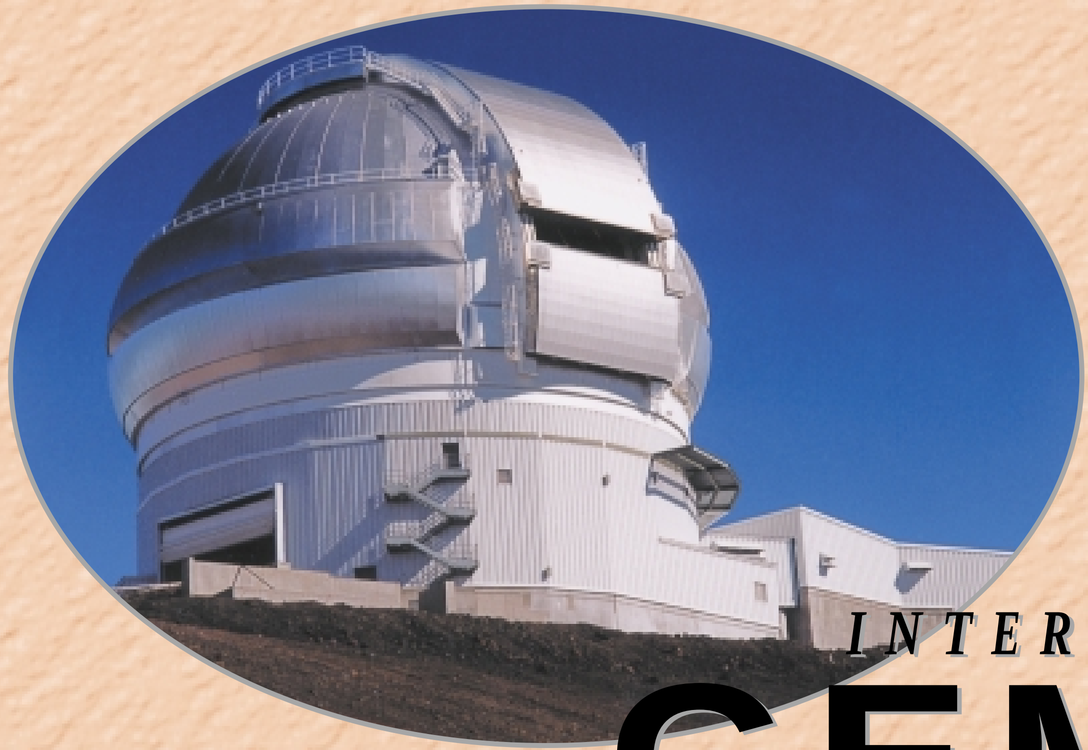

THE INTERNATIONAL GEMINI TELESCOPES

Annual Report 1998

United States

United Kingdom

Canada

Australia

Chile

Brazil

Argentina

Gemini primary mirror en route to the Mauna Kea summit, June 1998

Top Gemini Project management at the Hilo base facility dedication, November 1998

The Gemini Board at Laval University, Quebec City, Canada, May 1998

The Gemini North telescope, December 1998

The cover photographs show (upper) the completed dome at Mauna Kea in April 1998; and (lower) the Cerro Pachón dome, enclosure base, and support building in June 1998.

Photograph credits: Gemini Board and management photos by Susan Kayser; all others from the International Gemini Project Office

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Gemini Project Annual Report 1998

Message from the Gemini Board

The year 1998 has been a period of stunning progress at both northern and southern sites of the Gemini Observatory. We watched the Gemini Mauna Kea (MK) telescope rapidly taking shape in Hawaii and witnessed the swift completion of the enclosure at Cerro Pachón (CP), Chile. The first finished primary mirror left REOSC in France, where it had been polished to an unprecedented accuracy, and arrived in Hawaii in March. The mirror was transported to the summit in late June, and was successfully aluminum-coated in early December. The first Zerodur secondary mirror was also received and coated. Many images documenting these events can be viewed on the picture gallery of the Gemini 8-m Telescope web site (http://www.gemini.edu/).

At the end of December 1998, the MK telescope was fully assembled, the primary mirror coated and installed, and ready for first light images. At Cerro Pachón, most of the enclosure erection work was completed. In the meantime, all the main telescope components had arrived in Chile. As the new year arrived, the project was well into the challenging tasks of overall system integration. The schedule continues to call for a handover of the Mauna Kea telescope for observations by the astronomical community in June 2000. While this Annual Report was in preparation, the first images from the MK telescope were being secured, analyzed and released. To share more broadly these events and the future Gemini science with a greater public, Gemini established a public outreach and education office. It is a great satisfaction to see the Mauna Kea Gemini telescope likely to be completed within schedule and budget.

Some first generation Gemini instruments are near completion: the Near Infrared Imager built by the University of Hawaii, and the mid-infrared spectrograph MICHELLE built by the Astronomy Technology Centre in Edinburgh, will be the first two instruments to be installed on the Gemini MK telescope. However, the Board is concerned about substantial slips in schedule and running over in cost of several Gemini instruments. It is clear that there has been insufficient appreciation of the scale and complexity of Gemini instruments. A change in culture is needed in instruments groups, including adoption of modern project management and systems engineering; a “Design to Budget” approach should be realized at all levels.

In a happy development, NASA offered $4.7M to provide a Coronagraph for Gemini South. Discussions between Gemini and NASA are in progress, and an agreement based upon these negotiations may be reached in early 1999. The Board is most pleased to see that sources of funding outside the Agencies can be exploited to develop and build powerful Gemini instruments.

A key event of the year was the official joining of Gemini by Australia. This was ratified at the Gemini Board May meeting in Quebec City, when Dr. Vicki Sara, president of the Australian Research Council, signed the Gemini agreement. The Board directed the Project to use most of the Australian contribution for accelerating the Instrument Development Program and creating a Facility Development Fund, which would include a laser-guide star Adaptive Optics System and the development of infrared wavefront sensors to observe in the early daytime hours of the morning. Some of the Australian fund has also been reserved for high performance secondary mirrors, for the expansion of facilities at La Serena, and for other added value to Gemini operations such as a Gemini Science Archive.

The Board approved the appointment of C. Matthias Mountain as Gemini Director for a second five-year term ending in November 2004.

The Board looks forward to 1999 when the MK Gemini Telescope will start capturing faint light having traveled for billions of years to reveal the secrets of the distant universe. Astronomers of the Gemini community will be getting ready to use the two telescopes to monitor young giant planets orbiting nearby stars, to see the first phases of newly born stars in obscure interstellar clouds and to tune the instruments to the light of baby galaxies. The Board is particularly pleased to see the strengthening of the adaptive optics effort at Gemini. The implementation of this technology on Gemini promises an increased science capability.

The transition between construction and operation is rapidly taking shape. New issues are arising such as instituting an effective mode to operate two large telescopes located far from each other. In this context of very tight operational constraints, the Board insists on timely contributions to the operations budget by all the Gemini partners. It would be unfortunate if, while the Gemini Telescopes are being completed within schedule and our scientific communities are preparing for the scientific use of these forefront facilities, the Board's level of confidence were shaken by financial uncertainties affecting the running of the Gemini Observatory.

The Board is most grateful to all members of the Gemini staff and to their spouses who have devoted an unaccountable amount of time and energy, and many of whom have accepted the upheaval of moving and changes in family life, to ensure the success of the Gemini Observatory. Project Director C. M. Mountain, Project Scientist F. C. Gillett and Project Manager J. Oschmann, through their skillful leadership of the Gemini Project Team, have kept the project on track despite the many scientific, technical, and political problems they have had to solve, many on very short and difficult timescales.

Jean-René Roy
1998 Chair, Gemini Board
April 1999

Introduction

With assembly of the first of the twin telescopes having been completed in 1998, and with engineering first light achieved on 26 February 1999, this has been both an extremely busy and an extremely rewarding year for the International Gemini 8-meter Telescopes Project. A large number of activities converged on the Mauna Kea summit in July and August, requiring careful scheduling to keep all the work groups occupied, without interfering with each other. The work load was even greater than anticipated, due to unexpected problems with some delivered components, particularly the primary mirror cell and the coating chamber, as described later in this Annual Report. These difficulties were compounded by the closing in August 1998 of the Royal Greenwich Observatory, where many of the work packages to build major components of the telescope were still in progress. Round-the-clock work shifts enabled the Project to finish constructing the Gemini North telescope and make the first prime focus tests before the end of the year. The first call for proposals on Gemini North will take place in January 2000 for “shared-risk” observations beginning in June 2000, at Operational handover.

At Cerro Pachón, the dome was erected, and most of the enclosure and support building finished. The telescope assembly and the primary mirror cell arrived in Chile and went into storage. Construction is still ahead of schedule there.

With the northern telescope finished, science is taking a more prominent role. A number of astronomers have been hired, at both junior and senior levels. In addition to carrying out their own research, they are assisting with the next generation of instrumentation, including the adaptive optics program.

Although some people in construction will be leaving the project soon, others will be going to Chile, and yet others have switched to operations. Recruitment for the operations staff continues.

A major change in the partnership was the accession of Australia as a 5% “added-value” partner (that is, Australia’s financial contributions are intended to add additional scientific value to Gemini, not to reduce the obligations of the other partners). The Gemini Project welcomes Australia’s active participation in instrumentation, as well as the opportunity for advancing new instrumentation that the additional funding makes possible.

With observations beginning so soon on Gemini North, it has become critical that all partners make their contributions to operations fully and on schedule. Administrative Guidelines have been adopted to cover the case in which a partner is deficient in its scheduled payments.

Schedule of Construction

The present schedule for the Gemini Project is shown in Table 1. The original dates are from the schedule as of December 1994.

Table 1. Schedule for the Gemini Project as of December 1998

ID	Name	Date	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	Submit CDUA - Mauna Kea	23 Dec 1993	◆									
2	Award Primary Mirror Polishing Contract - Mauna Kea	14 Mar 1994		◆								
3	Award Enclosure Contract - Mauna Kea	25 May 1994		◆								
4	Obtain CDUP and ODSA. Start Site Construction - Mauna Kea	1 Oct 1994		◆								
5	Award Telescope Fabrication Contract	15 Mar 1995			◆							
6	Award Coating Plant Contract	15 Feb 1996			◇	◆ 26.2 w						
7	Complete Foundations / Site - Mauna Kea	3 May 1996				◇ ◆ 13.4 w						
8	Completion of Control System Simulator	10 Jul 1996				◇ ◆ 6.2 w						
9	Deliver Telescope Structure - Mauna Kea	1 Aug 1997					◇ ◆ 6.2 w					
10	Complete Polishing Primary Mirror - Mauna Kea	15 Dec 1997					◇ ◆ 24 w					
11	Installation of Acquisition Guiding Unit - Mauna Kea	6 Nov 1998						◇ ◆ 20.4 w				
12	Completion of Functional Control System	15 Feb 1999					◇		◆ 89.4 w			
13	Install Primary Mirror - Mauna Kea	7 Dec 1998						◇ ◆ 19.4 w				
14	Install First Instrument “QUIRC” - Mauna Kea	15 Dec 1998						◆ 0.4 w				
15	Install M2 Assembly - Mauna Kea	18 Jan 1999						◇	◆ 27 w			
16	First Light - Mauna Kea	23 Feb 1999						◇	◆ 10.2 w			
17	Complete Coating Plant Site Acceptance - Mauna Kea	23 Nov 1999					◇		◆ 116 w			
18	Delivery of Specification Control System	23 Feb 1999						◇	◆ 48 w			
19	Complete Enclosure - Mauna Kea	15 Mar 1999					◇		◆ 99.2 w			
20	Acceptance of Control System - Mauna Kea	1 Jun 2000								◇ ◆ 11.6 w		
21	Handover of Operations - Mauna Kea	15 Jun 2000								◇ ◆ 13.6 w		
22	Complete Road Construction - Cerro Pachón	1 Jan 1996				◆						
23	Complete Foundations / Site - Cerro Pachón	9 Apr 1996				◆ ◇ -9.6 w						
24	Deliver Telescope Structure - Cerro Pachón	20 Oct 1998						◇ ◆ 2.4 w				
25	Complete Enclosure - Cerro Pachón	15 May 1999						◇	◆ 52.2 w			
26	Complete Polishing Primary Mirror - Cerro Pachón	15 Dec 1998						◆	◇ -15 w			
27	Complete Coating Plant Site Acceptance - Cerro Pachón	15 Feb 2000						◇		◆ 71.6 w		
28	Installation of Acquisition Guiding Unit - Cerro Pachón	23 Feb 2000								◇ ◆ 7 w		
29	Install Primary Mirror - Cerro Pachón	20 Apr 2000								◇ ◆ 9 w		
30	Install M2 Assembly - Cerro Pachón	18 May 2000								◆ 2 w		
31	First Light - Cerro Pachón	15 Jun 2000								◆ 1 w		
32	Final Acceptance of First Instrument - Cerro Pachón	15 Jan 2001								◇	◆ 31.6 w	
33	Acceptance of Control System - Cerro Pachón	15 Dec 2000								◆	◇ -25.6 w	
34	Handover of Operations - Cerro Pachón	15 Jan 2001									◆ ◇ -21.4 w	

LEGEND
◇ Original Date
◆ Revised Date

1998 Accomplishments and Plans for 1999

Project Overview

1998 Accomplishments

Several unforeseen events in 1998 made it a year of adaptability, re-negotiation, and change, in order to maintain the project schedule. Some key personnel left the project, preferring not to move to Hilo, including the financial administrator and, most crucially, the Project Manager of the past four years. As a result, a major reorganization occurred within the project team, including the appointment of Jim Oschmann as the Project Manager. Most of the team has now relocated to Hilo. The new Hilo base facility for the International Gemini Project Office (IGPO) was completed and occupied in August. The project continued to suffer from the late completion and delivery of many key subsystems. This led to considerable compression of the original schedule and substantial day-to-day coordination to allow several key tasks for Gemini groups and contractors to run concurrently. The first coating plant was installed and is working at an acceptable level on Mauna Kea. The first enclosure is complete (with the exception of the platform lift), the telescope structure has been installed with all systems including necessary software to control the mount, the mirror, the telescope, and closure.

The first primary mirror was received and coated in preparation for installation in the telescope by the end of 1998. The second primary underwent acceptance testing in November 1998. The figure on the first was 16 nm rms after active optics correction.

Unfortunately, the difficulties with the silicon carbide secondary mirror were not solved. After a fifth attempt, this approach was abandoned, and the contract with Zeiss was amended to provide for the delivery of two Zerodur secondary mirrors. Some money was recovered from the previous contract. The project will be developing a plan for a future high-performance secondary mirror. The first Zerodur mirror has now been accepted from Zeiss, and at the end of 1998 it was awaiting installation into the telescope.

By the end of 1998, the first pointing tests and prime-focus wavefront measurements of the primary mirror in the telescope had been made, but with only one week left in the year and the holidays imminent, trying to achieve first light by the end of the year was impractical.

NFM Technologies completed the second telescope, which was subsequently shipped to Chile. It is currently in storage until needed on Cerro Pachón. The second mirror-cell assembly and dummy mirror were also completed and shipped to Chile. The lateral supports could not be tested in France as planned, so the testing took place with a dummy mirror in the telescope on Mauna Kea.

On Cerro Pachón, Coast Steel is finishing the enclosure. An employee of a subcontractor of Coast Steel suffered a fatal accident in June 1998. This has been investigated, and further improvements to site safety have been implemented. The Gemini staff is continuing to work with the Chilean approach to safety.

Despite these events, morale in the project team is high. The focus of the construction team is now firmly in Hawaii. The ramp-up of operations hires continued through 1998, and the staff now occupies the new

Hilo base facility. Recruitment of Chile-based staff is now in the planning stages, and the Operations Manager has been working to solidify agreements with the Hawaiian and Chilean site partners.

During 1998 both the construction and operations budgets came under considerable pressure. In construction, the amount of project contingency is declining. Over $1M of contingency had to be used in 1998 to stay on schedule. Less than $1M is left for the remainder of the construction phase. The Cerro Pachón telescope is six months ahead of schedule, however, which will allow the construction of both Gemini telescopes to be completed within budget. In operations, the final fit-out of the Hilo base facility (renamed the Gemini Observatory Northern Operations Center) required substantial operations resources, and Hawaii costs are turning out to be higher than originally anticipated. However, other than cost-of-living and merit increases, no change in the 1998 operations budget was requested.

1999 Plans

Work in 1999 will focus on reaching first light and commissioning the Hawaii telescope. Because of the complexity of the telescope, attaining first light is a months-long process rather than a single event. Commissioning includes implementation of the software and computing systems needed to support observations; verification that the telescope, its instruments, and its control systems meet the science requirements; working towards the dedication ceremony in June; and preparation of the telescope and instruments for operations. During 1999, this will include observations made with available instruments, as well as work done by the science community in conjunction with the engineering team, to assure a smooth transition to full science operations on Mauna Kea in 2000. A major concern throughout 1999 will be the timely delivery of scientific instruments to the Mauna Kea telescope from the partner communities.

On Cerro Pachón, the telescope structure and the coating chamber will be transported to the summit and assembled, and much of the systems integration work will be performed. After acceptance tests for the second primary mirror are completed, REOSC will ship it to Chile. It appears possible to shorten the construction schedule by accelerating the commissioning phase, taking advantage of the experience gained in commissioning the northern telescope. Having operational handover for Gemini South in January rather than June of 2001 may be necessary to keep the total cost within $184 M.

With the change-order costs still running at 5%, the remaining contingency in the construction budget, $1M, is looking less precarious. Beyond this uncertainty, a positive cash flow is expected throughout 1998 and on through 2001. This is due in no small part to the addition of Australia to the project and making use of some of the additional funds. As usual, the project will be critically dependent on the timeliness of partner contributions throughout 1998 and 1999.

For 1999 and the following few years, a large increase in staff is needed in Chile to support the construction activities there. As the project moves toward operations, a ramp-up of permanent staff in Chile will be crucial to the support of the construction, integration, and testing (I&T) effort in Chile and to ensuring a smooth transition of the Cerro Pachón telescope to full science operations.

The initial implementation phases of the Gemini On-going Instrumentation Program will be continued in 1999. Also during this year, the System Verification Plan will slowly be expanded for the telescopes and instruments. The Gemini scientific staff, instrumentation scientists, and national Project Scientists from all seven partners will be involved in defining and executing this plan.

Scientist Activities

1998 Accomplishments

The first tenure-track Gemini scientific staff were appointed in 1998. Ted von Hippel, from the University of Wisconsin, and Inger Jørgensen, from the University of Texas, were appointed as Assistant Astronomers, and Tom Geballe, from the Joint Astronomy Centre (JAC), was appointed as Astronomer with Tenure. Marianne Takimaya, from the University of Chicago, was also appointed to a Gemini Science Fellow position. The relocation of the Gemini scientific staff to Hilo was completed this year, with Phil Puxley moving in early 1998, Mark Chun in June, and Fred Gillett in August (Joe Jensen arrived earlier). Jorge Garcia continues to be located at the Space Telescope Science Institute (STScI), supporting the development of the second Guide Star Catalog (GSC-II).

Two Gemini Science Committee (GSC) meetings were held in 1998: 16–18 April in Porto Alegre, Brazil, and 19–21 October in Hilo, Hawaii. A Gemini retreat was held before the April GSC meeting, on 19–21 February in Gainesville, FL, to discuss system verification of the Gemini telescopes and instrumentation. Gemini scientific staff, instrument scientists, and national Project Scientists participated in this retreat.
A workshop was also held 14 September in Hilo to discuss and formulate the requirements for a Gemini Science Archive. Gemini scientists, the Committee of Gemini Offices (CGO) and external experts from the Canadian Astronomy Data Center (CADC), the STScI, JAC, Australia, and the UK all participated in this workshop. In addition to these meetings, the Project Scientist Team met in March and again in September to participate in the Gemini Director's Review, the Gemini Instrumentation Forum and the meetings of the Committee of Gemini Offices.

Doug Simons, Phil Puxley and Fred Gillett, together with the national Project Scientists, are members of the Project Scientist Team and the GSC. They are also part of the Instrument Forum and the Committee of Gemini Offices.

Implementation and Oversight of the Phase I Instrumentation Plan

Doug Simons, the Associate Project Scientist for Instrumentation, provided daily oversight of the Phase I instrumentation program. In addition, staff scientists participated in Instrument Forum reviews of the program, and planning for and supporting the instrumentation design reviews held in 1998. These included the preliminary design review (PDR) for the Mid-IR Imager, PDR for the Integral Field Unit (IFU) addition to the Near InfraRed Spectrograph (NIRS), the critical design review (CDR) for the use of Michelle on Gemini North, and an interim review of NIRS as well as the AURA review of the NIRS program. Scientific staff also participated in the acceptance testing of the first IR Controller.

The On-going Instrumentation Program

The Gemini Instrument Forum and GSC developed recommendations for the acceleration of components of the On-Going Instrumentation Program (OGIP) and the addition of new elements including Near-IR Peripheral Wavefront Sensors (PWFS) for both Gemini telescopes, based on utilization of 90% of the Australian contribution to the construction budget. The Instrument Forum also reviewed proposals for conceptual design studies for the Acquisition and Guidance (A&G) polarization modulators and the

Near-IR Coronagraph / Imager, for infrared multi-object spectrograph (IR MOS) studies, and for the Gemini Adaptive Optics (AO) Program. Recommendations were made to the Director to support a UK conceptual design study for the A&G polarization modulators, provide partial support for US and Australian conceptual design studies for the Near-IR Coronagraph / Imager, and partial support for UK, US, and Australian proposals for IR MOS studies. The Board approved allocation of the conceptual design study for the A&G polarization modulators to the UK, and a workscope should be ready early in 1999.

Adaptive Optics Program

The Gemini Instrument Forum recommended that the IGPO lead the Adaptive Optics (AO) program. The Board approved this approach in May 1998. The AO Program activities within the On-Going Instrumentation Program are the Mauna Kea (MK) Natural Guide Star system called ALTAIR (a Canadian work package) and its Laser Guide Star (LGS) upgrade, the Cerro Pachón (CP) site characterization, and the Cerro Pachón LGS AO System. Mark Chun has been leading the MK LGS upgrade activities and providing oversight and support for the CP activities. An AO Working Group meeting is planned for April 1999 to assess the CP site characterization data and evaluate laser options for Mauna Kea.

Development of the Gemini time allocation and observing Process

Phil Puxley, Associate Project Scientist for Operations, led a wide range of activities preparing for the scientific use of the Gemini telescopes and instruments. Two key software tools in the observing preparation processes, the Phase I proposal preparation tool (alpha version) and the Phase II Observation Tool (beta-2 version) for refining an observation program, were released for testing. Test fields from the second Guide Star Catalog from STScI (GSC-II) were integrated with the Gemini control system and Gemini acted as beta-tester for the 2 milliarcsecond survey (2MASS) image and point source catalogue servers. A new web structure and preliminary content for help pages for science operations were established (see http://www.gemini.edu/sciops/ObsProcess/ObsProcIndex.html), and requirements for integration time calculators, a user support model, and an electronic helpdesk system were defined. Phil also participated in a proposal preparation workshop at National Optical Astronomy Observatories (NOAO) and a STScI / GSFC (NASA’s Goddard Space Flight Center) observing support software workshop, both intended to explore and develop commonality among proposal preparation and observing support tools in use and under development in the astronomical community.

Gemini System Verification

The Gemini approach to System Verification (SV) for both telescopes and instrumentation was the subject of a retreat held in February 1998. The intention is to verify that all the elements are in place that are necessary to allow Gemini community scientists to define their observations, execute them, and adequately reduce that data in preparation for analysis. Gemini scientific staff, Gemini instrument scientists, and national Project Scientists will continue to be involved in the further refinement and execution of the SV plan. A preliminary version of this plan was reviewed by the GSC at the October 1998 meeting and presented to the Gemini Board.

Definition of Gemini Science Archive Requirements

The scientific case for a Science Archive for Gemini data was endorsed by the GSC at its April 1998 meeting. A Gemini Science Archive Workshop, held in September, concluded that a science archive for Gemini data was technically and scientifically viable. This is in large measure because of the progressive planning and requirements inherent in the use of queued observations, the Phase I and II observation planning process, the engineering archive, and the data processing pipelines. The Workshop also identified the requirements and capabilities for an effective and useable science archive. After the conclusion of the Workshop, the CGO recommended that Canada and Chile be asked to submit a proposal for the conceptual design of a science archive based on the recommended requirements and capabilities.

Scientific/Technical Support of Project Activities

The staff scientists participated in project reviews, development activities, and the formulation and execution of the integration and commissioning plans for the Gemini telescopes and instrumentation. Such activities during 1998 included Cerro Pachón site characterization, the GSC-II catalog support activities, environmental monitoring for the Gemini facilities, and outfitting of instrument labs and control centers both in Hilo and on the summit of Mauna Kea. Gemini scientific staff are also heavily involved in the development of Gemini Multi-Object Spectrograph (GMOS) mask object definition and tracking capabilities, the engineering archive, and the data pipeline processing model and interface.

1999 Plans

There will be two more Gemini scientific staff hired in 1999. These long-term positions will be located at Gemini South and are open to all qualified scientists. Gemini staff scientists are expected to pursue an active research program, play a key role in preparing the Gemini South facilities for operational use, and support scientific use of the facilities by the Gemini communities. Gemini will continue the collaboration with STScI to support the development of the GSC-II catalog and database.

Phase I Instrumentation Program

During 1999, the Associate Project Scientist for Instrumentation, together with other Gemini scientific staff, the National Project Offices, and the instrument teams, will continue to work toward the completion of the Gemini Phase I Instruments. The first Gemini facility instrument, the Near InfraRed Imager (NIRI) will be delivered to Gemini and commissioned during 1999.

Instrument acceptance test plans will be developed by the instrument teams together with Doug Simons and the Gemini scientific staff instrument scientists. Instrument commissioning plans will be developed by the Gemini instrument scientists working with Phil Puxley and the instrument teams. The System Verification plans for the telescope and instruments will be refined by the Gemini scientific staff and the instrument teams, led by Tom Geballe.

On-Going Instrumentation Program

The initial implementation phases of the Gemini On-going Instrumentation Program will continue in 1999. The next steps include initiation of the conceptual design studies for the Near-IR Coronagraph / Imager for Gemini South and for the IR Multi-Object Spectrograph (MOS) studies. NASA has offered full funding for the Coronagraph / Imager, which the project appreciatively acknowledges; acceptance of NASA funding implies that this will be a US work package. The conceptual design study for the A&G polarization modulators (a UK work package) should be completed in 1999 and the development phase begun.

Adaptive Optics Program

A community workshop to present and discuss options for the Cerro Pachón Adaptive Optics (AO) capability will be organized for early 1999, and conceptual design studies will be initiated shortly thereafter. Mark Chun and other scientific staff members will also participate in the commissioning and use of the University of Hawaii (UH) AO System on Gemini North with UH's QUIRC (QUick IR Camera).

Preparations for Scientific Operations

The announcement of the first scientific use of the Gemini North telescope will occur late in 1999, with observing proposals due January 2000 and the first semester of shared risk observing starting in June or July 2000. The Gemini scientific staff will be working closely with the National Gemini offices to prepare for this first scientific use of the Gemini telescopes by the Gemini communities.

The Phase I Proposal Preparation Tool will have its final release to the Gemini partners. Prior to its use by Gemini, it will be used for submission of proposals for the Anglo-Australian Telescope. The Observing Tool will be released to support NIRI commissioning, including observation definition, calibration and pipeline processing. Integration time calculators will be produced to support preparation of the first proposals, as well as commissioning and System Verification observations. The requirements for queue merging and scheduling software, image quality estimators and the instrument status Graphic Users Interface for NIRI will be defined. The web content will be expanded to provide all available user information in support of the first call for proposals, and a prototype helpdesk will be implemented. In addition, software for GMOS mask tracking and object definition will be implemented, as will the Weather Server and environmental monitoring.

The conceptual design of the Gemini Science Archive will be completed in 1999, funding permitting.

Ted von Hippel will be participating in the oversight of commissioning. In addition, the Gemini staff scientists will continue to provide scientific and technical support to the project as needed, participating in the commissioning activities for the Hilo base facility, integration of the Gemini facility on Mauna Kea, and direct support of telescope commissioning and the acceptance and commissioning of the first Gemini facility instrument, NIRI.

Telescope and Enclosure

1998 Accomplishments

All of the goals outlined in the 1998 Project Plan were achieved:

Mauna Kea Site

Coast Steel successfully completed the site erection of the Mauna Kea enclosure, with the exception of punch-list work and testing of the platform lift (which raises heavy objects from the ground level to the observing floor). As the enclosure installation was already behind schedule at the beginning of the year, because of incorrect placement of the concrete anchors in 1997, unusually severe winter storms in early 1997, equipment failure, and labor disputes, the Gemini Project requested that Coast Steel meet certain critical milestones to allow the installation of the telescope structure and other work to proceed on schedule. These workarounds were carefully coordinated and successfully implemented. Acceptance testing of the enclosure was performed in May and November, and the enclosure is now fully functional.

After many setbacks, the platform lift was installed. Although the design load capacity was 110 tons, load testing in August found the platform lift unable to operate with loads in excess of 70 tons. As Coast Steel required unlimited use of the platform lift for a period of a month to understand and remedy the problem, correction of the problem has been postponed and the platform lift capacity has been limited to 70 tons, to allow the mirror cell integration with the telescope structure to proceed. Further platform lift tests will be performed in early 1999.

The Support Facility completion work (mechanical and electrical systems, and the Support Facility finishing work) by the San Juan company was finished in September, and the site crew reduced to a few persons working on punch-list items. County inspections and architectural and engineering firm compliance inspections, have been successfully performed. The elevator has been installed and tested, and an operation permit issued.

The telescope structure, including the drives, brakes, counterbalance systems, locking pins, cable wraps, overtravel stops, friction driven encoders, and top-end latches, has been successfully installed. Minor work, including alignment and clean up, remains to be done. Supporting this activity, Nippon Express and HT&T successfully completed the transportation of all the heavy loads from the Port of Kawaihae to the summit of Mauna Kea.

The Primary Mirror Cell Cart has been assembled, tested, and used to install the primary mirror cell in the telescope structure.

The secondary support vanes, fabricated by TIW, and the aluminum Secondary Support Structure, fabricated by CamTec, were delivered and installed on the f/16 top-end on Mauna Kea.

The Gemini Hilo base facility construction was completed by Isemoto, and the Gemini Project moved into the building in August. The building is now known as the Gemini Observatory Northern Operation Center (GONOC). A dedication ceremony was held in November, following the Board meeting.

The Coating Vessel was installed. The magnetrons were not up to specification, but after considerable manual adjustments, aluminum test coatings were made which proved adequate to permit the first coating of the primary mirror. The installation and coating operation, complicated and delayed by the closing of the RGO, required a significant involvement of Gemini staff to complete.

Cerro Pachón Site

Construction of the Cerro Pachón enclosure is nearing completion, with acceptance testing scheduled for early 1999. A fatal accident occurred in July involving one of Coast Steel's subcontractors' workers. Extensive safety reviews followed this accident, and all workers are being given additional safety lectures.

The Gemini Project purchased the materials and equipment for the fit-out of the support facility in the US, and shipped the items to Chile. Site installation of these purchased mechanical and electrical systems was bid, and a contract awarded to Babcock Montajes. The installation started in March and has progressed slowly. Other support facility fit-out work, including the architectural finishing of the building by Juan Cortes, is progressing well.

The elevator installation was bid and a contract placed.

The coating vessel was delivered to the Port of Coquimbo in February, successfully unloaded, and is being stored there.

TELAS completed the Cerro Pachón telescope structure fabrication and preassembly at their factory in Le Creusot, France. After acceptance testing, the telescope was disassembled, packed, and shipped to the Port of Coquimbo in Chile. The structure arrived in Coquimbo in October and is now being stored at the Port.

Transportation of the telescope structure and the coating vessel to Cerro Pachón was bid and a contract awarded.

1999 Plans

Mauna Kea Site

In 1999, the Project will:

- complete the alignment, clean up, and commissioning of the telescope structure, support facility systems, enclosure and coating vessel.
- perform tests and remedy the problem with the platform lift.

Cerro Pachón Site

In 1999, the Project will:

- complete the erection and acceptance testing of the Cerro Pachón enclosure and platform lift.
- finish the completion work for the Cerro Pachón support facility and enclosure base buildings.

- install the elevator.
- install and align the telescope azimuth track.
- install the main structural elements of the telescope structure.
- install the Cerro Pachón coating vessel.

Optics Group

1998 Accomplishments

Primary Mirror Finishing. REOSC finished polishing and figuring the Mauna Kea primary mirror in December 1997, and conducted acceptance tests in January 1998. The mirror has an intrinsic figure (that is, the figure with no support system errors) of less than 16 nm rms error. At the time it was finished, it was the most accurate mirror of its size ever produced. All the encircled energy specifications were met, as were the satellite image specifications.

REOSC started polishing the second mirror in December 1997. At the end of 1998, the second mirror was nearly finished, with acceptance testing scheduled for January 1999.

Primary Mirror Transportation. The first mirror was shipped from France on 4 February 1998. It arrived on the big island of Hawaii on 18 March, within days of the originally scheduled delivery date.

The mirror was transported to the summit of Mauna Kea during 26-28 June. The transportation was handled by REOSC and went very smoothly. The mirror arrived in perfect condition, was aluminized on 3 December, and installed in the telescope on 16 December 1998.

Primary Mirror Cell Assembly. The component systems of the Mauna Kea mirror cell were installed by Gemini and RGO staff in the factory of NFM Technologies, the French company that manufactured the mirror cell structure. All installation work was completed by January, followed by several weeks of testing. The mirror cell was turned over to NFM on 30 March for packing for the journey to Hawaii. There were several delays, however, and the cell did not arrive on the Big Island until 14 August. At that time, it was discovered that water had worked its way inside the crate and inside the plastic cover around the mirror cell, resulting in superficial rust damage, and damage to the control electronics. An expert in corrosion was hired to assess the problem. Correction of this damage is currently in progress, and its cost will be assessed against NFM.

Assembly of the Cerro Pachón mirror cell was finished in June. Unfortunately, the closure of RGO by PPARC resulted in premature removal of RGO staff from the NFM facility, so testing of the second cell was terminated soon after it started. This will necessitate more thorough testing after arrival at the Cerro Pachón observatory.

The Cerro Pachón cell was packed more carefully by NFM, with additional layers of waterproofing plastic. It was shipped to Chile along with the Cerro Pachón telescope structure. Inspections after arrival showed that it did not suffer any water damage in transit.

M1 Auxiliary Equipment. The Mauna Kea primary mirror (M1) lifting fixture was reassembled in the observatory, and was tested with the steel dummy mirror in several different applications involving the mirror cell, mirror wash cart, and coating chamber. Several minor adjustments and modifications have been made to improve its performance.

The Cerro Pachón mirror lifter was used successfully at NFM, and it has now been disassembled and shipped to Chile, with the Cerro Pachón dummy mirror.

The chiller (from NESLAB) for the Cerro Pachón mirror thermal control system was tested in operation at NFM, and is now in Chile awaiting installation. The Mauna Kea chiller has been installed in the plant room of the observatory.

The primary stray light baffles and their handling equipment have been fabricated by Stevested Machinery and Engineering, and are at the Mauna Kea summit awaiting installation.

The primary mirror wash carts were fabricated in part by Moran Iron Works and in part by subcontractors to RGO. The Mauna Kea wash cart was assembled and tested. Several modifications were required and have been accomplished.

Cassegrain Rotator. The Optics Group inherited responsibility in 1998 for the Cassegrain rotators, the Cassegrain cable wraps, and the instrument support structures. All of these systems had been contracted to AMOS in Belgium. AMOS finished fabrication and testing of the Mauna Kea Cassegrain rotator approximately six months late. Because of the late delivery of the Mauna Kea rotator, a dummy rotator was fabricated to duplicate the weight and mounting configuration of the final unit. The real rotator arrived in Hilo on 19 November and was installed on the telescope on 16 December. The Cerro Pachón Cassegrain rotator has been assembled and is ready for acceptance testing.

Cassegrain Cable Wrap. The Mauna Kea cable wrap was assembled, tested, and shipped to Hawaii. The Cerro Pachón cable wrap has also been assembled and tested.

Instrument Support Structures. Both instrument support structures (ISS) are finished. The Mauna Kea ISS was installed on the telescope. The Cerro Pachón ISS is being used to help test the Cerro Pachón Cassegrain rotator.

Secondary Mirrors. Morton, Inc. was not able to solve the technical difficulties with production of the lightweight silicon carbide secondary mirrors. After Morton failed five times in attempts to deposit the 1-meter diameter silicon carbide face plate blank, Carl Zeiss and Gemini decided to modify the contract. The contract now calls for Zeiss to produce two lightweight Zerodur secondary mirrors.

The Mauna Kea secondary mirror has been fabricated, polished and tested. It is 14 kg heavier than in the original specifications for the SiC secondary. It was delivered to Hawaii in early November, and coated at the Canada-France-Hawaii telescope on 14 December. The Cerro Pachón secondary mirror was generated to its lightweight form and was ready for polishing at the end of 1998.

The structural performance of the Zerodur mirrors will be close to that of the silicon carbide mirrors. When future funding is available, fabrication could begin on high-performance mirrors made of either beryllium or silicon carbide, if experience with the Zerodur mirrors shows this to be advisable.

M2 Tilt System. Lockheed Martin delivered the Mauna Kea tilt system in May. After testing in Tucson, the unit went to Hilo for integration with the other parts of the M2 Assembly. The Cerro Pachón tilt system was delivered to Tucson and was accepted in November. Problems in the MK system were found in early January 1999, resulting in the CP unit being used for Gemini North, while the original MK unit will be sent to Chile after the problems are corrected.

M2 Positioning System. The Mauna Kea positioning system is complete. It was in Hilo at year-end. Assembly in Tucson of the Cerro Pachón positioning system was nearly complete by year-end.

M2 Deployable Baffle. The Mauna Kea deployable baffle was finished and was integrated with the tilt system and positioning system in Hilo. The Cerro Pachón deployable baffle was assembled in Tucson by year-end.

M2 Auxiliary Equipment. Several pieces of handling equipment for the secondary mirror and the M2 assembly were designed and fabricated. These include handling/turnover carts, lifting equipment, and coating fixtures.

Telescope Integration. The Optics Group activities during the last six months of 1998 concentrated on integration of component systems in the Mauna Kea observatory. This included: preparation of the mirror cell; integration of the mirror cell on the mirror cell support frame; installation of the dummy mirror on the mirror cell; installation of the mirror cell, dummy mirror and support frame in the telescope; integration of the primary mirror control system; installation of the dummy Cassegrain rotator, dummy acquisition and guidance system, instrument support structure and dummy instruments (the “ballast weight assemblies”); and installation of equipment in the mirror washing area.

1999 Plans

First Light. First light is considered to be a process rather than an event. In the first half of 1999, the science fold mirrors, peripheral wavefront sensors, tip/tilt system, pointing system, and the secondary mirror itself, must be integrated and tested. Next, the performance of the telescope at the Cassegrain focus must be determined, and then that of the instruments. (The first image, taken for engineering purposes with the QUIRC camera, borrowed from the University of Hawaii while they are completing NIRI, occurred on 26 February 1999.)

The Dedication Ceremony for Gemini North will take place 25–26 June 1999.

By October, NIRI should be installed on Gemini North and commissioning will begin.

Primary Mirrors. The Mauna Kea primary (M1) mirror was aluminized and installed in the telescope before the end of 1998. Acceptance testing of the Cerro Pachón primary mirror began in December. Since that mirror is not needed in the southern observatory for almost a year, it will be stored for several months in France.

Primary Mirror Cell Assemblies. Work on the Mauna Kea mirror cell will continue for several months, up to and after first light. This work will include continued repair of the water damage (for example, replacing electronic components), as well as adjustment of the mirror support and thermal control systems. The most interesting and challenging part of this will be optimizing the performance of the active optics system.

The second mirror cell will be stored in Chile for the next year. Around November 1999, the cell will be prepared for installation in the telescope, initially with the dummy mirror.

M1 Auxiliary Equipment. The Mauna Kea primary baffle was installed in the telescope in December. At that point, all the M1 auxiliary equipment was fully integrated into the facility.

After first light in Hawaii, part of the effort will shift to preparation of the auxiliary equipment for Cerro Pachón. All modifications and enhancements that were developed during integration of the equipment on Mauna Kea (e.g. the M1 baffle, the wash cart, the wash area bridge, M1 lifter support stands) will be adopted in the equipment for Cerro Pachón. After appropriate modifications, this equipment will be packed and shipped to Chile.

Cassegrain Rotator, Cable Wrap, and Instrument Support Structure. The Mauna Kea Cassegrain rotator and cable wrap was installed in the telescope on 8 December 1998. The cable wrap will be filled with cables and hoses, which will be connected through the mirror cell to the telescope facility lines.

Acceptance testing of the Cerro Pachón Cassegrain rotator and cable wrap was completed at AMOS by the end of the year. These units, along with the instrument support structure and ballast weight assemblies, will be shipped to Chile.

Secondary Mirrors. The Mauna Kea secondary (M2) mirror was coated on 14 December. The schedule called for it to be mounted on the M2 Assembly and installed in the telescope in January 1999. The Cerro Pachón secondary mirror will be polished and figured by Zeiss. It is scheduled for delivery in September 1999.

M2 Assemblies. Integration of the Mauna Kea M2 Assembly was completed in December. The integrated system will be tested and tuned. It will be installed in the telescope in January 1999.

Assembly of the second positioning system and deployable baffle will continue in the first half of 1999. Because of problems with the first tip / tilt unit, the second one will be integrated with the Mauna Kea M2 system, and the first system shipped to Chile after repair.

Telescope Integration. The principal activities in 1999 will continue to be integration of component systems into the Mauna Kea telescope. The emphasis after first light will be to optimize the performance of the various systems. Several months later, efforts will shift to preparation of equipment for integration of the Cerro Pachón telescope. Optics Group activities in Chile will not ramp up until late in the third quarter of 1999.

Software and Controls

1998 Accomplishments

Focus of work. The focus of work shifted to integration as work packages were delivered and hardware installed on the summit of Mauna Kea. The closure of RGO meant that some work packages were delivered incomplete, so effort had to be diverted into finishing that work. Similarly, delays in delivery of some work packages combined with delays in hardware installation on the summit to compress the schedule for software integration. The controls group added temporary staff to help handle the increased load.

Organization. The group organization now conforms to the final plan for operations. There is a real-time software team consisting of four programmers located at the Gemini Observatory North Operations Center in Hilo, Hawaii, a high-level software team of two programmers in Tucson, and an infrastructure support team with three members in Hilo and one in Tucson.

High-level software. The high-level software development team (formerly the Observatory Control System team) continued work on the Phase I Proposal Entry tool, the Observing Tool and the Telescope Console software. Work on the planned observing system was suspended while team members developed and installed the Gemini Engineering Archive (GEA) but resumed by year’s end. The Telescope Console System (TCS), while under the direction of this team, is under development by former members of the TCS group from RGO. The consoles have been developed and tested with TCS, A&G, and SCS (the Secondary Control System). In addition an end-to-end test involving the consoles, TCS, SCS, and M2 tip/tilt hardware, was successfully completed in Tucson during the summer. The Phase I tool has been released in beta form and the group is evaluating how to adapt this tool and the Observing Tool so they are useful to other observatories. GEA was installed on the summit.

Core Instrument Control System. Integration of the core instrument control system with the Data Handling System is now underway at IGPO. Problems with underlying infrastructure and the unexpected loss of key personnel are hampering this work, which proceeds slowly. Additional effort has been assigned to solve the remaining problems.

Primary Control System. The PCS was delivered and installed on the MK summit. While final testing, which was not performed at NFM before the M1 cell was shipped, was still incomplete at year-end, the PCS had already proved useful in helping analyze the extent of damage to the mirror cell that occurred during transit.

Telescope Control System. The TCS was completed and delivered on time and (slightly) under budget. The TCS is operating quite well and is being integrated with the TCS subsystems as they are delivered. Gemini has contracted with three members of the former TCS group from RGO to assist in the integration effort.

Mount Control System. The MCS was delivered incomplete because of the closure of RGO. Gemini has hired the entire MCS group from RGO to help with the integration effort.

Data Handling System. The DHS was released to Gemini. The Data Processing Track remains to be done, as well as some additions to the Quick-look Tool. Integration of the DHS with the A&G system is underway at Gemini.

Secondary Control System. The SCS was completed by ROE and delivered to Gemini. Tests with the M2 tip / tilt system were successfully completed in the summer at Tucson, but some problems that were exposed only after initial installation on the telescope in January 1999 will take months to correct.

Communications System. The high-speed link for network traffic was installed between the GONOC and the summit, with ATM (asynchronous transfer mode) support. The GONOC network and phone systems are fully installed and operational. Work continues on linking the summit and base with high-speed video. Work on the Gemini South communications links has been started.

Enclosure Control System. The ECS was completed and delivered to Gemini by Canada's HIA / NRC. The ECS has been tested against the enclosure hardware at the summit, but delays in completing the enclosure have forced delays in finishing the integration. There are no significant problems anticipated.

1999 Plans

Work Packages. All work packages will be completed and delivered early in the year.

Transition of Work. Work will shift from early integration support to post-first light and early operations support by June or July. Support of Gemini South integration will become a high-priority task for the group.

High-level software. Work will concentrate initially on integration efforts and the Planned Observing System. A number of software projects needed for operations will be initiated, including image quality estimators (IQE), GMOS mask-making support, GSC-II access, and integration with the instrument software as it is delivered.

Real-time software. Work will concentrate on post-first light cleanup and commissioning activities on Gemini North, as well as installing and integrating the software for Gemini South.

Communications System. Work will be completed early in the year for Gemini North and the effort will shift to Gemini South communications.

Infrastructure support. An organizational restructuring is underway to a form better suited for operations. Jim Wright will move from communications development to the real-time software team, to assume the lead on instrument integration efforts. More of the effort of the two team members remaining in Hilo will be devoted to user support activities, while the position in Tucson will be moved to Chile to support Gemini South installation efforts.

Scientific Instrumentation

1998 Accomplishments

Near Infrared Imager. The fabrication phase of NIRI at the University of Hawaii continued throughout 1998. The cryogenic gimbal mirror assembly, the most complex mechanism in this instrument, was completed successfully during the summer of 1998. Currently all optics have been received at UH and all of the design effort has been completed. A first cold test of the basic cold structure (no mechanisms installed) indicated some problems with its cool-down time, but work-around strategies have been executed to mitigate this problem and minimize its impact on the final I&T phase. NIRI is expected to arrive in Hilo in the spring of 1999, where it will undergo final software integration with Gemini's control and data systems, before being sent to the summit for its first light tests. This will make NIRI about 6 months late. Until it arrives, intermittent use of QUIRC, a 1024^2 1-2.5 µm imager on loan from UH, will be used to support telescope commissioning. The UH adaptive optics system to work with QUIRC will be borrowed as well, beginning in May 1999.

Near Infrared Spectrograph. In the spring of 1998, GNIRS passed its interim review at NOAO, which was held to review outstanding technical issues from the CDR, including electronics, thermal modeling, and handling procedures. In the following months, NOAO concluded that significant mismanagement within the team had led to an instrument delivery and total price far beyond original expectations. Soon thereafter, a stop work order was placed on NOAO by the IGPO, and a review, organized by AURA, was held to assess NOAO's revised management plan for GNIRS. The stop work order was still in effect when this report was being written. At present, the earliest delivery date expected for GNIRS is late 2002 and it is likely that a GNIRS clone will not emerge.

Multi-Object Spectrograph. The construction of GMOS at HIA / NRC in Canada, and ROE and Durham in the UK, continued during 1998. A number of fabrication milestones were met, including the successful delivery of the dewars to NOAO, where CCDs will be installed and integrated with array controllers. The pneumatic grating turrets and filter wheels are near completion at Durham, and a major renovation of the laboratory facilities at ROE was completed in preparation for the integration of the instruments, starting in 1999.

High Resolution Optical Spectrograph. The design effort for HROS continued at UCL during 1998. The PDR is now scheduled for summer of 1999 (shifted from the end of 1998). During 1998 substantial progress was made with the final design of the optical system to support the detailed mechanical layout of HROS. Progress was also made with refining various Interface Control Documents that are linked to HROS and with devising more robust project management within the HROS team, the better to track progress and cost of the instrument.

Mid Infrared Imager. The University of Florida (UF) was awarded a contract to build Gemini's mid-infrared imager (MIRI; also known as the Thermal-Radiation Emission Camera System) during early 1998. Since then UF personnel have continued to develop the concept they proposed in 1997, and successfully held a PDR in September 1998. A modest spectroscopic mode, as originally proposed by UF, was adopted in 1998 as well, to augment the Gemini South mid-infrared capabilities at operational hand-over. Considerable work was performed during the remainder of 1998, including optical tolerancing, finite element analysis, and thermal modeling, to carry the instrument to CDR during the spring of 1999.

CCD Arrays and Controllers. EEV did not deliver the first of Gemini's 12 science grade CCDs by November 1998 as scheduled. In order to minimize the impact of this on GMOS and the CCD / controller integration effort at NOAO, a pair of engineering grade CCDs were purchased from EEV during the summer of 1998. These CCDs were integrated in a GMOS dewar supplied by ROE, and interfaced with a CCD array controller, a SDSU2 from San Diego State University (SDSU). Bob Leach, who designs and produces the SDSU2s at SDSU, delivered all of the science CCD controllers during 1998, which will support both

GMOS instruments and HROS. The GMOS dewar integrated with the CCDs, and a SDSU2 controller, were shipped to HIA / NRC near the end of 1998. At HIA / NRC, this detector system will undergo software integration with the GMOS instrument control system.

Near IR Arrays and Controllers. The NIR arrays program was quite successful during 1998, with the production of enough high quality 4-quadrant detectors to support NIRI, GNIRS, a two channel coronagraph, and still have a good spare device. It should be possible to upgrade Phoenix and the COB with remaining detectors as well. Production was halted after making the first 10 of the 12 arrays ordered, due to the prospect of using type-III MUX for the remaining 2 devices, which may lead to faster amplifiers and therefore improved long-wave performance. Three NIR controllers were also completed by NOAO for Gemini during 1998. These will be used for NIRI, GNIRS, and one will be used in the GONOC lab as a test station for continued array / controller development, as well as to provide a set of "hot" spare parts should the NIRI controller fail.

1999 Plans

Near Infrared Imager. All of the components needed for NIRI should be completed early in 1999, at which point an intensive integration and test phase for the instrument will begin. This activity will include the optical alignment of all three science channels, as well as the wavefront sensing optical channel. NIRI will be integrated with Gemini's principal software systems after it arrives in Hilo, including the TCS (Optical / Infrared-WFS control), DHS, and the Observatory Control System. After NIRI's first light in 1999, it will undergo an extensive commissioning phase to characterize the performance of all its modes, as well as to support various telescope commissioning functions.

Near Infrared Spectrograph. Once the stop work order on GNIRS is removed , progress can continue in 1999 with this key instrument. Approximately 10 man-years of design effort will begin, mainly in detailing the grating turret and forward two modules, and also fabrication of some of the GNIRS components.

Multi-Object Spectrograph. Fabrication of essentially all of the mechanisms, lens cells, various support structures, etc. should be completed for both GMOSes at HIA / NRC, ATC, and Durham during 1999. This activity leads into an integration phase for both instruments at ATC during 1999 as well. NOAO should also complete the CCD / controller integration effort needed for both GMOS dewars, including swapping out the engineering grade devices installed in the first GMOS dewar in 1998 with science grade CCDs.

High Resolution Optical Spectrograph. Both PDR and CDR are scheduled in 1999 for HROS. Fabrication should begin in earnest late in 1999. Long-lead items will also be purchased in 1999, including the echelle from Spectronics. The dewar will be built and sent to NOAO where a pair of science grade CCDs will be installed to finish the CCD / controller work NOAO is performing for Gemini.

Mid Infrared Imager. The CDR for the mid-infrared imager should be held during the spring or summer of 1999, with fabrication following soon thereafter. Leading into that important milestone will be extensive design work, including finite element analysis, opto-mechanical tolerancing, and thermal analyses to assess the dynamic and steady-state performance of various components.

CCD Arrays and Controllers. EEVs continuing slippage pushed delivery of the science CCDs into 1999. This may impact the GMOS and HROS schedules; hence, alternate sources of CCDs may be sought during 1999. The ability of NOAO to maintain its integration schedule will also be affected by the availability of CCDs. This situation requires close monitoring during 1999 to minimize its impact on the optical instrumentation.

Near IR Arrays and Controllers. With the delivery of all 3 array controllers in 1998, future effort in this area will be dedicated to optimizing low-level controller software for low and high background operating conditions. Gemini's technical staff will also focus on developing maintenance and support procedures for these complex electronic systems. Effort will be expended to characterize high speed Rockwell arrays for possible use in Gemini's future near-infrared wavefront sensing system. The final pair of 1024^2 InSb arrays from SBRC using the new type-III MUX are expected to arrive in 1999.

Systems Engineering

Part of the Systems Group's former tasks have now been split off into Electronic Systems Engineering, covered elsewhere in this report. The remaining Systems Engineering responsibilities include some facility instrumentation tasks.

1998 Accomplishments

Integration, Test, and Commissioning. The MK systems integration phase began in July 1998. There were many schedule conflicts, compounded by the fact that the coating chamber magnetrons required extensive rework, and the mirror cell arrived with water damage and needed repair. Although the Project Manager and all group managers worked hard together to prioritize and keep the Project on track, hoping to achieve first light by the end of 1998, that proved unfeasible. However, the Project at least succeeded in integrating the primary mirror, completed telescope pointing tests and active M1 control, and took the first photograph using the telescope on 23 December, with the acquisition camera.

Test and handling equipment. Tests of the prime focus WFS were carried out successfully on UKIRT at the beginning of 1998. Wavefront tests on Gemini were part of the activities on 23 December 1998, with the Shack-Hartmann sensor. Guide images of 0.6" were achieved on the first try.

The alignment test equipment was completed and mounted on the Gemini North telescope, where it was used for initial mount pointing tests.

Telescope services. The systems group, with others, completed the major water, air, and helium services installation on the telescope and in the MK observatory.

Coating Chamber. The systems group, supporting Keith Raybould, has taken over the responsibility of commissioning the coating chamber, which should have been the responsibility of RGO. The magnetrons need repair or, better, replacement. PPARC has been helping in this area. The coating chamber coated the primary mirror with aluminum on 3 December.

Error Budget. Trade-offs are expected to continue on the various system error budgets as the telescopes are integrated, by using the margins achieved in some areas to compensate for the few areas in which it is difficult to meet the derived subsystem specifications. The goal of this exercise is to keep the top level science specifications in mind so that they can be met economically, even though Gemini North is already in the final integration stage,

Reviews. The only remaining reviews in the construction phase are in the area of instrumentation. This has been a problem as all instruments are now coming late.

1998 Accomplishments for Facility Instrumentation

Acquisition and Guiding. The RGO / Zeiss-Jena MK A&G system was delivered to MK in the summer of 1998. Some software from the UK was delivered late in 1998 and some cleanup will be required in 1999. The software for the Zeiss opto-mechanical part was accepted with minor corrections required. Work on the Cerro Pachón system proceeded well and will be shipped in 1999.

Wave Front Sensors. Integration was delayed due to key people leaving RGO and new people having to come up to speed. The integration is expected to be acceptable for first light, with some further cleanup required shortly after. There was some trouble with the HR-WFS / Acquisition camera CCD and an engineering grade device was temporarily installed. This will be replaced during commissioning.

Calibration Unit. Preliminary design and critical design were completed in 1998 for the calibration unit.

Adaptive Optics. The CDR for the Shack-Hartmann sensor natural guide star system on MK, ALTAIR, under development at HIA / NRC, was delayed and rescheduled for January 1999. The work on the MK laser upgrade has been going slower than hoped, due to the priority of first light. The UH system "Hokupa'a" (a Hawaiian word meaning "fixed star", i.e., Polaris), a 36-element curvature-sensing system, will be installed on the MK telescope in May 1999 and will be used with QUIRC to support commissioning and the Gemini-North dedication. The overall planning was begun for a laser guide star upgrade and for an AO system for the southern telescope. To prepare for the southern system, site characterization testing was completed in 1998, using balloon and SCIDAR measurements.

1999 Plans

The following are the major plans for Systems Engineering in 1999:

- Complete first light work.

- Organize and plan the commissioning phase (working with the other groups):
  - Telescope performance improvements and tests
  - Science verification (working with science team)
  - Operational readiness
  - Coating chamber
  - Silver coatings

- Carry out most of the commissioning for the MK observatory, extending into 2000.

- Supervise and accept various CP systems equipment:
  - Coating Chamber
  - Acquisition and Guiding

- Participate in ramp-up of integration efforts in Chile. Organize plans from top level.

- Begin systems integration phase in Chile.

Electronic Systems

1998 Accomplishments

In the reorganization resulting from the departure of the Project Manager in February 1998, the Electronic System group was split off from the Systems Group, and all of the electrical engineers, technicians, and electricians were transferred there. Their areas of responsibilities were redefined to be all the cabling in the telescope, and any new electrical cabling in the support facility not included in previous contracts. The group is a multinational effort, with people hired from the UK work packages, Chileans (who had been hired previously), and hires within Hawaii.

During 1998, the MK telescope wiring progressed substantially. The cables were pulled from the Computer Room, through the azimuth wrap, up under the mount base to the mount base rack and both altitude platform junction boxes. Both of the altitude cable wraps were completed. The group mounted, wired, and tested the drive amplifiers for the azimuth and elevation. The azimuth motors were tested, and successfully drove the telescope in single-motor torque mode. The Mount Control System (MCS) was installed and the network to it became operational.

The Gemini Interlock System (GIS) was constructed, tested and installed, and completed in December. The Programmable Logic Controller (PLC) program is being verified as more and more systems come on line.

The Primary Control System (PCS) arrived, was installed and is now running the mirror cell on the telescope.

Tasks for the electricians included work on the coating chamber; running circuits for the telescope power, both mains and uninterruptable power; all power distribution on the telescope; many small jobs such as cranes, hoists, lifts and phone circuits; and finally the cable trays on the telescope, including the trays leading to the top end for the top end latches and tip / tilt system.

The Hydrostatic Bearing System for the primary mirror was installed.

Support for the Cassegrain cable wrap continued with the final visit to AMOS from the Electronic Systems Group in September for testing. The cable wrap parts arrived in Hilo on 20 November, were assembled for cable and service hookup, and installed on the MK summit in December.

The first components of the Castel Interlock Safety System were installed by early December. The system protects the telescope and people from hazard during telescope motion.

1999 Plans

During 1999, work efforts will begin to shift from Hawaii to Chile. Once cabling is finished on the Mauna Kea telescope and only minor electrical work in the facility remains, the two Chilean engineers will return to Chile to manage the cabling installation, as they did on Mauna Kea. The Electronic Systems group will take a support role for the other groups, especially instrumentation support.

Operations Planning

Background. The operations effort must first bridge the transition between facility construction and operational handover by supporting the Integration, Test, and Commissioning (IT&C) effort, and then continue the steady-state operation of all facilities, North and South, as well as the Instrument and Facility Development activities after operational handover.

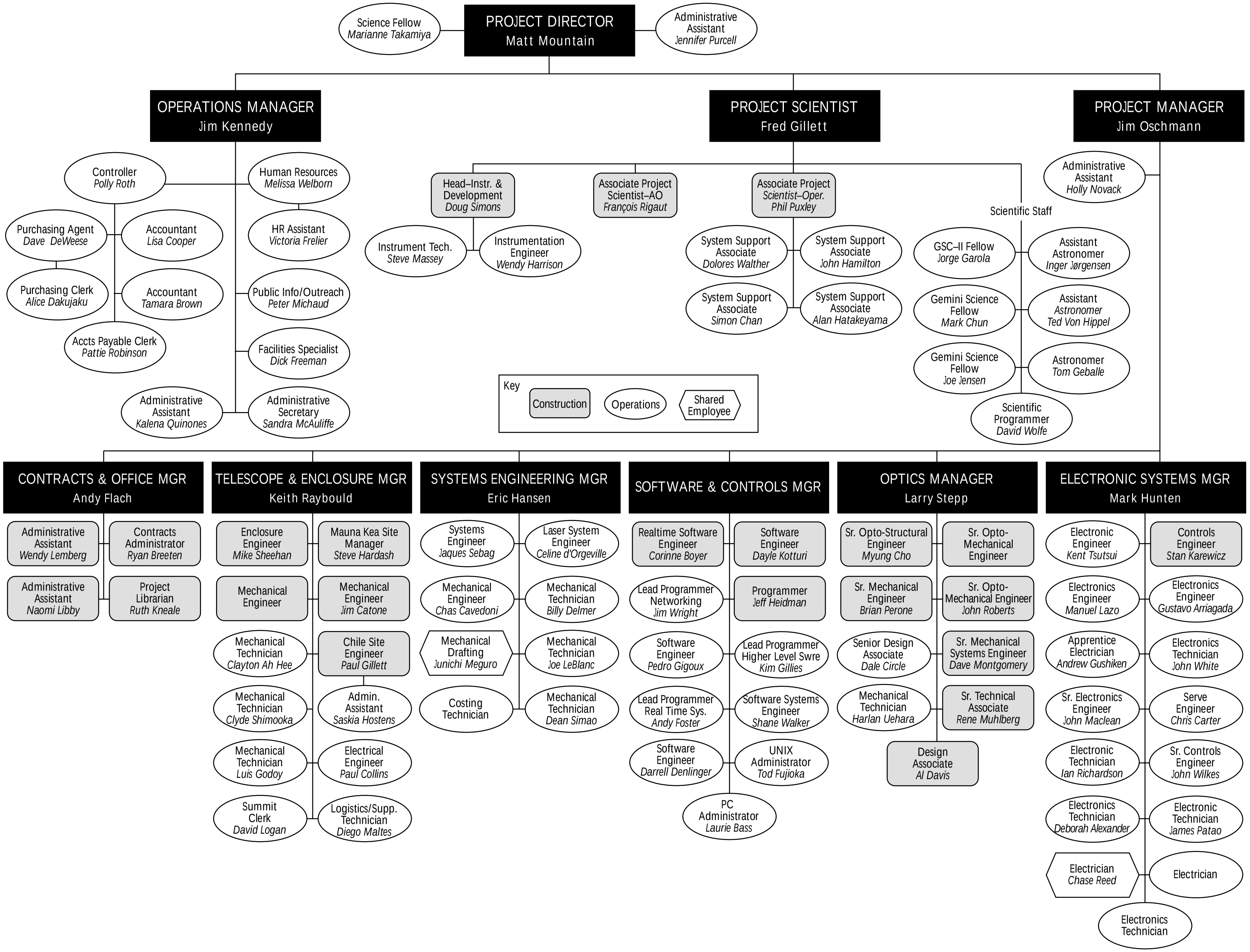
In the operations era after handover, activities such as administration, engineering, and software support, will flow from several single, though geographically-distributed, functional units, as shown in the organization chart. The intention is to preserve a consistent set of standards, processes, hardware, software, and so forth, as is appropriate and essential to maintain efficient operations in a one-observatory, two-telescope model. Aided by modern communications tools, particularly the use of high-speed data transmission and video conferencing, these functional units will provide services to both the North and South telescopes.

Infrastructure. In the near term, the development of the infrastructure to support operations, including base and mid-level base physical plants, communications systems, laboratories, administrative systems, staff, staff training, safety, and working relationships with partners and neighbor observatories, is a non-trivial effort.

Although the project might have chosen to develop the infrastructure of each project phase separately, it has been more economical and efficient to evolve them smoothly through the transition of the program from construction to full operations. A significant fraction of the infrastructure required to support true operations is substantially the same as that required to support the IT&C efforts, and the latter stages of construction. The operations program has been charged with developing that infrastructure.

Staff. While it is true that many of the technical staff traditionally associated with an IT&C effort are, in some sense, itinerant, moving on to the next project after the completion of the previous one, this does not have to be the case for many staff members. Ideally, one would like to preserve some significant portion of the expertise and experience gained in the IT&C era for the operations era as well. Consequently, as the staffing tables have been developed for IT&C, a deliberate effort has been made to identify both positions and applicants that might be suited to both IT&C and operations. Many of the construction phase staff who have proven themselves and indicated an interest have been targeted for longer-term “operations” positions that will begin as IT&C support and continue into operations thereafter. With the

Gemini Project Organizational Chart (April 5, 1999)



cooperation of the respective national partners, certain key people involved in the workscopes have similarly been targeted for recruitment.

Notwithstanding this effort, the project is not trying to force people into positions for which they are ill suited. There are still a fair number of IT&C positions which best fit the traditional itinerant mode, and these are also being filled from within the project and partnership, and from the outside as well.

1998 Accomplishments

Hilo Base Facility. The construction of the Gemini Observatory Northern Operations Center (GONOC), was completed on schedule in late July. The project moved into the new building in early August. While a number of minor adjustments are still being made, as is common with any new building, the staff is ensconced and pleased with the overall results.

Hilo Plaza Office. With the completion of the GONOC, the project has closed the Hilo Plaza office. The lease terminated on schedule in September.

Free Trade Zone. The project continues to lease 11,000 sf of nearly new warehouse space under roof and 22,000 sf of outdoor space at the Hilo airport. This facility is very reasonably priced as a result of a state government program to attract new business into the area. The trade zone is being used as a delivery and storage place for small to medium loads, and as an assembly area for many of these systems.

Staffing. In May 1997 the project had only three staff members based in Hilo. Since that time the group has grown to nearly 70 and will reach a maximum of 75 or 80, including “commuters,” in the first quarter of 1999, when the construction and operations teams overlap each other prior to the beginning of the migration of construction staff to Chile. This peak in staffing is about ten people above the long-term staff level in Hilo, crowding the base facility. In a year’s time the situation will approach more normal levels.

Sharing Agreements. The project and the Joint Astronomy Centre continue to engage in various sharing activities under an agreement worked out in 1997. This agreement provides for the collegial sharing of staff and facilities between Gemini North and the JAC on a work-order basis, formalizes mutual working relationships that had informally been in place for some time, and expands the basis for these mutual help efforts.

Under this agreement, Gemini North and the JAC have also arranged to cooperate in the hiring of shared new staff, to take advantage of a few situations where both discovered they had the need for a half-person in the same area. Two such hirings have taken place and the system is working out well for both groups. In addition, the two programs share the JAC machine shop and library, the Gemini main instrument lab, a staff lounge in the JAC with a number of furnishings provided by Gemini, joint seminars, and a number of other functions.

The project is also sharing resources and obtaining support from AURA Observatory Services in Chile. Although the amount of true sharing is limited at the moment, since the development of Gemini South is phased a year or so behind the North, the project, NOAO, and AURA are finalizing the administrative details for a centralized AURA support unit based in La Serena that provides infrastructure and at least some staff to all the AURA (and non-AURA) programs on Cerro Tololo and Cerro Pachón, including CTIO, Gemini South, and SOAR. The basic model is very much like Mauna Kea Support Services.

Finance and Accounting. The project's staged withdrawal from reliance on NOAO for administrative services support is very nearly complete. The last remaining service of significance is the processing of payroll. The project will take this service over on 14 January 1999. ISDN services have become available in La Serena and after the beginning of the year the project will begin using its ISDN connection to the Gemini office in La Serena to connect their purchasing system directly to the overall Gemini accounting computer system.

Human Resources. In the presence of the significant ramp-up of staff, including the relocation of so many staff to Hilo from all over the world, the Human Resources activities have been at fever pitch. The project has recently hired a dedicated assistant to support the HR manager in order to keep up with the work load.

Safety. Safety has always been a critical aspect of Gemini operations. Early in the year a Safety Manager was appointed to coordinate the activities of the Safety Officers at the various Gemini work sites. In addition, Safety Technicians have been hired at both telescope sites to extend the overview of safety activities.

Independent AURA inspections and reviews of safety practices at both Gemini North and Gemini South have been conducted (with good reports) and the details of these inspections used to improve processes and procedures. The fatal accident of an subcontractor construction worker at Cerro Pachón in June has underscored the importance of constant vigilance.

Public Information and Outreach. The project is actively engaged in expanding its connections with the scientific community and the general public, as described below. An experienced public relations manager was hired in June to handle these matters.

1999 Plans

Hilo Base Facility. The last of the informal punch-list items were completed by the end of 1998, at which time all aspects of the construction and immediate follow-on activities were completed. The HBF fund will be closed out and financial support for the facility will pass completely to the Operations & Management fund.

Free Trade Zone. The project will continue to use the FTZ warehouse space throughout the year. An assessment late in the year will determine if the space is still needed after 1999.

La Serena Base Facility. During this year, planning and architectural design will begin for the La Serena facilities required by Gemini in Chile.

Staffing. The staffing ramp-up in Hilo will continue with a combination of new hires and transfers from Gemini work sites in Tucson and Europe. This ramp-up will continue fairly steadily until it reaches 75 or 80 people at its peak in early 1999, before gradually dropping off after first light as construction work begins to move south. There also will be a small increase in project staff in Chile to support the administrative unit there.

Sharing Agreements. It is expected that all of the current agreements will remain in effect and active. No new agreements are anticipated at this time.

Finance and Accounting. The project will be totally self sufficient in all areas in 1999 except foreign imports and exports, where NOAO may still provide some services. Payroll is scheduled to come in-house in January. While it is true that Gemini South will continue to use AURA's Chilean unit to effect local purchases, the booking of those transactions will occur on-line on the Gemini side of the interface, using Gemini South staff and the American Fundware software package.

Human Resources. The project will remain self-sufficient, except for the HR aspects of Chilean hires in Chile. As with finance and accounting, Gemini will retain management responsibility, but work through an interface with the AURA Chilean unit to deal with the Chilean union and legal requirements.

Safety. The safety program will continue at all work sites, supported by periodic inspections and reviews by independent consultants and other outside experts.

Public Information and Outreach. The major event of 1999 is the dedication of the Mauna Kea telescope in June.

Public Relations and Outreach

The project is committed to facilitating the dissemination of information about the science and technology developed and exploited by the Gemini Project, as well as sharing with the general public the excitement of scientific discovery. The project's approach to optimize outreach involves not only distribution of materials by the project directly, but collaboration and facilitation of work with the partner agencies, and helping to coordinate these efforts for the common good.

The new Public Information and Outreach (PIO) manager, Peter Michaud, is developing plans for announcement of first light, the Gemini North dedication, and first science activities, as well as press releases, and expansion of the Gemini web pages (http://www.gemini.edu/).

1999 Plans

The principal focus of the PIO program in 1999 will be support of the Gemini North dedication. It will include the production of a new project brochure, a press kit, web page enhancements and a variety of other things. The PIO office will coordinate closely with the partners' press activities, the NSF, and AURA, as these efforts move forward.

Gemini North Dedication

The Dedication Ceremony will take place on 25–26 June, on the Big Island of Hawaii. The ceremony itself will be held at the Mauna Kea summit on the 25th. Since only about 120 visitors can be accommodated there, the ceremony will be shown on television to the overflow visitors at the base facility in Hilo. Tours of the telescope itself will take place afterward, on the 26–27 June.

Contracts

The following contracts were awarded in 1998:

Major contracts in 1998 (over $1,000,000)

- To U. Florida, under subcontract to AURA, for the Mid-InfraRed Imager.
- To Babcock Montajes of installation of mechanical and electrical components in the Cerro Pachón enclosure and support facility.
- Work Package to PPARC to design, build, ship, and install the High Resolution Optical Spectrograph.

Contracts between $250,000 and $1,000,000 in 1998.

- To PPARC to hire three specified programmers for integration and testing software at Gemini North.
- To PPARC to modify the Michelle mid-infrared spectrometer.
- To Brewer Environmental Industries for trucking in Hawaii.
- To Oda / McCarty Architects for architectural services to complete the Hilo base facility.
- To Baneven for meals and dormitory housekeeping for construction workers at Cerro Pachón.

Planned Contracts in 1999

Only one subaward over $250 K is expected in 1999 (it may be postponed to 2000), for communications network equipment for Chile. It will be offered for open bid.

1998 Gemini Science

1998 marked a major step in the formation of the Gemini North Scientific staff with the appointment of three long term scientific staff members, Tom Geballe, Ted von Hippel, and Inger Jørgensen, and also the third Gemini Science Fellow, Marianne Takamiya. (The other two Fellows, Mark Chen and Joe Jensen, joined the staff in 1997.) The range of interests of the nascent Gemini North scientific staff is very broad, with refereed publications in 1998 spanning the range from solar system studies to investigation of distant clusters of galaxies.

Planetary System studies

Tom Geballe and colleagues at the University of Hawaii, NASA Ames, and elsewhere, continued their spectroscopic survey of outer solar system objects. They completed a spectral survey of most of the larger moons of Saturn and Uranus. For many of the moons without atmospheres, spectral features seen in the JHK bands are due only to water ice in various grain sizes; however, the blue slopes of the IR continua of many of the objects require another material to be present on their surfaces. In a separate spectral monitoring program led by scientists at Northern Arizona University, Geballe and colleagues reported evidence for methane condensation clouds in Titan's troposphere. This conclusion results from observations of unprecedented enhancements in Titan's flux within four narrow infrared spectral regions where the satellite's atmosphere is otherwise transparent. Finally, Geballe and colleagues published a detailed long-term study of the Centaur object 5145 Pholus, one of the most primitive objects yet identified, whose JHK spectrum shows water ice as well as unidentified (but probably organic) chemical(s) absorbing strongly at 2.27 μm. The latter spectral feature is unique to Pholus at present.

Dolores Walther participated in two studies of the dusty debris disks around nearby stars, based on new infrared and submillimeter observations using the UKIRT and JCMT telescopes. The researchers derived dust masses and gas-to-dust ratios and found that many of their samples are less evolved than the archetypes of this class, α Lyr, β Pic, and α PsA; and that the Piscis Austrinus debris disk appears to have a central cavity which may be a signature of planetary system formation.

Interstellar Medium and Stellar studies

Ted von Hippel and colleagues published their technique to extract and digitize photographic objective prism spectra automatically. The goal of this work was to produce a large digital library of stellar spectra that had prior high-quality MKK classifications. From these data, the team developed an automated stellar spectral classifier. Ted plans to extend this work to derive detailed atmospheric abundances for a new Hobby-Eberly Telescope survey of low metallicity stars.

Ted and a colleague published their WIYN photometry and analysis of the old open cluster NGC 188. They rederived many of the fundamental cluster properties and found the bright end of the white dwarf cooling sequence, providing a lower limit to the age of the cluster that is independent of stellar evolution theory.

Ted also published his literature survey of the mass and number fraction of white dwarfs in open and globular clusters, where he found that the white dwarf mass fraction is sensitive to the cluster initial mass function(s) but generally insensitive to the cluster dynamical histories.

Tom Geballe and colleagues continued their work on interstellar H_3^+ (the starting point of interstellar gas phase chemistry), which they discovered in dark clouds in 1996 and in the diffuse interstellar medium in 1997. The team has concluded that the surprisingly large abundance of H_3^+ in the latter environment (roughly an order of magnitude more than predicted) implies either that the rate of production of H_3^+ in the diffuse interstellar medium is much larger than generally accepted, or that the rate of destruction of H_3^+ by dissociative recombination on electrons is much smaller than is inferred from recent laboratory work.

Geballe and various colleagues also reported on studies of a wide variety of unusual evolved stars. One long-term study has involved interferometry and near-simultaneous N-band spectroscopy of red supergiants with extensive and evolving dust envelopes. In another project, analysis of infrared spectra of the Pistol Star imply that this obscured object, located a few tens of parsecs from the nucleus of our galaxy, is perhaps the most luminous star known. Geballe and colleagues at Keele University continued their monitoring of Sakurai’s Object, an evolved star on the asymptotic branch, which appears to be undergoing its (final) helium flash before becoming a planetary nebula. During the last 1.5 years, their infrared spectroscopy has revealed a dramatic change in the photosphere of this object: it has changed from being warm and oxygen-rich to being cool and carbon-rich. Finally, Geballe with UK scientists reported on the evolution of the type IIp supernova SN1995V, showing for the first time the IR spectral evolution during the plateau phase, and detecting for the first time in this type of supernova the He I 10830 Å line. The presence of this line can be explained best by reionization of expelled material by gamma rays from the radioactive decay of dredged-up ^{56}Ni. If correct, the study of this line will provide an important constraint on initial mixing in explosion models for supernovae.

Phil Puxley has obtained new measurements of hydrogen recombination lines in the compact H II Region K3-50a from the near-IR through sub-mm and mm wavelengths to radio wavelengths using ISO, JCMT, NRO, VLA and WSRT telescopes. The observed line ratios are roughly consistent with a simple case B model. More realistic source models including the effects of dust will be constructed once the ISO data are fully reduced.

Extragalactic studies

Joe Jensen and colleagues at the University of Hawaii reported on their study of using IR surface brightness fluctuations (SBF) to measure distances. They calibrated the K’ SBF distance scale based on the Cepheid distance to M31, and studied the reliability of the method using observations of galaxies in the Fornax and Eridanus clusters. They found the K’ SBF to be a reliable distance indicator, provided that the residual variance from globular clusters and background galaxies is properly removed, and that adequately high signal-to-noise ratio is achieved to allow reliable sky subtraction. Their measurements of NGC 4889 in the Coma cluster, and of NGC 3309 and NGC 3311 in the Hydra cluster, will be published in early 1999. Observations using NICMOS on HST and new detectors on large ground-based telescopes like Gemini will enable distance measurements using the SBF technique to 100 Mpc and beyond.

Phil Puxley participated in a study of H_2 emission from the nearby starburst galaxy NGC 253, from which it was deduced that the bulk of the H_2 emission arises from photo-dissociation regions rather than from shocks. The rotation curves deduced from H_2 and ionized hydrogen suggest that the two forms of hydrogen trace different kinematic systems in this galaxy.

Inger Jørgensen led a study of the poor cluster of galaxies, S639. New photometry obtained with the Danish 1.5-m telescope on La Silla showed that if the Fundamental Plane is used as a distance determination for this cluster, then the previously determined high peculiar velocity of this cluster was most likely overestimated.

Ted von Hippel and colleagues published their discovery of intergalactic red giant branch stars in the Virgo Cluster using the Hubble Space Telescope. Intergalactic stars are expected from the cluster formation process, which should have involved numerous galaxy collisions and disruptions, but up to now there have been no direct detections of intergalactic stars. The team is continuing this work with HST optical and infrared photometry in order to measure the abundances and spatial distribution of the intergalactic stars.

Tom Geballe coordinated infrared observations of gamma ray bursters at UKIRT, as part of an international team which is obtaining observations covering the x-ray, optical, infrared, submillimeter, and radio bands. He monitored the decline of the burster GRB 980703 (in a z=1 galaxy) over a 2-week period; a paper containing these observations was in press at the end of 1998. The complete data set is consistent with a fireball seen through ~1.5 magnitudes of visual extinction. Geballe also collaborated with Meaburn and colleagues at the University of Manchester in imaging a disk of shocked molecular hydrogen surrounding the nucleus of the active galaxy NGC 3079. The disk, which contains roughly 1000 solar masses of vibrationally excited H II, is warped, and must be clumpy on angular scales smaller than the resolution of 0.6 arcseconds.

Matt Mountain and Fred Gillett looked back at the growth of collecting area of ground-based optical/IR telescopes and the advances in computers, materials and fabrication techniques that provided the technological basis for the current suite of 8–10 m class telescopes coming into use. They also looked to the future, speculating that the next generation of ground-based telescopes may need to be in the 30–50 m class to scientifically complement the next generation of space telescopes.

1998 Refereed Publications

Griffith, C. A., T. Owen, G. A. Miller, T. R. Geballe. *Nature*, vol **395**, 575, 1998. “Transient Clouds in Titan’s Lower Atmosphere”

Cruikshank, D. P., T. L. Roush, M. J. Bartholomew, T. R. Geballe, Y. J. Pendleton, S. M. White, J. F. Bell, J. K. Davies, T. C. Owen, C. De Bergh, D. J. Tholen, M. P. Bernstein, R. H. Brown, K. A. Tryka, C. M. Dalleore. *Icarus*, vol **135**, 389, 1998. “The Composition of Centaur 5145 Pholus”

Coulson, I. M., D. M. Walther, W. R. F. Dent. *MNRAS*, vol **296**, 934, 1998. “Infrared and Submillimetre Studies of Vega-excess Stars”

Holland, W. S., J. S. Greaves, B. Zuckerman, R.A. Webb, C. McCarthy, I. M. Coulson, D. M. Walther, W. R. F. Dent, W. K. Gear, I. Robson. *Nature*, vol **392**, 788, 1998. “Submillimetre Images of Dusty Debris around Nearby Stars”

Bailer-Jones, C. A. L., M. Irwin, T. von Hippel. *MNRAS*, vol **298**, 361, 1998. “Automated Classification of Stellar Spectra - II. Two-dimensional Classification with Neural Networks and Principal Components Analysis”

Bailer-Jones, C. A. L., M. Irwin, T. von Hippel. *MNRAS*, vol **298**, 1061, 1998. “Semi-automated Extraction of Digital Objective Prism Spectra”

von Hippel, T., A. Sarajedini. *AJ*, vol **116**, 1789, 1998. “WIYN Open Cluster Study. I. Deep Photometry of NGC 188”

von Hippel, T.. *AJ*, vol **115**, 1536, 1998. “Contribution of White Dwarfs to Cluster Masses”

McCall B. J., T. R. Geballe, K. H. Hinkle, T. Oka. *Science*, vol **279**, 1910, 1998. “Detection of H_3^+ in the Diffuse Interstellar Medium Toward Cygnus OB2 No. 12”

Monnier, J. D., T. R. Geballe, W. C. Danchi. *ApJ* vol **502**, 883, 1998. “Temporal Variations of Mid-Infrared Spectra in Late-Type Stars”

Figer, D. F., F. Najarro, M. Morris, I. S. Mclean, T. R. Geballe, A. M. Ghez, N. Langer. *ApJ*, vol **506**, 384, 1998. “The Pistol Star”

Eyres, S. P. S., A. Evans, T. R. Geballe, A. Salama, B. Smalley. *MNRAS* vol **298L,** 37, 1998. “Infrared Spectroscopy of Sakurai’s Object”

Chiar, J. E., Y. J. Pendleton, T. R. Geballe, A. G. G. M. Tielens. *ApJ*, vol **507**, 281, 1998. “Near-Infrared Spectroscopy of the Proto-Planetary Nebula CRL 618 and the Origin of the Hydrocarbon Dust Component in the Interstellar Medium”

Fassia, A., W. P. S. Meikle, T. R. Geballe, N. A. Walton, D. L. Pollacco, R. G. M. Rutten, C. Tinney. *MNRAS* vol **299**, 150, 1998. “^{56}Ni Dredge-up in the Type IIp Supernova 1995V”

Puxley, P. *ASP Conference Series*, vol **132**, 398, 1998. “Hydrogen Recombination Lines in the Compact H II Region K3-50a”

Jensen, J. B., J. L. Tonry, G. A. Luppino. *ApJ*, vol **505**, 111, 1998. “Measuring Distances Using Infrared Surface Brightness Fluctuations”

Harrison, A., P. Puxley, A. Russell, P. Brand. *MNRAS*, vol **297**, 624, 1998. “The Ortho- to Para- Ratio of H_2 in the Starburst of NGC 253”

Jørgensen, I., H. Jonch-Sorensen. *MNRAS*, vol **297**, 968, 1998. “The Poor Cluster of Galaxies S639”

Ferguson, H. C., N. R. Tanvir, T. von Hippel. *Nature*, vol **391**, 461, 1998. “Detection of Intergalactic Red-Giant-Branch Stars in the Virgo Cluster”

Groot, P. J., T. J. Galama, J. van Paradijs, C. Kouveliotou, R. A. M. J. Wijers, J. Bloom, N. Tanvir, R. Vanderspek, J. Greiner, A. J. Castro-Tirado, J. Gorosabel, T. von Hippel, M. Lehnert, K. Kuijken, H. Hoekstra, N. Metcalfe, C. Howk, C. Conselice, J. Telting, R. G. M. Rutten, J. Rhoads, A. Cole, D.J. Pisano, R. Naber, R. Schwarz. *ApJ*, vol **493**, L27, 1998. “A Search for Optical Afterglow from GRB 970828”

Mirabel, I. F., V. Dhawan, S. Chaty, L. F. Rodriguez, J. Marti, C. R. Robinson, J. Swank, T. R. Geballe. *A&A* vol **330L,** 9, 1998. “Accretion Instabilities and Jet Formation in GRS 1915+105”

Burton, M. G., J. E. Howe, T. R. Geballe, P. W. J. L. Brand. *PASA*, vol **15**, 194, 1998. “Near-IR Fluorescent Molecular Hydrogen Emission from NGC 2023”

Meaburn, J., B. R. Fernandez, A. J. Holloway, A. Pedlar, C. G. Mundell, T. R. Geballe. *MNRAS*, vol **295L,** 45, 1998. “A Disc of Shocked Molecular Hydrogen Around the Active Nucleus of NGC 3079”

Mountain, M., F. Gillett. *Nature* vol **395** suppl, A23, 1998. “The Revolution in Telescope Aperture”

Board Actions

The Board met on 25–26 May 1998 in Quebec City, Quebec, Canada, and on 16–18 November, 1998 in Hilo, Hawaii. There was full attendance by Board members at both meetings. During the latter meeting, a tour of the Gemini North telescope was made by Board members.

Changes in the Partnership

In 1997, Australia asked to be allowed to join as an additional 5% partner, augmenting the Project's total funding and supplementing its scientific expertise. The Gemini Science Committee unanimously considered this to be advantageous to the Project, and the Board recommended at its November 1997 meeting that the partners open formal negotiations with Australia to this effect, with the understanding that these additional 5% funds for both construction and operations would provide added value, not a cost reduction for the existing partners. The negotiations were completed early in 1998.

Possible uses for the added funds include obtaining high performance secondary mirrors, establishing and maintaining a science data archive, and accelerating the instrumentation program, especially the adaptive optics.

Formally, admission of Australia to the partnership was accomplished by the approval of the Second Amendment to the Gemini Agreement, which included Australia as one of the partners and specified the new proportions of monetary contributions and of observing time. The agreement was signed by the six previous partners in time for Vicki Sara, as the Australian representative, to add the final signature at the Board meeting on 25 May 1998. The resulting shares of observing time for each partner are:

Gemini North:	NSF including the University of Hawaii:	51.60%
	PPARC:	22.00%
	NRC:	13.20%
	ARC:	4.40%
	CONICYT:	4.40%
	CONICET:	2.20%
	MST:	2.20%
Gemini South:	NSF including Chilean astronomy:	51.60%
	PPARC:	22.00%
	NRC:	13.20%
	ARC:	4.40%
	CONICYT*:	4.40%
	CONICET:	2.20%
	MST:	2.20%

The figures for the NSF include the 10% allotment to the "host."

Administrative Guidelines

In 1998, a document proposing Administrative Guidelines for prudent financial operation of the Gemini telescopes was distributed to the partners, which has been signed by all the partners except Chile. It has also been approved in principle by Australia, although the financial figures were based on the pre-Australian partnership. The document included the payment schedule for the additional $8 M for the construction budget, the payment schedule for repayment to the US of 50% of the $3.6 M cost of the Hilo base facility, which the US had funded in advance, and the percentages of the operations budget for which each partner was responsible. (It is understood by the partnership that Australia’s contributions do not reduce the amount owed by the other partners, but will be used to provide added value to the partnership.)

The document also laid out a policy for dealing with delayed or missing operations payments from a partner. This policy was affirmed by the Board at its November meeting.

Financial Status

The year 1998 was the third full year of the operations phase of the Gemini Project. Contribution and expenditure budgets for construction and for operations are kept separate. At the November 1996 Board meeting, a 5-year operation plan for 1997-2001 was approved, which is presented in Table 3d, updated for actual expenditure and to 1998 US$.

The following Tables 2–4 show the actual and projected contributions from the partners from 1991 to 2001 for the construction phase, and for 1996 to 2005 for the operations phase; the annual and projected expenditures during this period; the actual and budgeted expenditure breakdown for 1998; and the 1999 budgets as approved by the Board in November 1998. The construction figures include the $8 M authorized by the Board at the November 1995 meeting.

Contributions and Outlays

Table 2a shows the actual and projected contributions from the partners from 1991 until the end of the construction phase of the project in 2001. The actual contributions from each nation are shown through 1998, and the projected contributions thereafter. The bottom line gives the total cumulative contributions. For the United Kingdom, all contributions include work credits.

Table 2a. Calendar Year Annual Contributions for Construction (US $000)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Total
United States	3,815	12,063	14,000	17,120	41,000			4,000	2			92,000
United Kingdom			3,638	6,622	2,761	2,128	10,706	4,070	10,127	4,750	1,144	46,000
Canada			6,813	2,722	2,869		3,416	9,689	2,091			27,600
Chile							3,520	967	1,913	1,400	1,400	9,200
Brazil				550	550	602	602	600	600	600	548	4,600
Argentina				400		1,030	681	611	653	611	614	4,600
Total Ann. Contrib.	3,815	12,063	24,451	27,414	47,180	3,708	18,979	19,937	15,386	7,361	3,706	184,000
Cumulative Funding	**3,815**	**15,878**	**40,329**	**67,743**	**114,923**	**118,631**	**137,610**	**157,547**	**172,933**	**180,294**	**184,000**	**184,000**

The construction project expenditure profile, including work credits for the United Kingdom, is shown in Table 2b. The entries for 1991–1998 are actual expenditures; the remainder are projections. (The last line in Table 2b, the cumulative total funding, is repeated from Table 2a.) A negative cash flow is projected for 1999 and 2000. To cover this, funds are being borrowed from the Australian capital contribution of 5% (which is reported in Table 2c, since these monies are intended to provide added value to the operations phase, not to increase the total construction budget). The borrowed funds are not immediately required by operations, and will be repaid from future construction contributions from the original six partners by 2001.

The difference between the total funding and the expenditure profile is the "funds carried forward." These funds are available to cover contingencies. Under the current long range projection, the contingency remaining at the end of the construction period will be $294 K.

Table 2b. Calendar Year Expenditures for Construction (cumulative in US $000)

Spending Profile	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**Total**
Cash	2,156	7,243	15,292	30,074	55,410	82,247	119,857	142,739	158,756	164,490	165,356	165,356
UK Credits			138	955	2,620	4,747	10,680	11,836	17,346	18,440	18,644	18,644
Funds Carried Fwd	1,659	8,635	24,899	36,715	56,895	31,638	7,072	2,972	(3,169)	(2,636)	(0)	
Cumulative Funding	**3,815**	**15,878**	**40,329**	**67,743**	**114,923**	**118,631**	**137,610**	**157,547**	**172,933**	**180,294**	**184,000**	**184,000**

Tables 2c and 2d show analogous information for the first ten years of operations funding, from 1996 to 2005. Actual contributions and expenditures are shown through 1998; the rest of the entries are projections, with no allowance for inflation. Australia's contributions for capital and for operations funding are both listed here. These funds are to add value to Gemini, not to reduce the charges on the other partners for operations, so they are not merged in with the other contributions.

Table 2c. Calendar Year Annual Contributions for Operations (US $000) (projected values are in 1998 $US; no inflation allowed for)

	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
United States	3,600	5,100	5,398	7,000	7,100	7,272	7,106	7,335	7,237	7,448
United Kingdom		1,212	2,312	3,253	4,268	4,154	3,995	3,736	3,687	3,817
Canada		906	1,581	1,904	2,453	2,385	2,289	2,242	2,212	2,290
Chile				0	2,191	840	808	747	737	763
Brazil				678	427	415	400	374	369	382
Argentina				0	481	470	537	529	506	519
(US forward funding offset)		(1,688)	(470)	(951)	(618)					
Subtotal Annual Contributions	**3,600**	**5,530**	**8,820**	**11,884**	**16,302**	**15,536**	**15,135**	**14,962**	**14,749**	**15,220**
Australia Construction			3,200	3,000	3,000					
Australia Operations			537	697	914	891	799	747	737	763
Total Annual Contributions	3,600	5,530	12,557	15,582	20,216	16,428	15,934	15,709	15,486	15,983

Expenditures are broken down into operations and management, instrumentation development, and the Hilo base facility construction (to be closed out in 1999). The Facility Development Fund has been split off from the Instrument Development Fund, with some items formerly in the IDF transferred to the FDF, e.g., the adaptive optics program.

The US has forward funded part of the operations in 1996–8, which will be reimbursed by the other partners in later years. By 2005, the cumulative contributions to operations from each partner will be proportional to that partner's share.

Table 2d. Calendar Year Projected Expenditures for Operations (US $000)

Spending Profile	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Operations & Management	30	2,675	6,767	9,952	11,544	12,206	11,935	11,816	11,852	11,852
Instrument Development Fund			559	4,225	4,010	3,959	3,342	3,578	3,000	3,471
Facilities Development Fund		65	344	3,782	2,355	2,580	1,854	1,806	280	280
Hilo Base Facility	131	1,602	2,580	39						
Southern Base Facility				50	860					
Value Added Fund										
Total Annual Expenditures	162	4,342	10,250	18,048	18,769	18,745	17,131	17,200	15,132	15,602
Loans to (repayments from) Construction				3,169	(533)	(2,636)				
Total funds carried forward	3,438	1,188	2,307	(5,635)	1,980	319	(1,197)	(1,491)	355	381
Total Cash	3,600	5,530	12,557	15,582	20,216	16,428	15,934	15,709	15,486	15,983

1998 Expenditures

Table 3a shows the cumulative actual construction project expenditures through 1997, the revised budget and actual expenditures for 1998, and the difference between the budgeted and actual expenditures.

Table 3a. Actual and Budgeted Construction Expenditures for 1998 and Prior Years (US $000)

	Prior Years	**CY 1998 Expenditures**		
Item	**1991–1997**	**Budgeted**	**Actual**	**Difference**
Subcontracted Services	85,313	20,674	14,818	5,856
Work Packages / UK Credit	10,354	4,696	1,155	3,541
Total Direct Labor	18,467	3,180	3,343	(163)
Total Purchased Services	3,349	794	974	(179)
Total Supplies / Material	5,540	1,774	2,436	(662)
Total Equipment	1,965	619	309	310
Total Travel	2,436	583	548	36
Total Overhead	3,149	285	457	(173)
Pending Alloc. & Contingency		104		104
Manager’s Reserve		64		64
Revenue	(35)		(3)	3
Grand Total	**130,538**	**32,773**	**24,037**	**8,736**

Similar values for the operations budgeted and actual expenditures for 1998 are shown in Table 3b. The underspend in all the funds is almost entirely due to invoices coming in slower than expected, so they will be paid in 1999 rather than 1998. There is just enough cumulative excess cash in each fund to cover the late invoices.

Table 3b. Actual and Budgeted Operations Expenditures for 1998 and Prior Years (US $000)

		CY 1998 Expenditures		
Item	**CY 1997 Expenditure**	**Budgeted**	**Actual**	**Difference**
Operations & Management				
Direct Labor	978	3,167	3,229	(61)
Supplies/Material	465	1,132	938	195
Travel	168	395	367	28
Purchased Services	475	1,359	1,327	32
Subcontracted Services	70	347	595	(247)
Equipment	409	782	206	576
Overhead	157	135	99	36
Revenue	(17)	10	6	4
Total O&M	**2,707**	**7,328**	**6,767**	**561**
Facilities Development Fund				
Direct Labor	0	0	49	(49)
Supplies/Material	0	0	25	(25)
Travel	0	0	27	(27)
Purchased Services	0	0	8	(8)
Subcontracted Services	65	889	223	666
Overhead	0	0	13	(13)
Total FDF	**65**	**889**	**344**	**545**
Instrument Development Fund				
Supplies/Material	0	0	28	(28)
Travel	0	0	6	(6)
Subcontracted Services	0	2,581	522	2,059
Overhead	0	0	2	(2)
Total IFG	**0**	**2,581**	**559**	**2,022**
Hilo Base Facility				
Direct Labor	7	0	14	(14)
Purchased Services	12	0	2	(2)
Subcontracted Services	1,734	2,648	2,561	88
Overhead	12	0	3	(3)
Revenue	(31)	0	0	0
Total HBF	**1,734**	**2,648**	**2,580**	**69**

In Table 3, the column labeled “Budgeted” displays the totals approved by the Board in 1997, although allocation among the items differs. The revision in allocation is primarily a matter of accounting, since supplies, equipment, and services can be purchased on subcontracts, and the classification as supplies rather than equipment may reflect the method of acquisition.

$5.6 M of the 1998 planned expenditures were delayed until 1999. Most of this was from subcontracts or work packages for which there were slower than anticipated receipts of invoices from work currently underway. The UK Coating Chamber workpackage request for credit was held into 1999 to get an invoice with more detail and reduced by the rework charges. The direct labor charge was above budget due to the revised staffing, which was not balanced by the fact that many of the replacements for people who have left took time to hire, and often are paid less. Freight charges to ship supplies and equipment to Chile for outfitting the enclosure and support building, included in purchased services, were higher than anticipated. Some items budgeted as equipment ended up as supplies; the remaining variance in supplies is due to unanticipated needs for the CP fitout. “Revenue” results from such items as reimbursements from staff travel expenses paid by other agencies, and quarterly rebates from the IGPO’s travel agency.

The financial data shown in Table 4 have been examined and verified by AURA’s auditors (KPMG LLP) through 30 September 1998. (AURA’s fiscal year coincides with that of the United States government.) The next audit will cover 1 October 1998 to 30 September 1999.

Proposed Budgets for 1999

A summary of the 1999 construction project budget to be presented to the Board in May 1999 is shown in Table 4a. Included in the direct labor category are anticipated credits for PPARC-paid salaries to the Project staff. The new commitments are the part of the expenditures (with cash as a positive entry and credit as a negative one) that represent commitments to be started in 1999.

The amount of planned expenditures and new commitments for 1999 continues to decrease, since almost all major subcontracts and UK work packages were awarded by the end of 1997. The proposed budget anticipates bringing forward the construction schedule on Cerro Pachón by six months, which increases the expenses in 1999 and 2000, though decreasing the total cost. This would not have been possible without borrowing from the Australian funds; in fact, there would have been a negative cash flow without the loan. The amount to be borrowed in 1999 is $3.2 M; it will be repaid in 2000 and 2001.

Table 4b shows the Board-approved operations budget for 1999. There are no contribution credits shown, as operations will be conducted on a cash basis.

Table 4a. Summary of Calendar Year 1999 Construction Budget ($)

Expense Category	Cash Expenditures	Contribution Credit	New Commitments
Subcontracted Services	11,045,423		1,623,683
Work Packages / UK Credit		5,442,890	(51,400)
Direct Labor	2,446,609	67,515	2,462,524
Supplies / Material	355,970		355,970
Travel	390,826		390,826
Purchased Services	508,602		508,602
Equipment	166,808		74,646
Overhead	95,777		91,067
Pending Allocations & Contingency	124,525		124,525
Manager's Reserve	882,399		882,399
Total	$16,016,939	$5,510,405	$6,462,842
Grand Total (cash and UK credits)		**$21,527,344**	

Table 4b. Summary of Calendar Year 1999 Operations Budget ($)

Expense Category	Cash Expenditures	New Commitments
Subcontracts / Work Packages	1,177,316	781,734
Direct Labor	4,990,723	4,990,723
Supplies and Material	862,069	794,951
Travel	633,618	633,618
Purchased Services	1,826,081	1,826,081
Equipment	404,760	345,000
Overhead	57,435	57,435
Operations & Management Total	**9,952,002**	**9,429,542**
Instrument Development Fund[1]	4,225,122	2,496,677
Facilities Development Fund[1]	3,781,551[2]	5,356,891[2]
Hilo Base Facility	69,094	
Southern Base Facility	50,000	
Grand Total	**18,077,769**	**17,283,110**

[1] These funds are for subcontracts or work packages.

[2] Of this, $2 M is for rework contingency

Organization

The Gemini Agreement, between the US, UK, Canada, Australia, Chile, Brazil, and Argentina, establishes the management structure of the Gemini Project. The Gemini Board is the supervisory and regulatory body, an Executive Agency is empowered to act on behalf of the parties to arrange for construction and operations of Gemini, and a Managing Organization is responsible for day-to-day management of the Project.

The Gemini Board

Board members are appointed for two-year or longer terms by the respective funding agencies of the partner nations. The semi-annual Board meetings in 1998 were held in Quebec City, Quebec, Canada in May, and in Hilo, Hawaii in November. The members of the Gemini Board during 1998 were:

Board Member	**Institution**	**Country**
Dr. Judith Pipher	University of Rochester	US
Dr. Jay Gallagher	University of Wisconsin	US
Dr. Robert Gehrz	University of Minnesota	US
Dr. G. Wayne van Citters	NSF	US
Dr. Robert McLaren	University of Hawaii	UH (US)
Dr. Ian F. Corbett	PPARC	UK
Dr. Richard Ellis	University of Cambridge	UK
Dr. Donald C. Morton	NRC	Canada
Dr. Jean-René Roy (Chair)	Université Laval	Canada
Dr. Vicki Sara (5/98 to (9/98)) Prof. Lawrence Cram (from 9/98)	Australian Research Council University of Sydney	Australia
Dr. Mauricio Sarrazin (Vice Chair) represented by Oscar Riveros	CONICYT	Chile
Dr. Jorge Sahade	CONICET	Argentina
Dr. Beatriz Barbuy (observer)	University of São Paulo	Brazil

The Executive Agency: NSF

The Executive Agency for the Gemini Project is the National Science Foundation (NSF) of the United States. It is empowered to execute the decisions of the Gemini Board, to handle the financial contributions of the Gemini partners, and to communicate decisions of the Board to the Managing Organization.

Dr. G. Wayne van Citters, acting for NSF, is a member of the Gemini Board. Other personnel are the Executive Assistant, Dr. Susan Kayser, and the Executive Secretary, Mrs. Mary Lou Renninger. Several offices within NSF provide support to the Project.

The Managing Organization: AURA

The Association of Universities for Research in Astronomy, Inc. (AURA) was designated by the Board as the Managing Organization for construction and through the operations phase until the end of 2000.

The senior key personnel in 1998 were:

Project Director:	Dr. C. Mattias Mountain
Project Scientist:	Dr. Fred Gillett
Project Manager:	Dr. Richard Kurz (to 2/98) Mr. Jacobus Oschmann Jr. (from 2/98)
Operations Manager:	Dr. James Kennedy

The AURA corporate office contacts were Mr. Richard Malow and Dr. William Smith.

National Project Offices

Gemini can operate successfully only if the project makes effective use of the infrastructure that already exists in the partner countries. To facilitate this, each partner to the Gemini Agreement has established a National Project Office. The functions of these offices are to formulate input to the project through national Science Advisory Committees, to provide engineering support for managing instrumentation and other projects and for technical reviews, to support the user community in pre- and post-observing activities, to provide technical support beyond that available at the telescope sites, and to be responsible for instrumentation undertaken by the partner countries. The National Project Offices will also manage the national telescope time allocation.

A National Project Office typically has a Project Scientist and a Project Manager. The personnel during 1998 were:

US	Project Scientist	Dr. Todd Boroson
UK	Project Scientist Project Manager	Dr. Patrick Roche Dr. Adrian Russell
Canada	Project Scientist Project Manager	Dr. Jean-René Roy Dr. Andrew Woodsworth
Australia	Project Scientist	Dr. Gary S. Da Costa
Chile	Project Scientist Project Manager	Dr. Maria Teresa Ruiz Dr. Oscar Riveros
Argentina	Project Scientist Project Manager	Dr. Emilio Lapasset Gomar Dr. O. Hugo Levato
Brazil	Project Scientist Project Manager	Dr. Reinaldo Ramos de Carvalho Dr. Thaisa Storchi Bergmann

Gemini Science Committee

The Gemini Science Committee (GSC) has the responsibility of making science policy recommendations to the Project Director, which are passed to the Board. The 1998 meetings were in Porto Alegre, Brazil in April, and in Hilo, Hawaii in October.

The members of the Gemini Science Committee during 1998 were:

Dr. Fred Gillett (Chair)	International Gemini Project Office
Dr. Todd Boroson	US Gemini Project Office
Dr. Reinaldo Ramos de Carvalho	Observatório Nacional / CNPq
Dr. Suzanne L. Hawley	Michigan State University
Dr. James H. Hough	University of Hartfordshire
Dr. Buell Jannuzi	NOAO/KPNO
Dr. Robert Joseph	University of Hawaii
Dr. Emilio Lapasset Gomar	Observatorio Astronómico, Córdoba
Dr. Simon Morris	Herzberg Institute of Astrophysics
Dr. Patrick Roche	University of Oxford
Dr. Jean-René Roy	Université Laval
Dr. Maria Teresa Ruiz	Universidad de Chile
Dr. Ray Sharples	University of Durham
Dr. Stephen Strom	University of Massachusetts, Amherst
Dr. Charles Telesco	University of Florida

Gemini Finance Committee

The Gemini Finance Committee of the Gemini Board oversees the financial matters of the Gemini Project. It provides advice on keeping the budget within the constraints of cash flow and of total expenditure. The 1998 meetings were in Kona, Hawaii in April, and in Hilo, Hawaii in October.

During 1998, the members of the Finance Committee were:

Dr. G. Wayne van Citters	NSF
Mr. Albert Muhlbauer	NSF
Mr. Aaron Asrael	NSF
Dr. Ian Corbett	PPARC
Mr. Jeff Down	PPARC
Dr. Donald C. Morton	NRC
Mr. Michael Pawlowski (Chair)	NRC
Prof. Lawrence E. Cram (after 9/98)	ARC/University of Sydney
Dr. Mauricio Sarrazin	CONICYT
Dr. Jorge Sahade	CONICET
Dr. Ubyrajara Alves	CNPq

Appendix A

Schedule of Events for the Gemini Board

According to the International Agreement and the Rules for Procedure, the annual schedule of activities for the Gemini Board is as follows:

February The Chairman and Executive Assistant write the **Annual Report** for the previous year, which is sent to all parties involved in the project. The report describes progress, expenditure, long-range plans, usage of manpower and schedules for the project.

March In early March, the official date and venue of the May meeting is communicated to Board members by the Executive Assistant.

April Before mid-April, meetings take place of the Finance Committee and the Science Committee.

May In first week of May, papers for the May meeting and a draft Agenda are sent to Board members by the Executive Assistant. Papers relating to reports from the Project are sent directly by the Project.

At least one week before the Board Meeting, attendance at the meeting is confirmed by Board members or their alternates.

The Board Meeting normally takes place in the 3rd or 4th week of May. The following items must be undertaken at the May meeting:

> Accept the auditors' report.
>
> Take formal note of the projected financial status of the previous calendar year.
>
> The Executive Agency provides an annual report of payments and accepted Work Packages credited to the Parties' contributions, sums transferred to the Managing Organization, and contributions received but not yet provided to the Managing Organization.
>
> Review of the Managing Organization.

June In mid-June, the minutes and the actions and decision list of the May meeting are sent to Board members. (Note: a draft set of decisions is recorded at the May meeting as a basis for action by the Board, the Executive Agency, the Managing Organization and the Project).

September In early September, the official date and venue of the November meeting is communicated to Board members by the Executive Assistant.

October Before mid-October, meetings take place of the Finance Committee and the Science Committee.

November In the first week of November, papers for the November meeting and a draft Agenda are sent to Board members.

At least one week before the Board Meeting, attendance at the meeting is confirmed by Board members or their alternates.

The Board Meeting normally takes place in the 2nd or 3rd week of November. (Note: the budget for the following year has to be approved by 30 November of each year.) The following items must be undertaken at the November meeting:

Approve the budget and work program for the following year.

Note the long-range plans for the completion of the construction and commission ing phase of the project.

Note the likely projected financial status at the end of the current calendar year.

December In mid-December, the minutes and the action and decision list of the November meeting are sent to Board members. (Note: a draft set of decisions is recorded at the November meeting as a basis for action by the Board, the Executive Agency, the Managing Organization, and the Project).

Note: There is one important variant in this proposal as compared with the Gemini Agreement. According to the Agreement, the proposed budget for the following year is to be made available to the Board by the 31 October of each year. This would not allow enough time for the Finance Committee to iterate with the Project and agree upon a set of recommendations to the Board in time for inclusion in the papers which have to be sent out in the first week of November. The Board, therefore, requests the Project to bring forward the date of submission of the proposed budget for the following year to 30 September, thus allowing iteration with the Finance Committee and allowing the papers to be included among those to be circulated during the first week of November.

Appendix B

Acronyms

A&G	Acquisition and Guiding
AO	Adaptive Optics
AMOS	Advanced Mechanical & Optical Systems
AURA	Association of Universities for Research in Astronomy, Inc.
ATC	Astronomy Technology Center (Edinburgh)
CADC	Canadian Astronomy Data Center
CCD	Charge-coupled device
CDR	Critical Design Review
CGO	Committee of Gemini Offices
COB	Cryogenic Optical Bench
CONICET	Consejo Nacional de Investigaciones Cientificas y Tecnicas [Argentina]
CONICYT	Comisión Nacional de Investigación Científica y Tecnológica [Chile]
CTIO	Cerro Tololo Inter-American Observatory
DHS	Data Handling System
GMOS	Gemini Multi-Object Spectrograph
GNIRS	Gemini Near InfraRed Spectrograph
GONOC	Gemini Observatory North Operations Center
GSC	Gemini Science Committee
GSC-II	Guide Star Catalog II (of the STScI)
GSFC	Goddard Space Flight Center
HIA / NRC	Herzberg Institute of Astrophysics
HROS	High Resolution Optical Spectrograph
ICD	Interface Control Document
IFU	Integral Field Unit
IGPO	International Gemini Project Office
ISS	Instrument Support Structure
IT&C	Integration, Testing, and Commissioning
JAC	Joint Astronomy Centre
M1	Primary mirror
M2	Secondary mirror
MOS	Multi-Object Spectrograph
MST	Ministry of Science and Technology [Brazil]
MUX	MUlti-pleXer
NIRI	Near Infrared Imager
NOAO	National Optical Astronomy Observatories
NRC	National Research Council [Canada]
NSF	National Science Foundation [US]
OGIP	On-Going Instrumentation Program
PDR	Preliminary Design Review
PLC	Programmable Logic Controller
PPARC	Particle Physics and Astronomy Research Council [UK]
RGO	Royal Greenwich Observatories
ROE	Royal Observatory of Edinburgh

SBRC	Santa Barbara Research Corporation
SOAR	Southern Observatory for Astronomical Research
STScI	Space Telescope Science Institute
TCS	Telescope Control System
UCL	University College, London
UH	University of Hawaii
WFS	Wave Front Sensor
WIYN	Wisconsin-Indiana-Yale-NOAO telescope at Kitt Peak

Appendix C

List of Publications in 1998

Doc_No	Author	Release Date	Title
REV-C-G0119	Paterson	2/06/98	SCS Acceptance Review Materials
REV-C-G0128	Wooff	2/26/98	ECS Beta Review Materials
RPT-PM-G0078	Various	3/01/98	Gemini SPIE Papers, Kona '98
SPE-C-G0073	Kotturi	3/03/98	Gemini Engineering Archive Requirements, Rev 02
Preprint #28	Kotturi	3/16/98	Gemini Phase I Science Proposal Entry Tool
Preprint #29	Cho	3/16/98	Design Study of the GNIRS Bracket Structure
Preprint #27	Puxley *et al.*	3/16/98	The Support Capability Requirements of 8m Telescope Science
Preprint #26	Puxley *et al.*	3/16/98	The Gemini Observatory Science Operations Plan
Preprint #31	Gillies/Walker	3/16/98	Infrastructure of the Gemini Observatory Control System
Preprint #30	Perona *et al.*	3/16/98	Hardware Implementation of the Primary Mirror Surface Heating System for the Gemini 8m Telescopes
Preprint #32	Jacobson *et al.*	3/31/98	Development of silver coating options for the Gemini 8m Telescopes Project
PG-PM-G0016	Mountain	4/02/98	Gemini Relocation Policy for Gemini South, Rev 1.0
RPT-PS-G0080	F. Gillett/Woodsworth	4/07/98	Committee of Gemini Offices Meeting Report
Preprint #33	Jensen *et al.*	4/17/98	Measuring Distances Using Infrared Surface Brightness Fluctuations
Preprint #34	Harrison/Ball/Fowler	4/21/98	Characterization of Gemini Near-IR Arrays
Preprint #35	F. Gillett/Mountain	4/21/98	Future Gemini Instrumentation
REV-C-G0129	Wooff *et al.*	4/27/98	ECS Acceptance Review Materials
Preprint #37	Mountain/F. Gillett/Oschmann	5/01/98	The Gemini 8m Telescopes Project
Preprint #36	Puxley *et al.*	5/01/98	The Ortho to Para Ratio of H_2 in the Starburst of NGC 253
PG-PM-G0018	P. Gillett	5/06/98	Gemini South Safety Program (Spanish), Rev 1.0
PG-PM-G0017	P. Gillett	5/06/98	Gemini South Safety Program (English), Rev 1.0
PG-HR-G0013	Welborn	5/11/98	Moving Guide to Hilo, Hawaii, Rev 1.0
REV-I-G0131	NOAO	5/12/98	GNIRS Interim 2 Review Materials
RPT-PS-G0081	Puxley *et al.*	5/15/98	Support Capability Workshop Report
PG-C-G0019	Wampler	6/12/98	An Engineering Backdoor for Gemini Instruments, Rev 1.0
ICD-03	Hill/Gaudet	6/16/98	(Software) Bulk Data Transfer, Ver 23
ICD-01c	Hill/Gaudet/Kotturi	6/16/98	(Software) Baseline DHS interface, Ver 05
SPE-C-G0076	Puxley	6/17/98	Integration Time Calculator, Rev 1.1

Doc_No	Author	Release Date	Title
Preprint #38	Jensen *et al.*	7/31/98	The Infrared Surface Brightness Fluctuation Distances to the Hydra and Coma Clusters
Preprint #39	Puxley/Brand	7/31/98	High Resolution Infrared Spectroscopy and Nuclear Clusters in the Starburst Galaxy NGC1614
SPE-C-G0077	Jensen	8/03/98	Weather Server Software Specification, Rev 3.0
MAN-TE-G0001	Pentland	8/04/98	Primary Mirror Cell Cart Mechanical Documentation
SPE-TE-G0078	Pentland	8/07/98	Primary Mirror Covers Assembly Procedure, Rev. 1.0
PG-PM-G0014	Welborn *et al.*	8/21/98	Visitor's Guide for the Mauna Kea Summit and Gemini Construction Site, Rev. 1.2
RPT-I-G0083	UKGPO	8/27/98	GNIRS Preliminary Design Report
SPE-TE-G0079	Pentland	8/31/98	Azimuth Cable Wrap Assembly Procedures, Rev. 1.0
SPE-TE-G0080	Pentland	8/31/98	Primary mirror cell cart assembly procedures, Rev. 1.0
TN-PM-G0056	Barr	9/01/98	Comments on the Early Work at KPNO and NOAO on Giant Telescopes
Preprint #40	von Hippel *et al.*	9/01/98	WIYN Open Cluster Study 1: Deep Photometry of NGC188
MAN-TE-G0003	Pentland	9/01/98	Azimuth Cable Wrap Mechanical Documentation
MAN-TE-G0004	Pentland	9/01/98	Altitude Cable Wrap Mechanical Documentation
MAN-TE-G0005	Pentland	9/01/98	Primary Mirror Covers Mechanical Documentation
REV-I-G0133	UKGPO	9/04/98	FCU CDR Papers
SPE-TE-G0082	Pentland	9/08/98	Altitude Cable Wrap Assembly Procedure, Rev 1.0
REV-I-G0132	U-FL	9/17/98	T-ReCS (MIRI) PDR
Preprint #41	Mountain/F. Gillett	10/01/98	The Revolution in Telescope Aperture
PG-PM-G0021	P. Gillett	10/22/98	Visitor's Guide to Cerro Pachón, Rev. 1.0
RPT-PS-G0082	von Hippel *et al.*	10/23/98	Gemini Science Archive Workshop Report

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