the Gemini Standard Controller (the exception is the PMAC Servo controller card, for which the driver is being produced by another group). A release of EPICS has been tailored to the Standard Controller hardware and incorporates the CAD, CAR and SIR record types, which will form the basis of command communication between the different Gemini software subsystems. The installation process is now fully documented and development groups should be able to get started using EPICS fairly quickly after they receive the software.

Observatory Control System (OCS). Work on the Observatory Control System has started at NOAO in Tucson. The OCS is responsible for presenting the Gemini control system to the users (observers and operators) and for managing the sequencing between the other principal systems (instrument control, telescope control, and data handling). The System Design Review (SDR) for the OCS was successfully completed in May. The purpose of SDR is to finalize functional requirements and ensure that the scope of the work package is understood and agreed.

VUI Observing Tool Simulator. A simulator of the OCS observing tool was created during the first part of this year. The simulator will be used to illustrate OCS concepts, and to demonstrate the OCS work package's view of how a planned observing program can be specified. By presenting a prototype early in the design stage, we hope to catch any misconceptions that may exist before considerable effort is spent. The simulator was demonstrated to the Gemini Operations Science Working Group, US Scientific Advisory Committee, and the Gemini Science Committee in April.

The simulator is available via anonymous ftp. It should work on any UNIX-like system (it was developed on a Sun workstation running Solaris, and tested on a PC running Linux). Tcl/Tk and various extensions are required. Contact *shane@noao.edu* for more details.

Telescope Control System (TCS). Work on the TCS is now gathering pace. Several meetings were held in March to discuss the details of the TCS work breakdown schedule (WBS). This has resulted in a full WBS and costing as well as a draft Work Package Description. These documents are currently with the Project Office for further comments and amendments. Once these documents are agreed, purchase of the TCS VME systems can proceed so that prototyping of some of the ideas being developed for the TCS can begin, in particular the interface between the TCS and its subsystems. The interface being addressed first is that between the TCS and the Mount Control System (MCS).

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The first critical date set in the TCS WBS is SDR in July. Work has been started on the major deliverables for that review. A draft documentation plan has been drawn up and the user requirements document is being written. Both of these documents will continue to be updated up to SDR.

Detailed work has been done on the main pointing flow of the TCS. Full rigour is used wherever possible and includes the handling of the main geometric pointing terms. Attention has been paid to the methods by which the pointing origin will be calibrated and how the algorithms will be implemented in an economical way. Both the "downstream" (i.e. given an RA & Dec, what are the Mount co-ordinates) and "upstream" (i.e. given a position in the focal plane, what is the RA and Dec) pointing flows have been worked through.

Mount Control System (MCS). The MCS provides the basic ability to slew and track the telescope. It provides the interface between the Telescope Control System and the mount hardware.

The MCS passed a SDR at the end of January. The review generated many comments and actions. Many of the smaller actions have now been resolved and an updated package requirements specification has been issued. Work has now started on the preliminary design phase of the project, and the PDR is due at the end of September.

Primary Mirror Support Control System. A successful SDR for this work package was held in Tucson at the end of January. We now intend to have one control node at each mirror support actuator. This has several advantages over the more centralized approach originally envisaged, including simplified heat extraction, simpler control electronics, reduced cabling and greater modularity. CANbus has been selected as the communication method between the primary control system standard controller and the remote I/O nodes controlling the actuators and sensors. CAN is an extremely robust and error resistant serial communications bus. Originally developed for the automotive market it is now increasingly being used in the industrial control and automation arena.

Secondary Control System (SCS). The work package definition phase is close to completion, and the WBS and project plan have been extensively revised to reflect a change in the structure of the project. The CDR and implementation phases have been replaced with a series of releases prior to final acceptance.

Design and implementation of the Event Bus have been incorporated into the package, and work has begun on ICD11 which describes the interface to the Event Bus. The revised ICD11 will be ready for distribution in late May for comment. The package now includes an option for integration and testing of the SCS with the tip/tilt hardware at the manufacturer's site, as well as an option for gyro stabilization of the secondary.

Core Instrument Control System (CICS). The core instrument control system provides a template that instrument developers can use when building their own control system. All the Gemini instruments need to interface with the other Gemini systems in the same way, and there are many functions common to all the instruments (for example they all have to understand OCS commands, configure themselves, take exposures and monitor their status). The CICS should allow all the instrument developers to handle these operations in a standard way, reducing the likelihood of two or more groups independently solving the same problem and duplicating their effort. Unlike the Standard Instrument Controller, which provides hardware drivers, the CICS provides a high level template which does not control any hardware.

The CICS work package includes a great deal of consultation with Gemini instrument groups, and this consultation will be a two way process. The CICS is due for PDR in July 1995, CDR in March 1996 and delivery at the end of 1996, although incremental

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prototypes will be provided throughout the development period after PDR.

Tucson Projects. The Controls Group has undertaken a number of projects that will be completed by the Tucson-based staff. The specific tasks underway are the Gemini interlock system, the hydraulic control system, and the control system simulator. The Gemini interlock system has reached SDR and will make use of Allen-Bradley programmable logic controllers to manage the telescope safety and protection systems as well as providing maintenance-mode or "hand-paddle" controls for the mount. The hydraulic control system will implement an Allen-Bradley-based control and monitoring system for the mount hydrostatic bearings. The purpose of the control system simulator is to provide an environment comprised of workstations, EPICS (VMEbus/VxWorks) systems, and Allen-Bradley crates that will allow the Project Office to study key components of the control system. The initial setup will include the TCS, a TCS subsystem, and an instrument controller.

Gemini Software Repository. The Controls Group has established an ftp site to act as a repository for all publicly distributable software packages used for software development. These packages are kept at the version levels acceptable for Gemini software development, which in some cases may not exactly match versions available elsewhere. For example, the GNATS problem-tracking software supplied by Gemini is based on modifications made by the Joint Astronomy Center and differs from versions of GNATS available elsewhere. People are welcome to this software, but there is no intent to provide support from the Gemini Project Office for these packages. The repository can be reached via anonymous ftp to

orpheus.gemini.edu

and plans are in progress to make it available through Gemini's WWW home page.

EPICS Consortium Meeting. The Gemini Controls Group played host to an EPICS consortium meeting during the week of 23 January 1995. The meeting drew approximately 40 control system engineers, programmers, and scientists from the international astronomical and particle accelerator communities. The remaining EPICS meetings scheduled for 1995 include:

- 1-5 May 1995, Dallas, TX, in conjunction with the PAC '95 conference. For information see the WWW page for the 1995 Particle Accelerator Conference and International Conference on High-Energy Accelerators:

http://www.atdiv.lanl.gov/doc/PAC95/PAChome.html.

- First week of November 1995, Chicago, IL, immediately following the ICALEPCS '95 conference. For information see the WWW page for the 1995 International Conference on Accelerator and Large Experimental Physics Control Systems, October 29-November 3, 1995:

http://epics.aps.anl.gov/icalepcs95/icalepcs95.html.

Performance Predictions. Our servo engineer, Mike Burns, made a number of simulations in the continuing effort to predict telescope performance. Working closely with Jim Oschmann and Earl Pearson, an image quality simulation was created. The image quality simulation works well and demonstrates that the different control loops can be designed to work together, including the fast tip-tilt secondary and slower x-y-z translational movements. Based on new information from the Telescope Group, the image smear due to windshake was re-examined and the performance was calculated for different sampling rates of the wavefront sensor. The tip-tilt model was used to quantify the disturbance rejection for atmospheric aberration (supplied by Charles Jenkins of RGO) and for enclosure bogie disturbances (supplied by the Telescope Group).

-Rick McGonegal
Controls Manager

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In the top layer of the A&G are two mobile wavefront sensors and the adaptive optics fold mirror. This mirror is deployed to fold the science beam into the AO module. The sensors are called the peripheral wavefront sensors (PWFSs) because they operate in the periphery of the telescope's field of view. They are low-order Shack-Hartmann sensors, perhaps with 2x2 or 4x4 lenslet arrays. The PWFSs deliver the tracking signal, measuring image motion at up to 200 samples per second with excellent sky coverage. These signals can also be integrated to give measurements of low-order aberrations. These signals will be fed back to the primary mirror control system at intervals of about a minute.

Because there are two PWFSs, they can carry out a variety of useful functions. For example, they will keep a continuous check on the performance of the Cassegrain rotator and on the collimation of the telescope. Used together, but pointing at well-separated stars, their signals can be combined to yield estimates of seeing and of the approximate vertical location of the main contributors to that seeing. This will be very useful information in optimizing the performance of the telescope and in choosing the most effective way of flushing the domes.

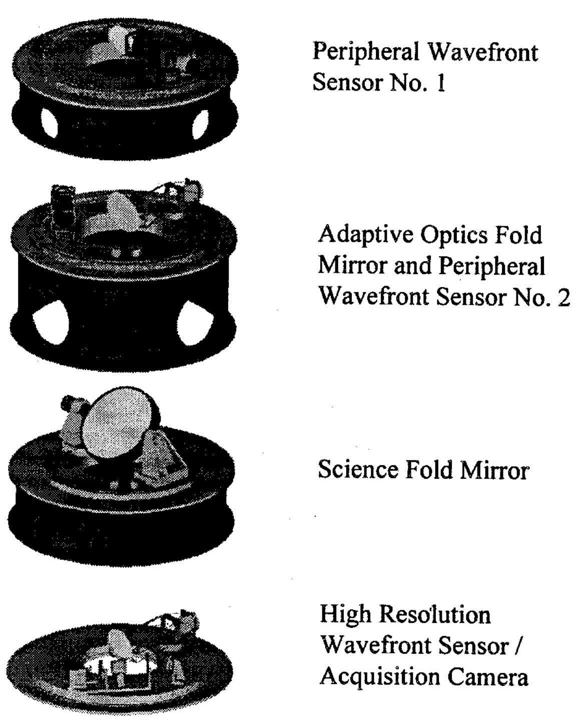

Figure 10. Exploded view of the modular A&G system.

At least one PWFS will be capable of making very accurate offsets. Hence objects whose positions are known relative to their guide star can be accurately acquired onto narrow slits.

The PWFS specification requires that the effect of all errors associated with them and the science fold should not broaden the perfectly tip-tilt corrected image by more than 15%. This specification is intended to apply in the visible (shortward of 1 micron) and the thermal IR (10 microns and longer). The omission of intermediate wavelengths is related to the effect of a subtle footnote in the specification. This says that the PWFS are not required to pay, out of their error budget, for the effects of differential image motion between the science target and the guide star. Because the PWFS are necessarily off-axis (they otherwise vignette the science field), there is some slight image broadening due to this angular anisoplanatism. Only in the 2 to 3 micron region do these off-axis effects become at all perceptible, a fact related to the nature of image formation through Kolmogorov turbulence.

To achieve the best performance in this key wavelength region, infrared instruments on Gemini will use dichroics to pass visible light, from near the science target, to on-instrument wavefront sensors. When suitable guide stars are available this mode will give better performance than the PWFS. Other instruments may use this type of on-axis guiding, but the benefits have yet to be balanced against the costs.

The bottom layer of the A&G contains a combined acquisition camera and high-resolution wavefront sensor (HRWFS). These both operate on-axis. The HRWFS is a 20x20 Shack-Hartmann sensor that will be used to calibrate the primary mirror support system and the collimation of the telescope. These data will be

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Instrumentation

The acquisition and guiding (A&G) system for Gemini is the responsibility of a project team at the Royal Observatories in the U.K., headed by Dave Gellatly (the work package manager) and Charles Jenkins (the work package scientist). The A&G went through a preliminary design review last November, and negotiations are now in progress to define the passage of the project through critical design review to construction and commissioning.

A&G in the Gemini system. To achieve the required image quality, the Gemini telescopes must be 'active'. This is not of course a new idea; a contemporary autoguided telescope could be said to be active. However, the Gemini telescopes require a very high degree of feedback for tracking, mirror figure, and control of the thermal environment. The A&G system provides much of the crucial information that constitutes this feedback. In particular, it measures image motion over a range of temporal frequencies up to 200 samples per second; it measures the delivered wavefront at a range of temporal frequencies and at varying degrees of spatial resolution; and it provides information on the natural and local seeing to provide a baseline for performance and the diagnosis of avoidable turbulence.

Placing very small and faint images on correspondingly small entrance apertures constitutes the acquisition problem for Gemini. The A&G gives methods of implementing the usual solutions, ranging from field viewing to accurate offsetting onto invisible targets from stars of accurately known position.

Finally, the A&G is a convenient place for introducing calibration light for instruments, particularly those with a large field of view. The A&G calibration unit is specified to illuminate uniformly a wide field with calibration light having a variety of known characteristics.

Main assumptions of the A&G design. Probably the most important assumption about the A&G is that it is worth having one. All of the functions identified for the A&G could be carried out by 'instruments', suitably specified. Some observatories do this, with common services relegated to little more than a mechanical interfacing unit. In the case of the Gemini A&G it seems clear that very good tracking, active optics and acquisition can be delivered by a system serving all instruments. This has two very marked advantages. First, it saves money and gives more opportunity for successive generations of instruments to concentrate on achieving their specific astronomical purpose. Second, it allows a focusing of effort on the provision of common A&G services and a consequent reduction in the effort of commissioning and maintaining those services.

Implementation. The A&G system fits inside the instrument support structure (ISS) and, as can be seen in Figure 10, is built in four independent layers. The calibration system fits on the outside of the ISS and feeds light in through one of the side-looking ports of the ISS, probably the one opposite the adaptive optics module.

The configuration of the A&G is almost completely determined by the need to fold out the science beam to side-looking foci. The second of the two A&G layers contains the large (7 arcmin diameter) articulated science fold mirror that does this. The science fold can take on a variety of orientations.

1. Retracted - the beam passes down to the up-looking focus.
2. Deployed and up-side-looking - the science beam is folded out to any side-looking focus.
3. Deployed and down-side-looking - the calibration beam is folded to any focus, or the science beam, processed through the AO module, is folded to any focus.

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built into lookup tables to give the basic wavefront quality, which will be checked and improved by the PWFS in closed loop.

The acquisition camera uses the same detector and much of the same feed optics as the HRWFS. It is a simple and rigid system and offers a field of view of about 2 arcmin at 0.1 arcsec/pixel. Coordinates defined in this field of view should translate into coordinates at the telescope focal surface with an accuracy of 0.05 arcsec or better. It should therefore be possible to define the position of a 'virtual slit' in the acquisition camera's focal plane and acquire targets onto it with sufficient accuracy for the majority of applications. In the most demanding cases we foresee some role for the instruments, either in verifying acquisition directly or in checking the relevant coordinate transformations close to the target.

Acquisition by offset, within the acquisition camera's field of view or within the search field of the PWFS, are the two basic methods of acquisition offered by the A&G. The choice between them will, in most cases, probably be decided by the availability of suitable offset stars.

Next steps. Work on the design of the A&G is well advanced and solutions have been found to many of the most pressing technical problems. Having found a way of meeting the functional specification, the task now is to try to fit within the financial budget. The IGPO and the project team are currently hard at work, trying to find the best balance between performance, cost, and risk.

-David Robertson
Instrumentation Manager

Reports from the National Project Offices

From the Canadian Project Office

GMOS Activities at DAO. The optical design of the Gemini Multi-Object Spectrograph (GMOS) and an atmospheric dispersion corrector (ADC) have been central to GMOS design efforts for almost a year now. The baseline requirements for GMOS are given in the Project Scientist's article, on page 5. The current design has three lens groups in both the collimator and camera and meets most of the GSC specifications. The superb image quality of the current GMOS design is illustrated by the fact that it will produce images in R and I meeting the AO goal of 50% encircled energy within a diameter of 0.04".

Enroute to the current design, several specific issues have been addressed to ensure that GMOS will be very competitive. For example, completely different designs (e.g., reflective collimator or fewer lens groups) have been investigated to see if they could satisfy the requirements and simultaneously provide better throughput. No superior designs have yet been found, and the transmission of the current design (~80% in imaging mode) is comparable to, or better than, those expected for the Keck Deimos and the VLT WFIS spectrographs.

The AO field and the slit masks will be flat, but the telescope field has a radius of curvature of 2m. The edges of the 7' field will therefore be considerably defocused with respect to the center. Early in the project it was decided that acceptable performance (with 0.25" seeing) could still be achieved if the spectrograph slit mask were placed at the best compromise focus. However, degradation of the spatial resolution along the slits will become noticeable under the best seeing conditions (see upper half of Figure 11). Similarly, in imaging mode the PSF will vary across the field under such conditions, so ways to flatten the field are being investigated.

Reports from the National Project Offices

It was accepted from the outset that correction for atmospheric refraction is essential to maintain the expected image quality. Since GMOS is the only 'large field' first-light instrument, it was decided to investigate a combined ADC - Corrector (ADC-C). Unfortunately, the location and available space for a ADC-C are severely constrained by practical considerations related to the instrument support *structure and acquisition and guiding systems.* A preliminary design which flattens the field enough to meet the specifications at the expense of only two more air-glass surfaces than a bare ADC is shown in Figure 12. There is almost no freedom in the physical locations of the ADC and additional lens, so that optimal correction is impossible. However, the spot diagrams in the lower part of Figure 11 show that the improvement in image quality over the full 7' diameter field will more than compensate for the extra few percent loss of transmission.

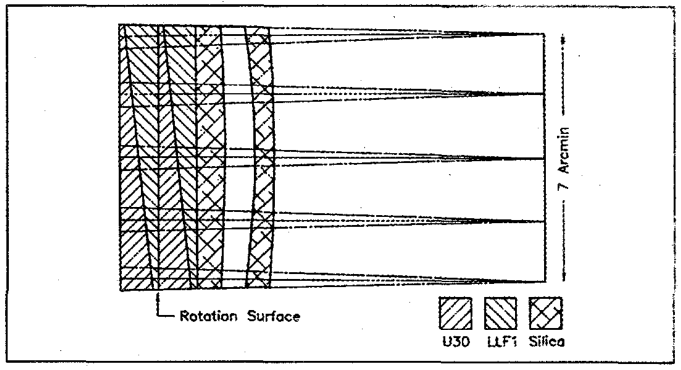

Fig. 12: A schematic diagram of the ADC-C. The ADC part, two pairs of counter-rotating prisms, will be situated inside the ISS port, with one element of the corrector attached. The other lens will be located within critical GMOS real estate, but will still leave space for other 'before-focus' functions.

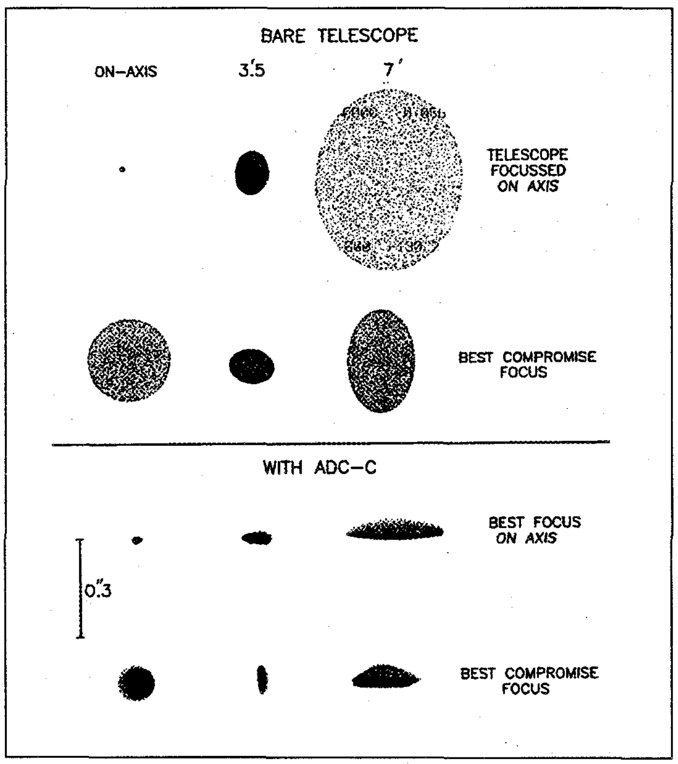

Fig. 11: Images delivered by the telescope on-axis, at half-field and full field (7'). The top row is for the telescope focused on-axis and the next row is for an intermediate compromise focus. The lower half of the diagram shows the same thing with the proposed ADC-C in place. Model predictions of the Gemini T/T corrected image quality indicate a 50% EE of 0.28" and 85% EE of 0.56" at V under the best tenth percentile seeing conditions on Mauna Kea. These values degrade to 0.46" and 0.94" respectively under median seeing conditions" (see bar).

The design described above is optimized for the 0.4 - 1.1 micron wavelength range (to be used on Gemini North), but it is recognized that an ultraviolet version for Gemini South will be scientifically important. A preliminary investigation indicates that optical designs giving excellent performance in the 330 - 550nm range are possible that will still fit within the present mechanical layout (which is necessary if it is to remain within budgetary constraints).

Work is continuing in all these areas, and more, in preparation for the CoDR in June.

-David Crampton
Dominion Astrophysical Observatory

Reports from the National Project Offices

From the US Project Office

New Staff. As many of you know, we welcomed Mark Trueblood to our office staff in December as a Project Engineer to assist in the procurement and management of the US-allocated instruments. Mark has previously contributed to the data management system designs for Space Telescope and more recently for the Global Oscillation Network Group here at NOAO.

New Phone Area Code And Prefixes At NOAO. All Tucson phones are now (520) area code and all NOAO (and Gemini) telephone numbers begin with 318-8 followed by the same last 3 digits as before.

Todd Boroson	*(520) 318-8352*	*tboroson@noao.edu*
Mark Trueblood	*(520) 318-8519*	*mtrueblood@noao.edu*
Kathy Wood	*(520) 318-8175*	*wood@noao.edu*
USGP FAX	*(520) 318-8596*	

South American Gemini Workshop. The USGP is coordinating with the South American Gemini partners to hold a workshop in conjunction with the VIII Latin American Regional Meeting of Astronomy in Montevideo, Uruguay, November 27 - December 1. The purpose of the workshop will be to foster closer cooperation among the South American Gemini partners and their Northern Hemisphere counterparts, to help inform the South American astronomical community about the Gemini Project in general, and to solicit input to the Gemini Project about the aspirations of our South American partners for its scientific programs.

Gemini Project / Le Projet Gemini / Proyecto Gemini. The USGP was pleased to assist the Gemini partners in the recent publication of Gemini pamphlets for Canada (in both English and French languages), the United Kingdom, and the international project office on the occasion of the reprinting of a technically updated US pamphlet. We are soon to assist both Chile and Argentina with the publication of Spanish language pamphlets. (I just learned that Brazil has published a similar pamphlet in Portuguese.)

Status Of Us-Allocated Instruments.
Near-IR Imager: The Near-IR Imager will be designed and built by a group led by Dr. Klaus Hodapp at the University of Hawaii. The instrument successfully completed its Conceptual Design Review in March, 1995.
Near-IR Spectrograph: As a result of a competition evaluated by an NSF-appointed committee, Gemini has begun negotiations with NOAO to provide this instrument. A conceptual design review is planned for fall, 1995.
Mid-IR Imager: The USGPO is working on an Announcement of Opportunity to the US community to provide this instrument. A number of groups have expressed interest, and it is expected that a competitive procurement will be held in late 1995.
IR Arrays and Controllers: The detectors for both of the initial Near-IR instruments will be 1024 X 1024 InSb arrays produced by SBRC. Gemini and NOAO are working through the details of an agreement by which NOAO can manage a Gemini-funded foundry run to produce the required devices for Gemini. The controller definition and procurement was delayed until it was known who would build the Near-IR Spectrograph. As soon as that agreement is successfully completed, the controller procurement can be started.
Science CCDs: The international CCD consortium continues to refine the requirements for these detectors in collaboration with the groups building the optical instruments. The best way to acquire CCDs that will meet these requirements has not yet been identified, but the consortium is monitoring development progress at a number of potential suppliers.

-Kathy Wood
US Gemini Project Office

GEMINI

8-M Telescopes Project

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THE GEMINI 8-METER TELESCOPES PROJECT is an international partnership managed by the Association of Universities for Research in Astronomy under a cooperative agreement with the National Science Foundation.

As a reminder, effective April 1, 1995, the telephone numbers for all Gemini Project personnel located in Tucson became:

(520) 318-8xxx

where xxx is the preexisting extension number.

Also, please visit Gemini's WWW page, at the above address!

Starting in 1995, the Gemini Newsletter will be published twice a year, in June and December.

The following technical documents have been published by the Gemini Project since the last edition of the Gemini Newsletter (October 1994). Copies of these and other publications are available on request by contacting the Gemini Project Documentation Coordinator at the above address, or by e-mailing *rkneale@gemini.edu*. Specific report numbers are listed in parentheses.

- AG/WFS/Science Fold Mirror Unit PDR, November 1994. (REV-I-G0023)
- Project Scientist's Report on the Coating/Cleaning PDR. F. Gillett, December 1994. (REV-PS-G0025)
- Mount Control System - Package Requirements Specification. J. Wilkes, January 1995. (SPE-C-G0053)
- Background Material for System Review #2. January 1995. (REV-S-G0029)
- Primary Control System - System Design Review Documents. J. Maclean, January 1995. (REV-C-G0032)
- Preliminary Road Survey in Hawaii, February 1995. (RPT-TE-G0055)
- M1 Cell Assembly 80% Design Review Presentation Materials. February 1995. (REV-O-G0031)
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