Audit of the Financial Management of the Gemini Project

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National Science Foundation
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Executive Summary

Purpose

Since the early 1990's, the National Science Foundation (NSF) has taken a more active interest in projects that require international collaboration and/or facility construction. The portion of NSF's portfolio that includes its capital asset activities is called,the Major Research Equipment (MRE) account. The Gemini Project, which began in 1991, was one of the first projects to receive funding from this account in 1995, when Congress established it as a separate appropriation. Our audit reviewed the Gemini Project as one example of how NSF is managing large infrastructure projects.

Background

'The Gemini Project supports the construction and subsequent operation of twin 8-meter telescopes located in Hawaii and Chile. This Project is the result of a scientific and financial collaboration among seven partner countries and is designed to give astronomers in the partner countries' scientific communities access to the entire sky. The United States is a 50-percent partner of the Project and provides funding through NSF.

Gemini North, the telescope located atop Mauna Kea in Hawaii, is scheduled to begin scientific observations in the fall of 2000. Construction efforts at Gemini South, located atop Cerro Pachon in Chile, are approaching their conclusion and observations at this location are expected to begin in mid-2001.

Results in Brief

NSF's current policies and procedures for overseeing and administering large infrastructure awards need improvement. NSF's current policies and procedures directed at managing are geared toward the small, single-investigator awards. While these may be appropriate for the bulk of NSF's awards, they are not adequate for managing capital, MRE funded projects like Gemini.

In particular, we found that the Gemini Project will spend at least $52.8 million more than its approved budget for Construction and Commissioning and has been and is planning to continue to use its Operations budget to cover these costs. This has resulted in misstating both the Operations and Construction and Commissioning costs, and is potentially a nonconformance with federal appropriations law.

In addition, not all partners have met their contribution commitments. Accordingly, NSF has largely shouldered the additional costs by advancing

$6.2 million more funds to the project than were required and purchasing observation time. This has resulted in NSF exceeding its 50 percent authorized funding cap.

Further, there is a high risk that some partners will continue to be unable to meet their Project commitments and NSF's funding levels will remain above the cap.

Recommendations

Accordingly, to address these issues, NSF needs to develop policies and procedures specifically focused at managing large capital projects. These procedures need to address the fiscal and legal implications of funding projects from the MRE appropriation. Additionally, they should include project management principles of providing decision-makers with good and timely information about cost estimates, risks and project scopes before committing substantial resources. They should also provide for monitoring performance against cost, schedule and technical goals. Further, NSF needs to provide for an appropriate level of senior management and National Science Board involvement in reviewing actions to provide additional funds for large capital and infrastructure project awards.

In addition, NSF, along with the Gemini Board, needs to reevaluate the Project's cash plan for operations through 2005 to realistically assess the ability of all members to meet their financial commitments for operations.[1] NSF should also reevaluate its level of contribution to Project operations costs in light of Congress and the NSB's intent that NSF's contributions not exceed 50 percent. A contingency plan should be developed which equitably distributes among the partners the responsibility for funding cash shortfalls.

[1] This recommendation coincides with the NSF's 5-year award period for the management of Gemini, which requires a thorough review of operations budget needs. Thereafter, the Gemini Board would review the project's operating needs and cash commitments concurrently each 5-year period.

Agency Response

The Agency has accepted a number of our recommendations and is taking strides to address the issues raised by this report. The Agency plans to provide more complete details in its policies and procedures for managing large capital and infrastructure projects and is exploring organization changes to address the need for greater oversight over MRE projects. However, the Agency believes that the $52.8 million identified in the report as Construction and Commissioning costs are appropriately classified as Operations. Thus, the Agency believes it has acted in accordance with appropriations law and there is no need to reclassify obligations from the R&RA to the MRE appropriation.

The Agency believes its cash plan to advance funds in the early years that will be repaid by the partners in later years is within NSF policy because NSF's limitation to 50 percent of contributions need not be met annually. Moreover, the Agency is confident that all partner countries are making best efforts to contribute despite difficult times. Regardless, the Agency agrees there is a need to develop a five-year cash plan for operations that will be independently reviewed.

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Abbreviations

AURA	Association of Universities for Research in Astronomy, Inc.
GIA	Gemini International Agreement
IGPO	International Gemini Project Office
MRE	Major Research Equipment
NSB	National Science Board
NOAO	National Optical Astronomy Observatories
NSF	National Science Foundation
R&RA	Research and Related Activities
UK	United Kingdom

Chapter 1

Introduction

Since the early 1990's, the National Science Foundation (NSF) has taken a more active interest in projects that require international collaboration and/or facility construction. The Gemini Project ("Gemini" or the "Project"), initially proposed as a national observatory, fit within NSF's plans for an international scientific and financial collaboration.

Funding for the Project began in 1991 through a subaccount of NSF's Research and Related Activities appropriation. However, when the US Congress requested a separate appropriation account for capital asset activities, the Gemini Project was one of the first projects, in 1995, to receive funding from the now separate Major Research Equipment (MRE) appropriation account.

The Gemini Project

Responding to a report advocating ground-based optical/infrared telescopes that would provide a ten-fold increase in light gathering capability, the National Optical Astronomy Observatories (NOAO), through its parent organization, the Association of Universities for Research in Astronomy, Inc. (AURA), submitted a proposal to NSF in 1989 to fund the construction and operation of a national observatory consisting of two 8-meter telescopes, one in the northern hemisphere and one in the southern.

In an effort to encourage collaboration among their countries, the scientific agencies of the United States, the United Kingdom and Canada began discussing the NOAO proposal as a joint effort. Subsequently, these nations formed a partnership, with NSF as the Executive Agency and AURA as the Managing Organization, to construct and operate Gemini. Because of a need for additional funding, they later added Chile, Argentina, Brazil and Australia as additional partners.

The Gemini International Agreement (GIA), signed by all of the partner countries, is the primary document governing Gemini. The GIA, which is non-binding under international law, covers the construction and commissioning, and operation of Gemini and spells out such details as the science requirements, the partners' contributions and observation rights, and the principal governing structure. The primary supervisory and regulatory

body over Gemini is the Gemini Board (Board), which consists of members from each of the partner countries with more members from countries with greater financial participation. NSF is named as the Executive Agency of Gemini and is primarily responsible for the financial management of Gemini. NSF receives and maintains records of contributions from the partner countries; NSF also chooses and oversees the Managing Organization. NSF selected AURA, a consortium of 29 U.S. institutions and 5 international affiliates, as Gemini's Managing Organization. To conduct the day-to-day management and operations of Gemini, AURA created the International Gemini Project Office (IGPO). The IGPO is led by the Gemini Director and, as of August 1, 1999, included a total of 93 employees. (For a more detailed description of Gemini Governance, see Appendix A.)

The Gemini Project is funded solely by the contributions of the seven partner countries. All contributions to construction and commissioning, which began in 1991, will be completely met by the end of 2001. Contributions to operations began in 1996. NSF, as the Executive Agency is responsible for the collection and recording of all partner contributions, and AURA is responsible for the reporting of contributions. Non-US contributions are held in trust and then made available to the IGPO through a cooperative agreement between NSF and AURA.

The Gemini telescopes are located at sites with superlative astronomical observing conditions, one atop Mauna Kea in Hawaii and the other atop Cerro Pachon in the Andean foothills of central Chile. The 8-meter telescopes are designed to work effectively at optical and infrared wavelengths through major transparent "windows" in the Earth's atmosphere. The two telescopes will have access to the entire sky, a capability crucial for obtaining coverage of unique astronomical objects that are visible only in one celestial hemisphere and will match the full-sky capabilities of space observatories.

Objective, Scope, and Methodology

In order to assess the overall readiness of the Gemini facilities to perform their mission, our audit had four objectives—to determine whether (1) the construction efforts were being completed within authorized funding levels, (2) partner contributions would provide sufficient cash to support operations through 2005, (3) the Project's instruments would be delivered on a timely basis, and (4) the Project's safety and health requirements are being met. This audit reports on the first two objectives. We will issue a subsequent report addressing the last two objectives.

To accomplish these objectives, we reviewed NSF and Gemini Project financial records capturing budget and actual cost information for comparison to authorized funding limits set by the NSF and the intent of the Congress. We also analyzed cash flows to operations for the years 1996 through 2005 to determine whether all partners were contributing to the project as required by the GIA. We reviewed NSF's and AURA's policies and procedures for collecting, recording and reporting contributions.

We interviewed key personnel of the International Gemini Project Office, NSF, the headquarters of the AURA organization, and both former and current members of the Gemini Board and Gemini Finance Committee to understand overall processes for managing the Project's construction, operations, and financial activities, and the various roles and responsibilities of these organizational elements of the Project.

We conducted our audit in accordance with the Comptroller General's standards for audits contained in the *Government Auditing Standards*.

Operations Funds Used to Cover Construction and Commissioning Costs

The Gemini Project will spend at least $52.8 million more than its NSB approved budget for Construction and Commissioning and has been and is planning to continue to use its Operations budget to cover these costs. This occurred because the budget used to establish the Congressional and NSF funding cap for Construction and Commissioning was premature and unrealistic, and because NSF lacked the policies and procedures necessary for managing large infrastructure projects. The use of Operations funds to cover excess Construction and Commissioning costs results in overstating actual Operations costs while understating the Construction and Commissioning costs. It also inconsistent with federal appropriations law and results in missed opportunities for funding other worthy NSF projects.

Construction and Commissioning Costs Exceed Budget

In its FY 1992 budget request to Congress, NSF requested initial funding for Gemini. Based on NSF testimony that "[t]he project is estimated to take 8 years to complete at a total cost of $176 million, of which the U.S. will provide half,"[1] Congress approved the project. Beginning that same year and continuing through FY 1995, Congress provided appropriations to fully fund the US share of $88 million.[2]

From the project's inception, it was understood that a project of this type would encompass three phases: Construction, Commissioning, and Operations. These phases were defined in the GIA and each was accounted for in the GIA Financial Provisions. Construction is defined as "the planning, design, construction, and installation of the Gemini Telescopes." Commissioning is defined as "the stage immediately following Construction in which the telescope and instrument systems are integrated and the telescopes are used with day-one instruments to characterize and de-bug the facility operations." Consistent with the Congressionally approved budget of $176 million, the NSB provided, first in 1991, then in 1993 and finally in 1995, authorization for NSF to obligate the full $176 million for the Construction and Commissioning phases of the Project.[3]

Subsequently, in November 1995, the Gemini Board initiated action to increase this budget by approving an additional $8 million, and thereby

[1] *Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations for 1992: Hearing Before the Subcomm. on VA, HUD, and Independent Agencies of the House Comm. on Appropriations*, 102nd Cong. (1991).
[2] *See e.g.*, S. REP. NO. 102-107 (1991); S. REP. NO. 103-311 (1994); H.R. CONF. REP. NO. 103-715 (1994).
[3] *See* NSB-95-127, June 23, 1995, at Tab E.

bringing the Construction and Commissioning budget for the project to $184 million. This increase was not specifically approved by the NSB, but was allowable under an NSB delegation of authority, which provided authority to NSF's Director to supplement NSB-approved awards by up to $10 million.[4]

To cover its fifty percent share of this increase, NSF for FY 1998 requested and Congress subsequently provided the extra $4 million "for technical enhancements to the Gemini telescope project."[5] This additional funding brought the total amount of US funds appropriated for the project to $92 million, one-half of the $184 million budget.

In addition to the Construction and Commissioning budget, the NSB also approved amounts to fund operations-type activities of the Gemini Project. In contrast to Construction and Commissioning work, Operations, under the GIA, is defined as

> "the stage after each of the Gemini Facilities have been fully commissioned. This represents steady-state operation and requires all major telescope and building functions to have been tested and accepted, a complement of scientific and technical staff able to support routine astronomical observations with the existing facilities to be in post, and the capability to commission new instruments and telescope enhancements with minimal disruption."

To ensure a smooth transition and continuity of knowledge and expertise, the International Gemini Project Office (IGPO) planned to "ramp up" Operations activities as Construction and Commissioning work began to "ramp down." Accordingly, beginning in 1995, the Gemini Board began approving 5-year Operations budgets for gradually increasing amounts. The NSF-estimated amount for Operations from 1996 through 2000 was $28.4 million, which was approved by the NSB in June 1995.[6]

[4] *See* NSB-99-112, July 29, 1999; O/D 99-15, September 30, 1999.
[5] H.R. CONF. REP. NO. 105-297 (1997).
[6] NSB-95-127, June 23, 1995.

Operations Budget Used to Cover Additional Costs

The Gemini Project, however, has currently exceeded its Construction and Commissioning budget. As of February 29, 2000, the Project has spent $188.4 million for Construction and Commissioning related work and plans to spend at least $48.4 million [7] more to complete these two phases of the project. The Project has exhausted its $184 million Construction and Commissioning budget, and is using the Operations budget to fund the additional Construction and Commissioning costs. Our review identified $52.8 million in Construction and Commissioning costs that the Project has or plans to charge to the Operations budget, the major cost categories of which are described below. (*See* Appendix B for additional detail.)

- Integration, Test and Commissioning Costs (IT&C) – Under the GIA definitions, these costs are part of the Commissioning phase. Also, early Project records show that these costs were intended to be included within the original $176 million budget. However, in 1992, the IGPO, with Gemini Board approval, implemented a plan that moved these costs to the Operations budget. Project records also indicate that this decision was based on financial constraints and the need for a greater contingency fund for construction costs rather than on a change in definitions. Included in this category are the costs associated with "rework," which may be necessary to bring an instrument or other telescope component up to fully functional standards, and spares, which are extra parts for the telescope to be used as back-ups. The total IT&C costs that we calculated as being or expected to be charged to Operations is $17.5 million.

- Phase I Instruments – Instruments are an essential component of any telescope and are necessary to achieve scientific observation. While the telescope itself may have a useful life of 20 to 50 years, the complement of instruments is continually updated to take advantage of the latest technology. The Project planned to fund the initial complement of instruments from the Construction and Commissioning budget, with the Operations budget covering the costs of an ongoing, future-years instrumentation program. However, in 1995, the IGPO realized that the Construction and Commissioning budget was not large enough to cover all of the costs of this initial complement of Phase I instruments and, with Gemini Board approval, charged the excess instrument costs to the

[7] This amount is based on Project budgets and estimations and may not include all Construction and Commissioning related costs still to be spent. For example, we were unable to determine a reasonable basis for estimating integration, test and commissioning costs past 2000. Thus, we feel this number is conservative and is subject to increase.

Operations budget. We estimate a total of $8.0 million in Phase I instrument completion costs to be charged to the Operations budget.

- Facilities – The Gemini Telescopes have various components and facilities that will be in need of future upgrades. As with the instrument program, the Project planned to fund the initial facilities costs from the Construction and Commissioning budget, with the Operations budget covering future-years maintenance and upgrades. However, many facilities costs, with Gemini Board approval, have been charged to the Operations budget. For example, the 1992 Science Requirements for the telescopes included an adaptive optics system. However, the system actually being provided has a laser capability that was not originally envisioned. With this added capability comes an added cost of $12.5 million that has been charged to Operations. We have estimated total facilities costs, in addition to the ongoing facilities upgrade program, of $20.0 million that will be charged to Operations.

- Hawaii Base Level Headquarters – In 1994, the NSF signed a Memorandum of Understanding with the University of Hawaii (UH) for the lease of a site for the Gemini North telescope on Mauna Kea. At the same time, UH agreed to use its best efforts to provide sea level office space for the IGPO. However, the UH was unable to acquire the necessary funding and the Project proceeded to construct its own facility. Because the Construction and Commissioning budget could not absorb the $4.4 million cost of this capital asset, the Project funded the entire amount through the Operations budget.

- Chile Base Level Headquarters – The original Construction and Commissioning budget included a small amount for the cost of sharing existing facilities with other Chilean observatories rather than providing separate office space for Gemini South. The Project, however, is planning to construct its own office space, as it did for Gemini North, and is anticipating spending $1.5 million from the Operations budget for this effort.

Impact of Using Two Budgets

The use of Operations funds to cover excess Construction and Commissioning costs has had several results. First, classifying the costs as operating costs has resulted in overstating the Operations budget, while simultaneously understating the true costs for the Construction and Commissioning of the Project. Second, NSF may not be in conformance

with Federal appropriations law by not funding Construction and Commissioning costs exclusively out of the NSF appropriation intended for this purpose. Finally, NSF has potentially missed opportunities to fund other worthy projects in order to absorb the additional Construction and Commissioning costs.

Inflated Operations Budget

Using Operations funds to cover the excess Construction and Commissioning costs has inflated the Operations budget. The Gemini Board has approved a 1996 to 2000 Operations budget[8] of $58.8 million. However, the majority of this budget is related to Construction and Commissioning, rather than Operations ramp-up, costs. After removing Construction and Commissioning costs from the Operations budget, we found that actual Operations ramp-up costs through December 31, 2000 are expected to reach only $19.5 million, $39.3 million less than the Gemini Board-approved Operations budget (*see* Appendix C for more detail).

On the other hand, this use of Operations funds has understated true Construction and Commissioning costs and enabled the Project to artificially maintain its $184 million budget. By artificially keeping within this spending cap, NSF has not sought further approval from either the NSB or Congress for additional Construction and Commissioning funds.

NSF May Be in Noncompliance with US Appropriations Law

Additionally, in using Operations funds to cover Construction and Commissioning costs, NSF may be in noncompliance with Federal appropriations law. Under US appropriations law, an agency must spend funds in accordance with the purpose for which Congress provided them. Specifically, this "purpose" statute requires that "[a]ppropriations shall be applied only to the objects for which the appropriations were made except as otherwise provided by law."[9] If an agency has an appropriation for a specific object, that appropriation is available to the exclusion of a more

[8] In October 1997, the Partners, with the exception of Chile, executed Administrative Guidelines to "supplement the relevant Provisions of the Gemini Agreement." These Guidelines provide that the Gemini Board will approve an annual Operations budget and a 5-year plan each November. The Guidelines also define the percentages of this budget that each Partner is to contribute. Unlike the GIA and its amendments, the Administrative Guidelines was not signed by the NSF Director, rather it was signed by an NSF Grants Officer. Additionally, the Administrative Guidelines was not reviewed or approved by the US Department of State.

[9] 31 U.S.C. § 1301(a).

general appropriation.[10] Further, even if there is not a specific appropriation and an agency has two appropriations available for the same purpose, once the agency has made a choice as to where an object should be funded, the agency must continue to use this appropriation to the exclusion of any other.[11] An agency generally may not use funds from one appropriation to supplement or augment another appropriation.

In the case of the Gemini Project, Congress provided funding for the Construction and Commissioning of this Project through NSF's Major Research Equipment (MRE) appropriation. NSF established this appropriation account for FY 1995 at the request of Congress and in recognition of a need to handle the different funding issues associated with capital projects. In doing so, NSF described in its FY 1995 budget request to Congress the purpose of this account:

> "[t]he [MRE] account is established to provide funding for the construction of major research facilities that provide unique capabilities at the cutting edge of science and engineering . . . Projects supported by this Account will push the boundaries of technological design and will offer significant expansion of opportunities, frequently in totally new directions, for the science and engineering community."

In contrast, NSF described the Research and Related Activities (R&RA) account as providing "Operations and Maintenance, once construction of the basic facility is completed." For that same fiscal year, Congress approved for Gemini $41 million for Construction and Commissioning costs as part of the MRE appropriations account.[12] Congress provided all subsequent appropriations for the Construction and Commissioning phases of Gemini through the MRE account.[13] Also, in keeping with the descriptions of the MRE and R&RA accounts, NSF funded the Projects' Operations costs from the R&RA appropriation account.

[10] *See* UNITED STATES GENERAL ACCOUNTING OFFICE, PRINCIPLES OF FEDERAL APPROPRIATIONS LAW, 2-17 (2nd Ed. Vol. I 1991)(hereinafter "RED BOOK")(*citing* 1 Comp. Dec. 126 (1894); 4 Comp. Gen. 476 (1924)).
[11] *See* RED BOOK, *supra* note 18, at 2-19 to 2-20 (*citing* 68 Comp. Gen. 337 (1989); 23 Comp. Gen. 827 (1944); 10 Comp. Gen. 440 (1931); 5 Comp. Gen. 479 (1926); 15 Comp. Dec. 101 (1908); 5 Op. Off. Legal Counsel 391 (1981)).
[12] *See* H.R. CONF. REP. 103-715 (1994).
[13] H.R. REP. NO. 105-175 (1997).

Accordingly, funding Construction and Commissioning of Gemini from the MRE account has been recognized as appropriate by Congress[14] and is in keeping with the purpose for which this account was established. It is also the account from which NSF chose to fund Construction and Commissioning activities. Therefore, in using Operations funds to cover Construction and Commissioning costs, NSF does not appear to be using the R&RA account for authorized purposes. At the same time, NSF may be improperly augmenting its MRE appropriation.

In order to prevent an agency from undercutting the Congressional "power of the purse,"[15] Federal appropriation law requires an agency to have specific statutory authority before it can transfer monies between appropriations.[16] NSF does not have this transfer authority currently and thus when Congress appropriated funds for MRE activities, this appropriation represented a limitation of the amount of funds that NSF had authority to obligate.[17] Accordingly, NSF's use of the R&RA account to pay for Construction and Commissioning costs is essentially an unauthorized transfer of funds and an improper augmentation of the MRE account.

In addition, NSF's action may not be in accordance with the requirements of the Antideficiency Act. The Antideficiency Act, 31 U.S.C. § 1341(a), provides that an officer or employee of the United States may not obligate funds in excess of the available appropriation. Therefore, while the NSF obligations for the excess Construction and Commissioning costs did not actually come from the MRE account, they *should* have come from this account.

[14] Letter from Jerry Lewis, Chairman, House Subcommittee on Veterans Affairs, Housing and Urban Development and Independent Agencies and Christopher Bond, Chairman, Senate Subcommittee on Veterans Affairs, Housing and Urban Development and Independent Agencies, to Neal Lane, Director, National Science Foundation (December 30, 1996) ("To the extent additional funds [for Gemini] are needed in future years to achieve initial operating capability, the Committees strongly urge the Foundation to request these funds as part of the Major Research Equipment account if these funds directly relate to the construction of the facilities.") (emphasis added).

[15] *See* U.S. CONST. art. I, § 9, cl. 7.

[16] *See* 31 U.S.C. § 1532.

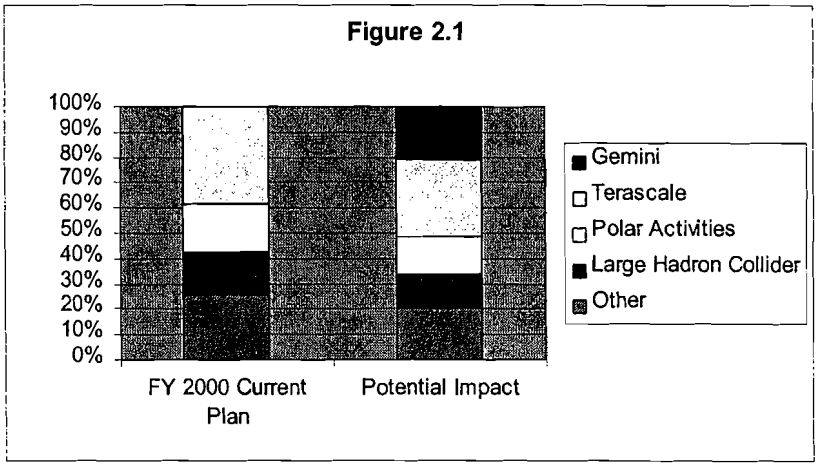
We have calculated approximately $19.3 million[18] in R&RA obligations to date that should have been MRE obligations. (See Appendix D.) Because the MRE account contains funding for more than the Gemini Project, there may be a sufficient balance in the account to absorb these extra Construction and Commissioning obligations. However, to the extent that reclassifying the Construction and Commissioning costs to the MRE account results in exceeding the existing fund balance, NSF will not be conforming with the Antideficiency Act. This would require immediate reporting to the President and Congress and possible administrative sanctions.[19]

NSF May Have Unmet Opportunities

If NSF has to make adjustments to the MRE and R&RA appropriations to properly account for all of the Construction and Commissioning costs, such adjustments will lead to unmet opportunities in both accounts. This means that NSF will have lost the opportunity to potentially fund other, worthy scientific projects.

First, if the Construction and Commissioning costs that are currently funded by the R&RA account are reclassified as obligations to the MRE account, funds available for existing MRE projects would have to be reduced in order to absorb these additional Gemini Project obligations. Currently, the MRE account contains funding for seven specific projects.[20] Figure 2.1 depicts the potential impact on these seven projects if Gemini Construction and Commissioning costs are reclassified to the MRE account.

Figure 2.1



[18] While we are estimating the total amount of Construction and Commissioning costs that have been or will be paid from the Operations budget as $52.8 million, only a portion of these costs are attributable to NSF. Further, because the entire $52.8 million has not yet been spent, not all of the NSF share has been obligated.

[19] *See* 31 U.S.C. §§ 1349(a), 1351.

[20] As described in the FY 2000 Current Plan contained in NSF's FY 2001 Budget Request to Congress.

Second, the reclassification of R&RA obligations to the MRE account will result in an equal amount of unobligated funds now being available in the R&RA account. However, since the R&RA appropriation is a two-year appropriation; that is, it is available for two fiscal years only, these funds may no longer be available for obligation. Thus, while NSF may have excess unobligated R&RA funds resulting from reclassifying the Construction and Commissioning costs to the MRE account, it may not be able to use all of them to make other awards because the authority to spend some of those funds has expired. Accordingly, we estimate NSF could lose the use of at least $5.1 of the $19.3 million in funds that would be available after the reclassification.

Lack of Planning and Policies

The decisions made by the Gemini Board to fund Construction and Commissioning costs from the Operations budget largely stem from the rigid budget cap that was placed on the project at an early date and from a lack of adequate policies and procedures in NSF to manage large capital projects.

Budgets Were Unrealistic to Meet Scientific Needs

Throughout this project, the collaborating countries have struggled to remain within the funding cap on Construction and Commissioning set by the NSF and adopted by Congress. The Gemini Board and the Managing Organization have continuously worked to explore the lowest cost alternatives available. However, we believe that some of the decisions reached by the Board in the early 1990's set a spending pattern that resulted in any excess Construction and Commissioning related costs, whether in or out of the original project scope, being spent out of the Operations budget.

The project was initially proposed to NSF by NOAO, a division within AURA, as a national observatory to be built and managed by NOAO. The proposal contained a preliminary construction and commissioning budget of $143.8 million, which was developed before the project was designed or engineered and did not account for inflation. Using this initial proposal, NSF performed a "should cost" analysis of the budget applying inflationary factors to the amounts, but not for any new analysis of the technical aspects of the Project, to derive a budget of $176 million.

NSF, however, was unwilling to fund the total project. The NSF Director at the time was interested in NSF engaging in more international collaborations and saw Gemini as a perfect opportunity for such a project. He set the requirement that the project be funded for $176 million with the

NSF providing only half of the funding. The other half would need to come from international partners, originally identified as the United Kingdom (UK) and Canada.[21] This is the vision of the project that NSF took to Congress, including the $176 million budget, and the basis on which Congress subsequently approved and provided funding for the project.

Subsequently, however, in 1991, once an international partnership was established, scientists from the US, UK and Canada reviewed the science requirements of the telescopes and developed a "bottom's-up" budget of the costs for the project. The estimate came in at $237 million, 35 percent more than the $176 million budget that Congress had approved. At the time, no one involved believed that NSF or Congress would approve additional funding and it was feared that the project would be lost unless the cap could be met.

Therefore, in 1992, to accommodate these funding constraints, the Project scope was significantly reduced, e.g., descoped. Various features and facilities were eliminated, including a secondary mirror, in an effort to pare down the budget and bring it back within the funding cap.

While the descoping effort did result in significant cost reductions for the Project, it was not enough to bridge the entire funding gap. Accordingly, later that year, the Project decided that Commissioning costs would be spent out of the Operations budget, thereby setting the precedent for charging costs to Operations that were originally intended to be paid from the Construction and Commissioning budget.

Accordingly, in 1995, the IGPO, with Gemini Board approval, began charging other costs previously identified as Construction and Commissioning to Operations, including integration and test costs associated with assembling and testing the telescopes components and spares.

Also, costs for specific telescope components were coming in higher than the 1992 budget provided and the additional costs were again paid for with the Operation budget funds. This included the increased costs for Phase I instruments that were budgeted in 1992 using technological paradigms for

[21] Initially, both the UK and Canada planned on providing 25% of the funding, half of the remaining 50%. Canada, however, was only able to provide 15% necessitating the search for other partners that resulted in the addition of Chile (5%), Argentina (2.5%) and Brazil (2.5%).

4-meter telescope instruments. Unbeknownst at the time, 8-meter telescope instruments cost significantly more than 4-meter telescope instruments. Because the Phase I instrument budget was not large enough to cover the costs of all these instruments, the IGPO recommended and the Gemini Board approved funding Phase I instrument completion costs from the Operations budget.

Subsequently, the Gemini Project continued to fund unanticipated and extra Construction and Commissioning costs from the Operations budget. (*See* Appendix E for a timeline of relevant Gemini Board funding decisions.)

The Project faced the ever-overwhelming task of completing a project within a capped budget that was immature and unrealistic from the outset. The scientific and technological needs of the telescopes simply cost more than the authorized budget would allow. Therefore, rather than build an obsolete facility or risk project termination if additional funds were sought, the Project looked to the Operations budget as its alternative funding source.

NSF Needs Improved Controls and Processes

The need for improved controls and processes for managing large capital projects may have also contributed to financial management issues. Specifically, NSF lacked adequate policies and procedures to guide the NSF program representatives in the use of the MRE and R&RA appropriations when making funding decisions affecting the Project. NSF's Proposal and Award Manual has not been formally updated since before the creation of the MRE account and contains no guidance on the management of large capital and infrastructure projects. It also does not recognize the establishment of the MRE account as an appropriation separate from the R&RA appropriation. This lack of guidance allowed the Gemini Board to approve the use of the Operations budget to fund Construction and Commissioning costs. For NSF this action may be in noncompliance with Federal appropriations law and had other significant impacts.

Prior to 1995, the MRE account was a sub-account of the R&RA appropriation. This "bricks and mortar" sub-account funding the capital-type projects that now make up the MRE account along with the Major Research Instrumentation program that has continued to be funded by the R&RA account. When the new MRE account was established in 1995, it continued to retain the same account name and to fund the same type of projects as the old MRE sub-account. NSF staff members associated with

the Gemini Project did not realize that the MRE account represented a new appropriation, separate from the R&RA appropriation. Therefore, they did not understand that the R&RA account could no longer be used to supplement the MRE Construction and Commissioning costs, as was done in the past with the sub-account.

Also, while the NSB in May 2000, approved the adoption of Interim Guidelines for Planning and Managing Major Research Equipment Account Projects (Guidelines), these Guidelines continue to indicate a misunderstanding of the new MRE appropriation account. In particular, in discussing the requirements for internal cost-sharing of construction/acquisition costs, the Guidelines state that the NSF program proposing an MRE project should "[p]ropose a plan for significant sharing of construction/acquisition costs, which typically represents the level of anticipated operating costs by the final year of construction/acquisition." Additionally, the Guidelines note that "[c]ost sharing for construction is reflected in a downward adjustment to the Originating Organization's base budget during the period of construction and an upward adjustment to the Organization's base budget for operations costs of the project after construction." Accordingly, these Guidelines seem to be advocating using R&RA funds to supplement the MRE account on a project-by-project basis rather than recognizing the MRE account as a separate appropriation requiring separate fund control management.

The Guidelines also do not seem to adequately address the post-award management of these large projects. Rather, they deal primarily with how to initiate funding of a new MRE project and the steps a program must go through to gain approval for such a project. Little description is provided on how to effectively manage these large projects after they are awarded. For example, the Guidelines do not discuss clear definitions and criteria for the costs to be covered by the MRE account and the nature of the budget analysis and cost projection necessary prior to funding limitations being established. Nor do they discuss NSF's expectations and standards for good project management including the monitoring of projects, accountability for tracking the project's cost, schedule, and technical performance, and methods for addressing problems such as cost overruns, schedule delays and changes in the technical scope of work.

We also believe the lack of senior NSF management and NSB knowledge and involvement in the Gemini Project has contributed to the financial management issues associated with Gemini. NSF's Director and the NSB

were not aware of the ever increasing Operations budget because NSF policy did not provide for this information to be elevated to their level. The NSB has delegated authority to the Director to supplement NSB-approved awards by twenty percent or $10 million, whichever is less.[22] This authority has, in turn, been re-delegated through the Division of Grants and Agreements to the various staff-level grant officers. Accordingly, under this delegation, neither the NSF Director or the NSB must be notified nor their approval sought until award costs reach the NSB-approved award amount plus the supplemental authority. Therefore, in circumstances where the program fully expects the award to reach a higher expenditure level, further approval is not needed until costs have actually been incurred at that level. For example, for the Gemini Project, the NSB approved, in June 1995, a total of $204.4 million for both Construction and Commissioning, and Operations through December 31, 2000. As early as November 1995, the Gemini Board approved a total budget for the same activities of $222.1 million. This Gemini Board-approved budget continued to increase and now stands at $242.8 million. However, because actual obligations to the Project have just now reached the NSB approved amount plus the $10 million supplemental authority, the NSF program has not sought NSB approval for these additional costs. Accordingly, although this Project has been underway for almost years, the Director and NSB are only now being informed of the need for additional funding authority. Therefore, the Director and NSB lacked the opportunity to provide guidance and suggest options for addressing the financial issues facing the Project.

Similarly, NSF's practice of using future funding for an award to offset any current funding deficit also limits senior NSF management and NSB knowledge of a project's additional funding needs. For example, the current funding authority for Gemini of $214.4 million (including the extra $10 million in supplemental authority) is insufficient to meet the Project's needs for the completion of Construction and Commissioning and Operations costs through December 31, 2000. In fact, the IGPO informed us that if its funding were limited to this amount it would have to immediately stop work and lay off its employees. AURA has recently submitted a proposal for the continued management of Gemini. This proposal covers operations costs for the years 2001 to 2005. The NSF program expected to obtain NSB approval for this proposal and use the funding to cover any excess Construction and Commissioning costs. Under this practice, the NSB would not be aware of the significant additional funding needed to complete the work under the current funding authority.

[22] *See* NSB-99-112, July 29, 1999; O/D 99-15, September 30, 1999.

Instead, by using future authority, the Project would have an additional 5 years to try to make up the difference.

Taken together, the need for effective controls and processes appear to have contributed to the problems that we have identified with Gemini. Improved policies and procedures for funding and managing large infrastructure projects and a better understanding of the fiscal accounts supporting the Project would help avoid the issues of appropriations law. Also, policies that provide for keeping senior NSF management and the NSB informed of the status of major projects allows for a proactive process of solving problems and considering other options as they occur.

Conclusions and Recommendations

Given the increasing emphasis that NSF is placing on large, collaborative projects, NSF needs to develop effective policies and procedures for managing large capital and infrastructure projects. Such policies and procedures should help NSF on future projects to better address the legal and financial management challenges that have faced the Gemini Project. While the Project has continuously worked to explore the lowest cost alternatives available and endeavored to meet the needs of the partner countries scientific communities, it has lacked the necessary support and guidance from NSF, the Executive Agency.

NSF's current policies and procedures are geared toward single-investigator awards. Therefore, while these policies may be appropriate for the bulk of NSF's awards, they are not adequate for managing the large awards financed by the MRE account.

Additionally, while NSF has developed interim guidelines, these guidelines do not address the areas of fund controls and project oversight of MRE account projects. We believe strong policies that clearly recognize the MRE as an appropriation separate from the R&RA account and establish the appropriate controls and processes for managing this account are necessary.

Finally, the lack of clear guidance has led to a fragmented and decentralized process of overseeing MRE projects. A cohesive set of policies and procedures that cover all aspects of project management – from inception to final closeout – will ensure that information on major changes in the status of MRE projects is surfaced to the appropriate top-level policy makers as well as enable the project to be supported by individuals having the necessary knowledge and expertise from across NSF.

We recommend that NSF's Assistant Director of the Mathematical and Physical Sciences Directorate, and Acting Director of the Office of Budget, Finance and Award Management and Chief Financial Officer:

- notify the NSF Director and NSB that the Gemini Project has exceeded its authorized Construction and Commissioning budget, and

- work with NSF's General Counsel to take the appropriate steps to address the potential legal issues, including addressing the need to reclassify $19.3 million in R&RA costs to the MRE appropriation account and/or seek Congressional authority to transfer R&RA funds to the MRE account or obtain additional MRE funds.

We further recommend that NSF's Acting Director of the Office of Budget, Finance and Award Management and Chief Financial Officer:

- Issue compliance guidelines for managing MRE projects that, at a minimum, (1) provide clear definitions and criteria for the costs to be covered by the MRE account, (2) establish processes for ensuring realistic project cost estimates, including contingencies for unanticipated costs, (3) provide guidance consistent with appropriate law requirements for handling intra-agency cost sharing, and (4) identify NSF's expectations and standards for good project management including guidance for how projects will be monitored, accountability for tracking the project's cost, schedule, and technical performance, and methods for addressing problems such as cost overruns, schedule delays and changes in the technical scope of work.

- Update its current policies and procedures with respect to award management to recognize the need for a more extensive and higher level of oversight for MRE project awards. As part of this process, NSF should consider revising its current delegation of authority to require notification to the NSF Director and the NSB when MRE project costs exceed authorized funding levels.

- Provide training to all NSF staff engaged in MRE projects on the fund control and project management procedures necessary to effectively manage these programs, including compliance oversight procedures.

Agency Response

NSF management agreed with many of these recommendations. Specifically, the Agency's response indicates its plans to update its policies and procedures to include more detail for awarding and managing MRE funded capital and infrastructure projects.

In addition, the Agency will continue to explore ways for more extensive and higher level oversight of MRE project awards and has taken steps to ensure that the Office of the Director is aware when the delegated authority to increase NSB awards is being used. Further, NSF's response to this report emphasizes the importance of providing more training to all NSF staff who are engaged in planning and managing large projects and considers the need for developing a permanent cadre of staff experienced in project management principles and practices.

NSF management also has notified the Director and the NSB of the need for additional funds for the Gemini Project and have contacted NSF's General Counsel to address the legal issues in accounting for the Project's costs.

However, NSF's managers do not believe they have inappropriately classified Construction and Commissioning costs as Operations costs, nor that they have exceeded the authorized Construction and Commissioning budget. In particular, they argue that the allocation of costs between the R&RA and MRE appropriations is legally within the Agency's discretion under appropriation law, although they acknowledge the merits of the OIG's concerns for augmentation of the MRE account. Accordingly, NSF plans to seek clarification from the Congress that funds from other sources might be used to supplement those in the MRE appropriation.

Therefore, while the Agency has technically complied with our recommendations, its decision not to recognize $52.8 million in project costs as Construction and Commissioning rather than Operations is risky. The Agency represented to the NSB and to the Congress that it would cost $184 million for operational telescopes, which is not the case. The true costs of obtaining fully operational telescopes is likely to be over $250 million, yet the Congress and the NSB have been told that Gemini is on budget with a total cost of $184 million.

Continuing to keep these costs in the Operations budget, which is funded by the R&RA appropriations account, masks the true costs of the construction and commissioning of the Gemini telescopes. Further, it creates the potential for losing credibility with the NSB and the Congress, which have

funding authority over these large capital projects. They set a standard of poor financial and project management within the Agency creating a disincentive for other projects to remain on budget. All of this, in turn, creates the potential for higher scrutiny and greater funding limitations should the Congress lose confidence and trust in NSF's management of large projects.[23]

[23] This is especially risky given the Agency's plan to seek clarification from Congress that it may supplement the MRE account from other sources. This appears to seek a fix to a problem that the Agency does not believe exists and may receive a less than favorable response from the Congress.

Partners Encounter Difficulties Meeting Agreed Contributions to Operations

Some of the Gemini Partners have had difficulties providing their contributions to Operations according to their agreed share amounts. Political and economic circumstances have severely limited the ability of the South American partners to fully meet their funding commitments for Operating costs. In order to cover for these shortfalls as well as to build a contingency for further shortfalls, NSF advanced funds of approximately $6.2 million to the Project. Also, NSF made payments on behalf of noncontributing partners in exchange for future telescope observation time. In so doing, NSF has exceeded its 50 percent funding cap. Also, although the Project's cash flow projection plan suggests that all partners, including NSF, will be in compliance with their percentage share requirements within five years, this seems unlikely given the past and present difficulties facing the South American partners.

Partner Contributions Vary Significantly from GIA

The Gemini International Agreement (GIA) defines the percentage shares that each of the seven Gemini partners has agreed to contribute for Operations costs of the project. The partner contribution percentage shares to Operations are shown in Table 3.1.

Table 3.1 Contributions to Operations by Percentage

United States	50%	
United Kingdom	25%	
Canada	15%	
Chile	5%	
Argentina	2.5%	
Brazil	2.5%	100%
Australia[1]	5%	105%[2]

However, partner contributions to operations have varied significantly with their agreed upon percentage share commitments. As indicated in the following table, Brazil, Argentina, and Chile, for the period 1996 to 1999,

[1] In 1998, Australia was added as a seventh partner, without changing the existing commitments of the other partners. Australia's contributions were to provide for additional "value-added" enhancements to the Project, thereby resulting in funding to the Project at 105 percent.

[2] In November 1999, the Board recalculated the contribution shares to operations to include the newest partner, Australia, but has not yet amended the GIA. When the agreement is amended, the recalculated shares would be United States 47.62 percent, United Kingdom 23.81 percent, Canada 14.39 percent, Chile 4.76 percent, Australia at 4.76 percent, Argentina 2.38 percent, and Brazil at 2.38 percent.

have paid significantly less than they agreed or not at all. On the other hand, NSF's contributions have been substantially more than that which was agreed.

Table 3.2 Comparison of 1996-1999 Operations Contributions to Contributions Received[3]

	Amounts Due to Operations	Amounts Obligated	Amounts Held in Reserve	Difference
United States	$14,917,432	$21,098,000		$6,180,569
United Kingdom	7,458,716	5,564,923	$1,212,043	(681,750)
Canada	4,475,229	1,903,662	2,486,518	(85,049)
Brazil	745,872	351,000[4]		(394,872)
Argentina	745.872	0		(745,872)
Chile	1,491,743	0		(1,491,743)
Total	$29,834,863	$28,917,585	$3,698,561	

Several Factors Affected Partner Contributions

The South American partner countries have not met their funding commitments primarily because of uncertain political and economic conditions. The partner countries, including NSF, have been reluctant to initiate default actions as a means of pressuring countries for their payments to Operations.[5] Therefore, to ensure Operations activities were able to move forward, NSF contributed amounts greater than it was required to both cover for the shortfalls of the South American partners as well as establish a cash reserve for future shortfalls.

Representatives from Brazil stated that they have had difficulty gaining their government's approval for Gemini Operations funding. Nevertheless they stated that they have reaffirmed their intention to meet their commitments to the project. The Gemini Board is optimistic about Brazil's ability to fully contribute in the future.

A newly elected government replaced Argentina's previous government less than a year ago. Economically, Argentina has been affected by the

[3] Funds received and obligated from Australia during this time are not included in this comparison because until November 1999 the Board allocated the Australian partner's funds to value-added activities.
[4] Brazil's payment of $328,000 for 1999 was paid in the first quarter of 2000.
[5] In contrast, the Gemini Board initiated the default process toward a partner in 1998 for nonpayment to Construction and Commissioning, resulting in receipt of the partner's contribution.

devaluation of money in the mid-1990s of its largest trading partner, Brazil. Although it is an original partner, in 1997 Argentina rescheduled its contributions to Project Operations to begin in 2000. Argentina recently notified the Gemini Board that it might continue to have difficulty providing funds for Project Operations.

To date the Chilean government has not approved the funding for Operations. Chile's new government is in the process of reevaluating its commitment to the project. However, since Chile's scientific community has less than 30 astronomers, it will likely not take advantage of all of the observation time it receives as host country.[6] Therefore, Chile may not wish to provide funding to assure additional use of the telescope.

Further, the major partner countries did not believe it was feasible to initiate default proceedings to pressure the noncontributing countries for payment. This is because the three original partners were well aware from the outset of the financial risk of the South American partners defaulting. The original partners accepted the risk in order to gain support for the project.

The governments of the US, UK and Canada limited their partner contribution percentage to 50 percent, 25 percent and 15 percent, respectively, in order to foster an international collaboration. Therefore, to secure full funding for the remaining 10 percent, the Project sought the South American partners. The US, UK and Canada were satisfied that the South American partners could at least meet their share of costs for the larger Construction and Commissioning budget, and if necessary, the US and/or the UK were prepared to cover the unmet Operations budget contributions. Accordingly, the Gemini Board has been very lenient with the noncontributing partners and has avoided taking default actions.

NSF Provides Contributions to Meet Shortfalls

In order to ensure that the Project's operating cash needs were continuously met, NSF has shouldered the responsibility of providing the necessary additional funds. Specifically, through December 1999, NSF advanced approximately $6.2 million to meet the Operations costs of the project, in addition to funding its own $14.9 million contribution. These advances covered not only the South American partner shortfalls, but also allowed the

[6] Chile receives ten percent of observation time as host country to Gemini South. As a contributing partner, Chile receives an additional 4.4 percent of observation time at both facilities and voting rights on the Board.

UK and Canada to partially delay their initial contributions.[7] In addition, NSF's advances enabled the Project to build a cash reserve for future shortfalls by holding and not releasing to the project $3.7 million in payments received from the UK and Canada in 1997 and 1998. The Project's Managing Organization currently estimates future shortfalls could be as much as $8.6 million[8] through 2005.

In addition, NSF and other major partners agreed to purchase future observation time from noncontributing partners as a means of offsetting their financial commitments. The 1997 Administrative Guidelines of the GIA provided for this practice in order to enable a noncontributing partner to avoid default and thereby lose its entire investment for missing its annual contribution to Operations.

This practice requires additional up front funds from the purchasing partner. For example, in 1999, NSF purchased $805,000 in time from Chile,[9] and has budgeted another $400,000 for this purpose in 2001. These funds are in addition to both advances NSF has provided and annual contributions for Gemini Operations.

Also, NSF will not receive the benefit of these funds until the telescopes are fully operational in several more years. Observing time purchased in 1999, and paid for in 2000, will not be realized until 2002. Therefore, while NSF may ultimately be able to better support its astronomical community with additional observation time, that benefit is several years in the offing, and in the meantime NSF is having to incur these costs in the present.

NSF Needs Realistic Cash Plan for Operations

As a result of making up for the shortfalls of noncontributing countries, NSF has paid more than it planned and has currently exceeded the fifty percent funding cap imposed by Congress and the NSB. Currently, as shown in Table 3.3 below, NSF has contributed 73% or 23% more than its authorized percentage share.

[7] The UK and Canada were fully prepared to meet their percentage commitment, but the advanced funds provided by NSF in 1996 were such that, this was not required.
[8] This amount is the minimum amount needed under current project plans. The Board is considering increased contributions needed for higher than expected operations, indirect costs for instruments, and inflation, that will increase cash needs substantially from current plans.
[9] In 1999, the US purchased 20 nights at $805,087, the UK purchased 10 nights at $402,543, and Australia purchased 3 nights at $120,763 from Chile to make Chile's 1998 and 1999 contributions to operations.

Table 3.3 Partner Percentage Contributions to Operations[10]

	Amount Due	Amount Paid
United States	50%	73.0%
United Kingdom	25%	23.4%
Canada	15%	15.2%
Brazil	2.5%	1.2%
Argentina	2.5%	0%
Chile	5%	0%

Further, as long as the South American partners are in arrears, it is likely that NSF will continue to fund amounts greater than its fifty- percent share. Accordingly, the Project's future funding plans should appropriately recognize and realistically address this risk.

However, the Project's current Operations Cash Flow Report does not reflect this risk. To the contrary, this report indicates that all partners, including the South American partners, will fully meet their funding commitments by 2005. Specifically, it suggests that the noncontributing partners will pay over the next 5 years, not only what they have not paid to date, but also their full percentage share of all future commitments. It is expected that these higher payments will be used to reduce NSF's future contributions, thereby offsetting the advances it has made to date to cover funding shortfalls. The end result is a cash projection that over the 10 year period 1996 to 2005 "smoothes" out the contributions of all partners, indicating all partners as having met their required percentage contributions by 2005 and NSF as no longer exceeding its funding cap.

While these projections for cash commitments are worthy goals, they do not reflect the past or present reality of the South American partners. To the extent that the South American partners continue to face economic challenges in meeting their commitments, this projection appears overly optimistic and not reliable as a basis for setting future contribution amounts. Further, given that NSF would likely be most affected by any unrealistic

[10] We recognized all possible partner payments for this percentage comparison to the amounts due. Accordingly, the "Amount Paid" column includes $3,698,561 paid by the United Kingdom and Canada that NSF did not apply to the amount due, resulting in 112.8 percent total payments compared to 100 percent of payments due. This occurred because NSF advanced more funds than were due from the US and, rather than offsetting those advances with payments received by the United Kingdom and Canada, withheld the funds. See "NSF Provides Contributions to Meet Shortfalls", page 27, for further details.

projections, reliance on this cash flow report further delays senior NSF management and the NSB the opportunity to proactively consider options for handling future financial needs.

Conclusions and Recommendations

In the interest of a successful collaboration in the long term, NSF endeavored to provide the financial support necessary to stabilize the project's cash flows in the first years of Operations. By relying on NSF to stabilize early cash flows to Operations, the Gemini Board did not have to consider other alternatives to deal with the cash flow problems. The actions taken by NSF and the Gemini Board optimistically relied on improved, stable cash flows to operations in later years that are not likely to occur. The risk of nonpayment to Operations by Argentina and Chile continues to be high. As a result, NSF has effectively increased its participation in the project operations in excess of its intended fifty percent, and is likely to sustain a higher level of participation in the future.

Consequently, we recommend that NSF's Assistant Director of the Mathematical and Physical Sciences Directorate, and Acting Director of the Office of Budget, Finance and Award Management and Chief Financial Officer, representing the Executive Agency:

- Release to the Project as US contributions the $3.7 million in funds currently held in reserve.

- Work with the Gemini Board to ensure that a realistic assessment is conducted of each partner's ability to meet its percentage share commitment and develop a 5-year plan for operations for 2001-2005. Safeguards established to meet cash shortfalls should spread the risk of meeting cash shortfalls equitably among the partners, and not rely primarily on NSF.

To the extent that this plan indicates funding shortfalls on the part of some countries, the NSF may wish to seek the approval necessary to exceed the fifty- percent funding cap.

Agency Response

NSF agreed that a 5-year operations plan is needed and indicated that such a plan is presently under review as part of the AURA proposal for renewal of the cooperative agreement to manage Gemini. An assessment of the partners' abilities to meet commitments is part of the fiscal planning of the partnership. The projected budget will receive an independent review examination in order to establish its credibility. Further, the Gemini Board has expressed resolve to enact the provisions of the GIA regarding default of noncontributing members.

However, NSF's response was unclear as to whether it agreed or disagreed with the OIG's recommendation to release the $3.7 million funds to the Project. NSF indicated only that it will consider this OIG recommendation. In light of future operations budgets, the Agency's purpose for holding $3.7 million of funds in reserve over the next five years that are now available for Project use is unclear. In August 2000 the MPS requested additional budget authority to cover increased Gemini expenditures for operations of $7.5 million that could have been reduced by the $3.7 million being held in reserve for operations. We believe NSF should use available cash for US contributions to operations before requesting any additional funding and therefore continue to recommend that NSF release the $3.7 million in funds held by NSF to the Project.

Gemini Governance

In the early 1990's, the United Kingdom, through the Science and Engineering Research Council (SERC), and Canada, through the National Research Council (NRC), were each supporting astronomical facilities on Mauna Kea, Hawaii. At the same time, the United States, through the National Science Foundation (NSF), was supporting astronomical facilities on Cerro Tololo, Chile. In an effort to encourage scientific collaboration among these countries, NRC, SERC and NSF began discussing the joint construction and operation of twin 8-meter telescopes on Mauna Kea, Hawaii and Cerro Pachón, Chile, to be known as the Gemini Facilities.

These three nations, the Parties, entered into a Memorandum of Understanding effective September 15, 1992, and subsequently replaced this with an International Agreement[1] (Agreement), which became effective October 28, 1993. The Agreement begins by stating that the Parties desire "to achieve full intellectual and economic benefits to all Parties in the execution of Gemini with a fair and equitable division of responsibilities and benefits among the Parties, consistent with their contributions and the timely and cost effective execution of Gemini."[2] The Agreement covers the construction, commissioning and operation of the Gemini telescopes and spells out such details as the Parties' contributions and observation rights. The Agreement also describes the contemplated management structure of the Gemini project (Gemini).

[1] Agreement Among: The National Science Foundation of the United States of America, The Science and Engineering Research Council of the United Kingdom of Great Britain and Northern Ireland, The National Research Council of Canada Concerning the Construction and Operation of an 8 Meter Telescope on Mauna Kea, Hawaii and an 8 Meter Telescope on Cerro Pachón, Chile to be Known as the Gemini Facilities, July 28, 1993.

[2] Id. at 3.

International Partners

Currently, Gemini is made up of the following international partners:

United States - National Science Foundation (NSF)
Canada - National Research Council (NRC)
United Kingdom - Particle Physics and Astronomy Research Council (PPARC)
Chile - Comisión Nacional de Investigación Científica y Tecnológica (CONICYT)
Australia - Australian Research Council (ARC)
Argentina - Secretaria de Ciencia y Technologia (SECYT-CONICET)
Brazil - Ministry of Science and Technology (MST)

Originally, the Partners consisted of the sole Parties to the Agreement (NSF, NRC and SERC (the predecessor to PPARC)). However the Agreement specifically contemplated additional Partners. The original financial provisions called for contributions as follows:

United States	50%
United Kingdom	25%
Canada	15%

The remaining 10 percent was to be provided by partners Brazil, Argentina, and Chile, added in 1994.[3] Section 8 of the Agreement covers "New Membership" and provides that new Partners may join Gemini "subject to the unanimous agreement of the [current] Partners."[4] When a new Partner joins, the Agreement is amended so that the new Partner becomes a Party to the Agreement.[5]

The Agreement was further amended in May of 1998 to add the Australian Research Council as a Partner.[6] Australian financial contributions were considered new funding, raising the total

[3] Id. at 10.
[4] Id.
[5] Id.
[6] See Second Amendment to the Agreement Concerning the Construction and Operation of an 8 Meter Telescope on Mauna Kea, Hawaii, and an 8 Meter Telescope on Cerro Pachón, Chile, to be Known as the Gemini Facilities, May 1998.

funding available to 105 percent. Currently, the contributions, for the construction phase of the project are as follows[7]:

United States	47.62% (50/105)
United Kingdom	23.81% (25/105)
Canada	14.29% (15/105)
Chile	4.76% (5/105)
Australia	4.76% (5/105)
Argentina	2.38% (2.5/105)
Brazil	2.38% (2.5/105)

Partner Project Offices

"Gemini partners have established project offices to coordinate their contacts with the international project." The purposes of these offices are to "(i) support the Gemini Director in carrying out the project, (ii) maintain communications between the project and their science community, and (iii) represent their interests in Gemini."[8] A listing of these project offices, including links to individual web sites, can be found at http://www.gemini.edu/project/contacts.html.

Gemini Board

The primary supervisory and regulatory body over Gemini is the Gemini Board. While originally consisting only of members from the original three Partners and the Host, the current makeup of the Board is as follows:

Four members appointed by the United States
Two members appointed by the United Kingdom
Two members appointed by Canada
One member appointed by Chile
One member appointed by Australia
One member appointed, on an alternating basis, by Argentina and Brazil
One member appointed by the University of Hawaii (voting rights only on scientific matters pertaining to Gemini North)

The Agreement spells out in Section 10 the Responsibilities of

[7] Without decreasing existing contribution commitments, Australia was added to provide incremental value to the project.

[8] Association of Universities for Research in Astronomy, Inc., Memorandum Re: Gemini Organization, August 30, 1993.

the Gemini Board. These include ensuring that "Gemini is carried out in accordance with the terms of [the] Agreement;" and reporting "at least once per year in writing to the parties on the progress of Gemini including the financial situation, projected timescales and the estimated cost to completion."[9]

The Gemini Board is not to employ staff, however it may request the Executive Agency to supply staff to assist with various oversight and management tasks. In addition, the Board is supplied, at the expense of the Executive Agency, a Secretary for the Board and associated administrative support.

The Gemini Board also has the responsibility for reviewing and approving various administrative decisions such as:

- Annual and multi-year Gemini budgets
- Subawards made by the Managing Organization over $1 million
- The Executive Agency's selection of the Managing Organization
- Annual accounts and auditor's reports of the Managing Organization and the Executive Agency
- The Managing Organization's management plan; and
- Other scientific and administrative decisions.[10]

Gemini Finance Committee

The Gemini Finance Committee (GFC) of the Gemini Board, made up of eleven members representing the international partners, oversees the financial matters of Gemini. The GFC monitors the budget, cash flow and expenditures of the project, and provides advice to the Gemini Board.[11]

Executive Agency: National Science

The National Science Foundation (NSF) is an independent agency of the Executive Branch of the United States

[9] Agreement, *supra* note 1 at 12.
[10] *Id.* at 12-13.
[11] Gemini Project Annual Report 1998.

National Science Foundation

Government. The Congress created NSF in 1950 through organic legislation, the National Science Foundation Act of 1950,[12] and gave it additional authority through the Science and Engineering Equal Opportunities Act[13] and Title I of the Education for Economic Security Act.[14] Its mission, created by its organic legislation, is to "promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense."[15] NSF carries out this mission through "programs that invest over $3.3 billion per year in almost 20,000 research and education projects in science and engineering."[16]

"The Foundation consists of the National Science Board of 24 part-time members and a Director (who also serves as ex officio National Science Board member), each appointed by the President with the advice and consent of the U.S. Senate. Other senior officials include a Deputy Director who is appointed by the President with the advice and consent of the U.S. Senate, and eight Assistant Directors."[17] Under the direction of the NSF Director are the following seven scientific directorates: Biological Sciences, Computer & Information Science & Engineering, Education & Human Resources, Engineering, Geosciences, Mathematical & Physical Sciences, and Social, Behavioral & Economic Science. Within each directorate are divisions and the programs which fund the research and education projects.

Within the Mathematics & Physical Sciences Directorate is the Division of Astronomical Sciences (AST). In addition to providing support through individual investigator awards, AST "supports the development and operation of three National

[12] 42 U.S.C. §§ 1861 *et seq.*
[13] 42 U.S.C. § 1885.
[14] 20 U.S.C. §§ 3911-3922.
[15] NSF Mission Statement.
[16] http://www.nsf.gov/home/about/start.htm.
[17] http://www.nsf.gov/home/about/creation.htm.
[18] http://www.nsf.gov/mps/ast/start.htm.
[19] While, information is to flow between the Gemini Board and the Managing Organization through the Executive Agency, in practice, the Managing Organization often communicates directly with the Gemini Board.
[20] Agreement, *supra* note 1 at 13-14

Astronomy Centers: the National Optical Astronomy Observatories (NOAO), the National Radio Astronomy Observatory (NRAO), and the National Astronomy and Ionosphere Center (NAIC)."[18]

NSF was named in the International Agreement as the Executive Agency of Gemini. It is through AST that the US provides its share of funding for the construction and operations of Gemini. AST provides the executive secretary to the Gemini Board, and administers the cooperative agreement with the Managing Organization. The Executive Agency acts as a conduit for information from the Gemini Board to the Managing Organization[19] and its responsibilities, under the International Agreement,[20] include:

- Select the Managing Organization
- Receive and maintain records of contributions from the International Partners
- Transfer contributions to the Managing Organization
- Facilitate the movement of labor, materials and equipment between the US and Chile and the International Partner countries
- Ensure full access by the International Partners to the Gemini facilities
- Ensure that the contributions provided for Gemini are properly accounted for annually
- Ensure that agreements between the Managing Organization and subawardees do not conflict with the International Agreement; and
- Provide the Gemini Board with an Executive Secretary.

Hosts

The University of Hawaii (UH) has a lease from the State of Hawaii for all land within a 2.5 mile radius of its own 2.2 meter telescope located on Mauna Kea. The Gemini North telescope lies within this radius and NSF subleases the land from UH. Thus, UH acts as the host site for the Gemini North Facility. UH's Institute for Astronomy (IfA) conducts research programs at and receives observing time on each of the telescopes located on Mauna Kea including Gemini North.

The Gemini South facility is located on top of Cerro Pachón, Chile. Thus, Chile and the Chilean Astronomy are the hosts for Gemini South.

The Agreement specifies that UH and Chile "shall be guaranteed 10% of the Observing Time"[21] at their respective host facilities. In addition to receiving observing time, UH also has a representative on the Gemini Board (subject to certain voting restrictions) and may have a representative attend all Board committee meetings and formal meetings concerning Gemini that involve all of the Parties.[22] As one of the International Partners, Chile has a seat on the Gemini Board and full voting rights.

Managing Organization

The Association of Universities for Research in Astronomy, Inc. (AURA), founded in 1957, is a consortium of 29 US institutions and 5 international affiliates. Two are in Chile, and one each in Mexico, Canada, and Australia. Its mission is to "advance astronomy and related sciences, to articulate policy and respond to the priorities of the astronomical community, and to enhance the public understanding of science."[23]

AURA has three major components. First, under a contract with NASA, AURA operates the Space Telescope Science Institute, which carries out the mission of the Hubble Space Telescope. Second, through cooperative agreements with NSF, AURA operates the National Optical Astronomy Observatories (NOAO).

[21] Id. at 22.
[22] Id. at 10-11.
[23] AURA Mission Statement, http://www.aura-astronomy.org/WWAstatement.html.

Finally, through another cooperative agreement with NSF, AURA acts as the Managing Organization of Gemini. "As managing entity, AURA is responsible to the NSF for executing the project within approved budgets and policies, and within the terms of a mutually agreeable Cooperative Agreement (a form of contract)."[24] AURA's responsibilities, under the International Agreement,[25] include:

- Overall management of Gemini
- Development of management plans (to be approved by the Gemini Board)
- Employ key Gemini staff
- Carry out decisions of the Gemini Board as transmitted by the Executive Agency
- Keep proper accounts and records
- Prepare construction and operations budgets
- Facilitate access to the work sites
- Establish safety rules; and
- Report to the Gemini Board through the Executive Agency.

[24] Memorandum, "Gemini Organization", from [redacted], August 30, 1993.
[25] Agreement, *supra* note 1 at 14-15.

AURA Board

The AURA Board, as well as the Gemini Board, is responsible for providing oversight to the project. The AURA Board is made up of one Director from each of AURA's members and up to 12 Directors-at-Large.

The AURA Board appoints the AURA President and the Gemini Director, and reviews their performance. The Board meets annually and elects or appoints an Executive Committee and working committees as necessary to carry out its functions between annual meetings

AURA President

The AURA President is the Chief Executive Officer of the corporation and an ex officio member of the AURA Board and its major committees. The AURA President reports to the AURA Board and gives formal direction to the Gemini Director.

Gemini Science Committee

Reporting directly to the AURA President with science policy recommendations being approved by the Gemini Board, the Gemini Science Committee (GSC) provides advice on scientific priorities to the Gemini Project. The GSC is made up of fifteen members, in addition to the chair, with six from the US (including some NOAO scientists), three from the UK, two from Canada and one from each of the remaining Partners. Each Partner country determines how it will appoint its representatives to the GSC.

Gemini Director

The Gemini Director is appointed by the AURA Board and formally reports to the AURA President. The Director is responsible for the overall conduct of the Gemini Project and heads up the International Gemini Project Office.

International Gemini Project Office

The International Gemini Project Office (IGPO) is the administrative unit in charge of the day-to-day management and operation of the Gemini Project. The IGPO is led by the Gemini Director and, as of August 1, 1999, included a total of 93

employees. These employees fall primarily under one of four units headed by the Operations Manager, the Project Manager, the Head of Instrumentation and Development and the Project Scientist.

United States Gemini Program. Under a cooperative agreement with NSF, AURA operates the National Optical Astronomy Observatories (NOAO). NOAO, headquartered in Tucson, Arizona, "[provides] leadership in the establishment and operation of premier ground based astronomical research facilities, [promotes] public understanding and support of science, and [advances] all aspects of U.S. ground based astronomical research."[26]

Within NOAO are four major divisions. The Cerro Tololo Inter-American Observatory located in northern Chile operates three telescopes. Kitt Peak National Observatory, headquartered in Tucson, operates four telescopes on Kitt Peak Mountain, about 55 miles southwest of the city. The National Solar Observatory, headquartered in Tucson, also has five solar telescopes on Kitt Peak Mountain, as well as telescopes on Sacramento Peak, New Mexico.

The fourth division of NOAO is the SCience OPErations division (SCOPE). SCOPE's mission is "to provide the community interface and support before and after observing runs for all nighttime facilities available to the astronomical community through NOAO, including the Gemini telescopes."[27] Also included in SCOPE is the United States Gemini Project (USGP), established in 1993, which support the U.S. national interests in Gemini. The USGP acts as the United States Partner Project Office and is the "gateway for the U.S. astronomical community to the international Gemini Project."[28]

U.S. Workpackages. Among the responsibilities delegated to the USGP is the development and management of U.S. workpackages for instrumentation needed for Gemini. NOAO through USGP determines the instrumentation needs and then

[26] NOAO Mission Statement.
[27] http://www.noao.edu/noao/intro.html.
[28] http://www.noao.edu/usgp/.

seeks to fill those needs from qualified sources.

Non-U.S. Workpackages. The IGPO is also responsible for the management of non-U.S. workpackages. These instrumentation workpackages needed for Gemini have been distributed to the UK, through the PPARC, Canada, through the NRC, and Australia through the ARC. These agencies have provided the instrumentation themselves rather than seeking non-governmental sources.

OIG Estimate of Construction and Commissioning Costs

Description	Costs	Scope*
a) Instrument Development Fund		
Gemini Multi-Object Spectrograph (GMOS)	$ 875,000	In
Small Gemini Multi-Object Spectrograph (GMOS)	99,000	In
Near Infrared Arrays	500,449	In
Near Infrared Spectrograph (NIRS)	607,227	In
Near Infrared Spectrograph IFU (NIRS)	354,360	In
Polarization Modulator	677,000	In
Near Infrared Arrays (OIWFS)	250,000	In
Near Infrared Arrays (OIWFS)	39,000	In
Near Infrared Imager (GRISMS)	90,571	In
Mid Infrared Imager (TRECS)	1,258,000	In
High Resolution Optical Spectrograph (HROS)	3,175,000	In
Flamingo Visitor Instrument Support	100,000	In
Total Instrument Development Fund	$ 8,025,607	
b) Facilities Development Fund		
La Serena Lab	$ 35,775	In
Calibration Unit	521,000	In
Array and Controller Development (ALTAIR)	2,312,231	In
Rework Contingency	1,847,141	In
Adaptive Optics Upgrade	2,399,999	Out
Adaptive Optics System North (ALTAIR)	300,000	In
Laser Beacon Adaptive Optics System South	12,539,512	Out
Visitor Instrument Support (HOKUPAA)	100,000	In
Total Facilities Development Fund	$ 20,055,658	
c) Hilo Base Facility	$ 4,382,000	Out
d) Southern Base Facility	$ 1,500,000	Out
e) Other	$ 1,300,000	Out
f) Integration and Test, and Commissioning	$ 17,566,892	In
Total Gemini Operations Budget Funds (a - f)	$ 52,830,157	
Total Gemini Construction Budget	$184,000,004	In
Total Construction and Commissioning Costs	$236,830,161	

*In scope costs were included in the construction and commissioning budget established by the GIA. Out of scope costs were not considered in the GIA budget, but were approved by the Gemini Board at a later date.

OIG Comparison of Project Costs to NSB Approved Budgets

OIG Analysis of Project Costs:	Construction Through 2006	Operations Through 2000	Total
Instrument Development Fund	$ 8,025,607	$ 3,549,379	$ 11,574,986
Facilities Development Fund	20,055,658	1,356,959	21,412,617
Hilo Base Facility	4,382,000		4,382,000
South Base Facility	1,500,000		1,500,000
Operations and Maintenance	17,566,892	14,472,810	32,039,702
Other	1,300,000	140,770	1,440,770
Total Operations Reclassified*	$ 52,830,157	$ 19,519,918	$ 72,350,075
Construction	184,000,004		184,000,004
Gemini Board Approved Budgets	$ 236,830,161	$ 19,519,918	$ 256,350,079
NSB Approved Budgets	$ 176,000,000	$ 28,400,000	$ 204,400,000
Add Other NSF Funding	8,000,000	0	$ 8,000,000
Total NSB Approved Budgets	$ 184,000,000	$ 28,400,000	$ 212,400,000
Difference Between NSB and Gemini Board Approved Budgets	$ (52,830,161)	$ 8,880,082	$ (43,950,079)
Percent Change	-28.7%	31.3%	-20.7%

* The Managing Organization classifies $18.8 million of the $52.8 million to be upgrades, chargeable to the operations instrument development fund.

OIG Estimate of Unauthorized Transfer

As of June 28, 2000, NSF has obligated $29.1 million from the R&RA account for Gemini Operations. The following table represents the difference between the amounts requested each year in NSF's budget request[1] to the Congress and the amounts actually obligated during the year.

Fiscal Year	R&RA Budget Request	Actual R&RA Obligations	Difference
1996	$ -	$ 3,817,444	$ 3,817,444
1997	5,100,000	5,317,444	217,444
1998	6,260,000	5,715,469	(544,531)
1999	6,980,000	8,030,000	1,050,000
2000	7,250,000	6,216,313	(1,033,687)
	$ 25,590,000	$ 29,096,670	$ 3,506,670

As shown in Appendix C, we have estimated true Operations ramp-up costs as $19.5 million. Because NSF's share of Gemini Operations costs is fifty percent, we have calculated $9.8 million of R&RA funds that should have been obligated from the MRE account.

Operations Ramp-Up Costs (see Appendix C)	$ 19,519,918
NSF Share (50%)	$ 9,759,959

Based on these amounts, we have estimated the amount of R&RA funds that were used to cover excess Construction and Commissioning costs – the unauthorized transfer amount – as $19.3 million. This represents the difference between the amount that NSF actually obligated from R&RA for Operations and the amount it should have obligated from R&RA for Operations.

Actual R&RA Obligations	NSF Share of True Operations	Difference (Transfer)
$ 29,096,670	$ 9,759,959	$ 19,336,711

[1] These amounts have not been adjusted based on the current plan submitted with each new budget request. Thus, the FY 1996 amount is the amount shown in the FY 1996 budget request, not the FY 1996 amount reflected as the current plan in the FY 1997 budget request.

Timeline of Gemini Board Decisions

Gemini Board Approval Dates	Description	Reference
1992	**Transition of Commissioning to Operations**—to ease the transition to operations and minimize commissioning costs, the project planned to ramp up operations personnel early.	Gemini Implementation Plan 10/92
1993	**Construction Personnel**—Some construction personnel would be identified to operations. **Commissioning**—All commissioning costs would be identified to operations.	Gemini Plan for Operations 4/93
1995	**Instrument Completion**—The project recommended that operations funds be used to complete the initial planned instruments because the construction budget was insufficient.	Recommended to Gemini Board by Project Scientist, accepted, 11/95
1995	**Integration and Test**—System integration and test costs were planned as part of operations. **Base Facilities**—Funding needed to construct the Hilo base facility was identified as operations.	[redacted], Project Engineer presented to Science Committee on 8/95, later approved at 11/95 Gemini Board meeting.
1996	**Test Equipment**—Was to be identified to operations beginning in 1997. **Communications**—These costs, such as computer/video links and network upgrades, were identified to operations.	Accepted by Gemini Board, 11/95 based on updated presentation by [redacted], Project Engineer.
1999	**Contingency for Rework**—An amount of $2 million was identified to the Facilities Development Fund, an operations fund.	Recommended to and accepted by the Gemini Board at the May 1999 meeting.

Agency's Response

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

MEMORANDUM OCT 19 2000

To: [redacted]
Office of Inspector General

From: [redacted]
Directorate for Mathematical and Physical Sciences

[redacted]
Office of Budget, Finance and Award Management

Subject: Draft Audit of the Financial Management of the Gemini Project

Thank you for the opportunity to review and comment on the draft audit of the financial management of the Gemini Project. We appreciate the time you have allowed us to prepare a thorough response, and would like to thank your staff for providing their worksheets and other analyses. Our reply, below, follows the structure of the draft report. We offer comments on sections of the report, and provide responses to the recommendations. We would be happy to share the more detailed underlying work, and to discuss our response with you.

1. Executive Summary

The OIG draft report on the Gemini Project represents a considerable effort to examine one of the National Science Foundation's largest, most complex projects. Such efforts are important to all of us as we seek to ensure the success of projects and full accountability for their execution.

We believe that Gemini is a remarkable achievement on several counts. Development of the telescopes has been a challenging, innovative and promising undertaking. The Project has worked to stay at the forefront as science and technology have continued to evolve – this is exceptional science, with the potential for exciting discoveries. New ground has also been broken in international cooperation. The Project reflects enormous efforts in uncharted waters to make a complicated international partnership work – balancing different national interests and conditions, and reconciling different national laws. We believe that NSF, as Executive Agency for the Gemini Project, has earned the trust and faith of our partners. Finally, the funding boundaries for delivery of a suite of capabilities to meet the Gemini science requirements have brought both challenge and discipline to the Project.

The OIG report on Gemini includes financial and legal analyses, and management recommendations. With respect to the analyses of costs and appropriations law, we differ with some of the interpretations in the draft report. With respect to the recommendations, we believe they include many positive suggestions to strengthen the management and oversight of large projects.

We are pleased that the report acknowledges the challenges met by the international project, and demonstrates that all funds have been devoted to the development and use of the Gemini telescopes. While there have been some additional costs, we do not believe that any costs have been misstated or misassigned. Our differences with the draft report's assignment of costs, between construction and operations, are judgments based on the characteristics of this type of scientific project and on the authority of the Gemini Board under the Gemini International Agreement (GIA) signed by the international partners. These judgements, however, do not foreclose a different characterization of costs, based on commonly understood notions of construction versus operations rather than appropriations accounting, if

that seems useful for management or for public understanding of the one-time and on-going expenses of the Gemini facility.

The Foundation also believes that its allocation of costs between its Major Research Equipment (MRE) and Research and Related Activities (R&RA) appropriations was within its discretion under the guiding principles of Federal appropriations law, but respects the concerns expressed in the report as to possible improper augmentation of the former account. Consequently, NSF will seek to have language included in future MRE appropriations to clarify that funds from other sources might be used to supplement those in that appropriation.

In early August 2000,the National Science Board (NSB) reviewed and approved the additional funding authority required for the Gemini Project.[1] A proposal for renewal of the cooperative agreement for management of the Gemini Project (through 2005) is currently undergoing review, and there will be an independent examination of the Project's cash plan for future operations. In addition, the Gemini Board will continue to assess the partners' abilities to meet commitments.

The management of large projects has been a focus of attention in the Foundation's Senior Management Integration Group (SMIG), special NSF staff working groups on large infrastructure projects, and the internal Management Controls Committee. Such examination reflects our commitment to be proactive in ensuring that our policies and practices continue to serve us well. Several of the draft report's management recommendations touch on issues that the Foundation has addressed or for which it has active efforts underway. We are examining a range of options for improvements, and intend to move vigorously to ensure that all concerns are addressed.

2. Operations Funds Used to Cover Construction and Commissioning Costs

The Gemini 8-Meter Telescopes Project involves the funding agencies of seven countries. These agencies are signatories to the Gemini International Agreement. The Agreement was reviewed and approved within NSF and by the Department of State before it was signed by the NSF Director, originally in 1993 and as amended in 1994 and 1998. It governs the conduct of the Project.

The GIA establishes the Gemini Board as a regulatory and management body with overall budgetary and policy control over the Gemini Project. The Board determines the duration of construction and commissioning of the Gemini facilities and the apportionment of costs between construction and commissioning and operations where these costs could overlap. The Board is also responsible for reviewing and approving plans for the use of the development funds for instruments and facilities. An Instrument Development Fund provides for instruments and their supporting systems to augment, upgrade or replace those provided as part of construction. A Facilities Development Fund provides an improvement program for the Gemini Telescopes and their support systems.

While the Gemini Board is the management structure established by the partner countries to carry out this Project, it is important to note that the Board has no legal status. It is, instead, the steering group for the Gemini partner agencies. While the Board approves the annual budget for the Project, such approval does not bind the agencies to provide the funds. It is rather a recommendation to each of the agencies that the budget is reasonable and programmatically justified, and a further statement that the partner agency representatives have mutually agreed to use their best efforts to provide their respective shares.

With the above understanding of the Gemini Project as our starting point, we offer comments on the draft report's discussion of construction, commissioning and operations costs.

[1]Memorandum to NSB, NSB-00-141. Approved August 3, 2000; Preliminary Report of the August 2-3, 2000 Meeting, NSB-00-160.

OIG Report: Construction and Commissioning Costs Exceed Budget; Operations Budget Used to Cover Additional Costs (pp. 9-12)

NSF Comments:

The draft report provides a description of construction and commissioning costs in Chapter 2, with a list of individual component costs in Appendix B. We believe that the items interpreted by the OIG as construction and commissioning costs are appropriately categorized as operations costs for the Gemini Project. We do not agree with the estimated projection that construction and commissioning costs will exceed the approved budget by $52.8 million.

A point-by-point comparison of our analysis, with the analysis in the draft report Appendix B, is provided in an attachment to this memorandum (Attachment A). Our analysis is based on our understanding of the GIA Annex A: Project Description, which represents the agreement among the international partners on what is to be accomplished by the Project. In brief, we believe that the costs cited in the OIG report represent added capabilities not in the GIA, upgrades to base systems, continuing operational costs, or other operational expenses. We offer some comments below on points in the OIG report (pp. 11-12):

$ 8 million	Instruments: Our categorization of these costs as operations is consistent with plans for the Instrument Development Fund to provide for instruments and their supporting systems to augment, upgrade or replace those provided as part of construction. For example, the Mid-Infrared Imager is not contained in GIA Annex A and is the type of new instrument that the IDF was established to handle in operations.
$20.1 million	Facilities: Our categorization of these costs as operations is consistent with plans for the Facilities Development Fund improvement program for the Gemini Telescopes and their support systems. For example, the Laser Beacon Adaptive Optics System South ($12.5 million) was not part of Annex A, and is still in the planning stages. It has not yet been approved by the Gemini Board, nor have any funds been disbursed.
$ 4.4 million	Hilo Base Level Headquarters: Use of U.S. operations funds to cover the unexpected cost for this operations base (when the University of Hawaii was unable to) was discussed with the Appropriations committees. It was not included in the construction budget.
$ 1.5 million	Chile Base Level Headquarters: While Annex A provides for the construction of office space in La Serena, a more extensive building would provide laboratory, meeting, and operations space -- an enhancement to the Project, enabled by the Australian contribution. This has not yet been approved by the Gemini Board, nor have any funds been disbursed.
$17.5 million	Integration, Test and Commissioning Costs: Inclusion of an integration, test, and commissioning item in the operations budget has been part of the Gemini Board - approved project implementation plan since 1995. In particular, use of operations funds from the R&RA account to support a phased build-up of staff to assist in integration and commissioning of the telescope, and eventually to assume operational responsibility, was explicit in the NSF FY1997 budget request and was accepted by Congress in their appropriation of these funds.
$ 1.3 million	These funds provide increased bandwidth from Cerro Pachon to La Serena (and ultimately to the Chilean research network) to enhance operations, jointly funded by CISE and MPS. They also include a supplement from NSF's Intellectual Infrastructure Funds to provide high-performance connection for enhanced operational capabilities between Gemini North and the mainland.
$52.8 million	

OIG Report: Impact of Using Two Budgets - Inflated Operations Budget (pp. 12-13)

NSF Comments:

The draft report suggests that operations costs have been inflated to cover construction and commissioning costs, and that the majority of the Gemini Board-approved operations budget for 1996-2000 was related to construction and commissioning rather than operations.[2] The report notes total NSF R&RA obligations of $29.1 million, and develops an estimate that $19.3 million of these obligations, in the OIG's opinion, should have been MRE obligations. It appears that the figure of $19.3 million is derived indirectly, based on an attribution of construction and commissioning costs and other calculations.

In comparison, our analysis approaches the issue of operations costs more directly, by examining specific funding actions. We examined Gemini R&RA obligations from FY 1996 through August 3, 2000. These obligations, made through twelve amendments to the Gemini cooperative agreement, account for the $29.1 million R&RA obligations cited in the draft report. Using this approach, we believe that the $29.1 million are properly considered Gemini operations costs, and appropriately charged to R&RA. Details of our analysis are provided in an attachment to this memorandum (Attachment B).

OIG Report: Impact of Using Two Budgets - NSF May be in Noncompliance with US Appropriations Law (pp. 13-16)

NSF Comments:

The Foundation believes that its allocation of costs between its Major Research Equipment and Research and Related Activities appropriations was within its discretion under the guiding principles of Federal appropriations law, but respects the concerns expressed by the Office of Inspector General as to possible improper augmentation of the former account. Consequently, NSF will seek to have language included in future MRE appropriations to clarify that funds from other sources might be used to supplement those in that appropriation.

OIG Report: Lack of Planning and Policies - Budgets Were Unrealistic to Meet Scientific Needs (pp. 17-19)

NSF Comments:

The draft report suggests that Gemini Project cost estimates were unrealistic from the outset. We believe the original estimate of $176 million was valid when adopted in 1991. As the Project progressed, it was de-scoped to stay within budget yet still deliver a suite of capabilities to meet all the essential science requirements. In addition, the construction budget was augmented by $8 million to allow for technical enhancements, additional staff, and greater contingency funds. This brought the total for construction and commissioning to $184 million.

The GIA Annex A - Project Description represents the agreement among the international partners on what is to be accomplished by the Project. We provide an annotated listing of Annex A (Attachment C). This listing details what will be delivered, on both sites, by the end of 2000; a brief description of the status of each item; and notations on any differences from the descriptions in Annex A. We believe this demonstrates that the Project is providing the suite of capabilities called for in Annex A to the original agreement, for $184 million.

[2] We suggest that draft report's footnote 8, on Administrative Guidelines addressing Gemini Board approval of operations budgets (p. 13), note that the signature of the guidelines was appropriate to the authority of an NSF Level IV Grants and Agreements Officer, and that the guidelines were signed by counterpart officers at the Particle Physics and Astronomy Research Council of the U.K. and the National Research Council of Canada in lieu of signatures by their Directors.

OIG Report: Lack of Planning and Policies - NSF Needs Improved Controls and Processes (pp.19 – 22)

NSF Comments:

The draft report discusses a need for earlier involvement of senior NSF management and the NSB regarding increased costs. It also expresses concerns about guidelines for the MRE account.

With respect to Project costs, since the 1995 NSB approval of $204.4 million for the Gemini Project there have been four additions to the budget, totaling $31.3 million:

$ 8 million	Added to the original construction budget of $176 million, for a new total of $184 million. The National Science Board Committee on Programs and Plans was informed of this increase in February and August 1997.[3] An amendment to the GIA to add this amount was signed by the NSF Director in April 1998. This amount provided for added capabilities not in the original budget, a replenished contingency, and additional staff for integration and commissioning.
$11.4 million	Additional capital and operations funding contributed since Australia joined the partnership in 1998. The Australian funding is being used for such things as to implement adaptive optics on the Cerro Pachon telescope and to enable the telescopes to be used during twilight, increasing the amount of observing time available. These additions extend the scope of the Project. The possible addition of Australia to the Gemini Partnership was discussed with the NSB CPP at its August 1997 meeting, in the context of possible Chilean default.[4]
$ 4.4 million	The Gemini Partnership provided additional funding for an operations building in Hilo, Hawaii, that the University of Hawaii was unable to provide.
$ 7.5 million	Increase in operations expenditures (total from 1996-2000) over the original cost models of 1995, resulting from actual implementation of operations. The ramp-up of operations showed that operations costs in both Hawaii and Chile were significantly more than originally thought. Relocation costs were high and salaries had to be higher to compensate staff for living in remote locations, a common occurrence in projects of this kind. Also included here are a number of items such as high priority upgrades to baseline instruments that were deferred in construction in order to be certain that the telescopes could be delivered within $184 million.
$31.3 million	

These components bring the projected expenditure (construction and operations) by the Gemini partnership to $235.7 million through the end of CY 2000. Funding actions through July 2000 were consistent with the authority approved by the NSB in 1995, within the Director's additional discretionary authority as delegated.[5]

[3] Memoranda of Discussion, NSB Committee on Programs and Plans (NSB/CPP-97-3; NSB/CPP-97-13; presentation viewgraphs, CPP files.)

[4] NSB/CPP-97-13. Discussed in the context of Australia picking up Chilean share in case of default, or with opportunity for Australians to join the project should the Chilean share be paid. This latter opportunity was the eventual outcome, with agreement from the NSF Office of the Director that the addition of Australia would be for accelerating the instrumentation program and enhancing scientific productivity of the telescopes. (Decision Memorandum to NSF Director, November 21, 1997.)

[5] Delegated discretionary authority most recently stated in NSB-99-112.

On August 3, 2000, the NSB reviewed and approved the additional funding authority now required for the Gemini Project, and an extension of the current cooperative agreement.[6] This extension allows an orderly transition to a new agreement and appropriate closeout of all construction expenses. In addition to the costs cited above, authority of $7.1 million was included in the recent NSB approval to provide funding during the transition period. (The U.S. share is included in the FY 2001 budget request Congress.) Thus the total budget authority for the Gemini Project now approved by the NSB is $242.8 million. This total is cited in the draft OIG report as the Gemini Board-approved budget (p.21).

With respect to the draft report's discussion of the MRE account and MRE guidelines, we offer some comments for clarification:

- The Gemini Project bridges the R&RA and MRE accounts. It pre-dates the MRE account, having originated in the MPS Directorate's budget subactivity for Major Research Equipment in FY 1991 (R&RA). The Project then became part of the newly-established MRE account in FY 1995. We have summarized the NSF account history for Gemini, through August 3, 2000, as follows (details in Attachment D):

R&RA FY 91- FY 94	$ 47 million	(pre MRE)
MRE FY 95 - FY 98	$ 45 million	
Subtotal	$ 92 million	
R&RA FY 96- FY 00 (August 3)	$ 29 million	
Total NSF funding	$121 million	

  The subtotal for R&RA (pre MRE) and MRE of $92 million represents the NSF share of the $184 million for construction and commissioning. The additional $29 million obligated in R&RA, as discussed earlier, is for operations costs.

- For completeness of the record, we note that there have been guidelines for the MRE account from its beginning, which have been widely available to NSF staff involved with the planning and implementation of MRE projects.[7] The most recent draft Interim Guidelines for Planning and Managing Major Research Equipment Account Projects have been included in the revised *Proposal and Award Manual* (PAM).

- Regarding the draft Interim Guidelines, the discussion of intra-agency cost sharing was not written with the intent to advocate use of R&RA funds to supplement MRE. The plans for cost sharing by Directorates are developed prior to the budget request, so that funds are requested, appropriated and obligated in the appropriate account. The draft Interim Guidelines (and prior versions of the guidelines) do state that any additional costs will not be funded through MRE -- so additional funding would be requested, appropriated and obligated through R&RA.

We agree that NSF management controls and processes could be improved. As the discussion above illustrates, there had been no formal discussion of the Gemini Project with the NSB since 1997, until the August 2000 meeting. Also, guidelines for the MRE account have been and continue to be the focus of attention. More broadly, facilities management and oversight have been recognized as a management

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[6]Memorandum to NSB, NSB-00-141; Preliminary Report of the August 2-3, 2000 Meeting, NSB-00-160. The current Cooperative Agreement between AURA and the NSF ends on December 31, 2000. A proposal from AURA for the next five years of operations of the Gemini Telescopes (January 1, 2001 – December 31, 2005) is currently under review by the Partnership.

[7] Initial guidelines, "Criteria and Implementation Procedures for the Major Research Equipment (MRE) Account," were distributed through Staff Memorandum O/D 94-29, November 28, 1994. They were revised and distributed through a memorandum to the Director's Policy Group June 6, 1997. The current "Draft Interim Guidelines for Planning and Managing Major Research Equipment Account Projects" were available April 20, 2000. These draft guidelines were discussed with the NSB Committee on Programs and Plans at its May 2000 meeting (NSB-00-92).

challenge, as has the need for up-to-date guidance in the PAM.[8] In the section below on Conclusions and Recommendations, we outline actions already taken, efforts underway, and possible approaches to additional changes.

OIG Report: Conclusions and Recommendations (pp. 23-24)

The draft report points out several areas for Foundation-wide improvement. NSF plans to develop improved policies and procedures for managing large capital infrastructure projects, and the management recommendations in the report provide valuable suggestions.

The draft report makes several specific recommendations to the Assistant Director of the Mathematical and Physical Sciences Directorate, and Acting Director of the Office of Budget, Finance and Award Management and Chief Financial Officer. Our responses are provided below.

- *OIG Recommendation: Notify the NSF Director and NSB that the Gemini Project has exceeded its authorized Construction and Commissioning budget.*

NSF Response:

We believe that the Gemini Project is providing the suite of capabilities described in the GIA (Annex A – Project Description) for the cost of $184 million, and that obligations remained within the limit authorized by the NSB in 1995 with the additional delegated authority. Our disagreements with the report's assignment of costs -- between construction, commissioning and operations -- are judgments based on the characteristics of this type of scientific project and on the authority of the Gemini Board to assign costs. The pivotal role of the Gemini Board reflects the agreement among the international partners. We will continue to consider, in future international agreements for major projects, the most appropriate balance of shared authority and responsibility in NSF's partnership role. Nonetheless, clearer guidelines for the communication of the changing conditions of such projects will help to avoid many of the concerns expressed in the OIG draft report.

There have been additions to the budget for the Gemini Project, and additional funding authority has now been sought and approved. When the NSB reviewed and approved the additional funding required for the Gemini Project, in August 2000, it was also notified that a proposal for renewal of the cooperative agreement for management and future operations of the Gemini Project is currently undergoing review. It is anticipated that a proposed award action on management and operations of the Project will be brought to the NSB for consideration in December 2000.

- *OIG Recommendation: Work with NSF's General Counsel to take the appropriate steps to address the potential legal issues, including addressing the need to reclassify $19.3 million in R&RA costs to the MRE appropriation account and/or seek Congressional authority to transfer R&RA funds to the MRE account or obtain additional MRE funds.*

NSF Response:

The Foundation's General Counsel advised that there is no need to reclassify spending, but recommended that NSF seek legislative clarification of the Foundation's authority to supplement MRE spending with funds from other sources. The Foundation will submit such clarifying language in our next budget request.

The draft report also makes specific recommendations to NSF's Acting Director of the Office of Budget, Finance and Award Management and Chief Financial Officer:

[8] FY 1998 Review: Management Challenges. Memorandum to the NSF Director from the Chair, Internal Controls Committee (December 22, 1998).

- *OIG Recommendation: Issue compliance guidelines for managing MRE projects that, at a minimum, (1) provide clear definitions and criteria for the costs to be covered by the MRE account, (2) establish processes for ensuring realistic project cost estimates, including contingencies for unanticipated costs, (3) provide guidance consistent with appropriate law requirements for handling intra-agency cost sharing, and (4) identify NSF's expectations and standards for good project management including guidance for how projects will be monitored, accountability for tracking the project's cost, schedule, and technical performance, and methods for addressing problems such as cost overruns, schedule delays and changes in the technical scope of work.*

NSF Response:

We plan to provide more complete details in our policies and procedures for managing large capital and infrastructure projects. MRE guidelines, first implemented when the account was initiated in 1995, have continued to evolve. Many of the issues identified in the draft report have been a focus of NSF-wide discussion.

In June 1998 the Foundation's Senior Management Integration Group (SMIG) chartered a cross-agency group to draft new guidelines for planning and managing large projects. The group included senior NSF staff who had experience in planning and managing large infrastructure projects. The report of the drafting group was presented to SMIG in December 1999, and formed the basis for the current draft Interim Guidelines for Planning and Managing Major Research Equipment Account Projects.

The draft Interim Guidelines begin to address several points called out in the recommendations. The Guidelines include a new working definition of MRE projects and the costs to be covered by MRE; they reinforce the requirement for independently confirmed cost estimates including contingencies; and they include a new appendix with a management plan developed for major research equipment, replacing the old management plan developed for research programs.

In transmitting the draft Interim Guidelines to the NSB for discussion in May 2000, the Director noted the complex task of developing definitions and guidelines for the MRE account as the concept of research tools continues to evolve.[9] The transmittal memorandum also noted the intention to use the guidelines over the next year, as more is learned about new MRE issues. Then a more final set of definitions, guidelines and practices will be developed. The recommendations of the draft OIG report will be incorporated into this effort. (The intent of the Guidelines' provisions for intra-agency cost sharing is consistent with appropriation law; the language will be clarified.)

While we believe that it is most appropriate for MRE guidelines to continue to be issued by the Director and the Chief Operating Officer, BFA will willingly take a key role in refining the draft Interim MRE guidelines, as it has in the past, with participation across the agency. Such guidelines, once finalized, could then be the basis for developing guidelines more broadly applicable to all large infrastructure projects. BFA has already taken the step of including the draft Interim MRE Guidelines into the revised *Proposal and Award Manual* (PAM). BFA also plans to develop a stand-alone PAM chapter stipulating good management practices for large projects.

- *OIG Recommendation: Update current policies and procedures with respect to award management to recognize the need for a more extensive and higher level of oversight for MRE project awards. As part of this process, NSF should consider revising its current delegation of authority to require notification to the NSF Director and the NSB when MRE project costs exceed authorized funding levels.*

[9] NSB-00-92

NSF Response:

We will continue to explore ways for more extensive and higher level of oversight for MRE project awards. The draft Interim Guidelines for MRE provide for a comprehensive yearly review of MRE projects by the special internal MRE Panel, chaired by the Chief Operating Officer and comprised of the Assistant Directors, research program Office Heads, and the Chief Financial Officer. Results of this review are reported to the NSB Committee on Programs and Plans. We will develop more specific guidance on what should be covered in this review.

Regarding the current NSF policy on Delegation of Authority for large projects, we have taken steps to ensure that the Office of the Director is aware when this authority is being used. Currently, NSF staff, including Grants and Agreements Officers, have a Delegation of Authority that allows the award of additional funding for NSB-approved awards, up to $10 million or 20% of the NSB-approved amount, whichever is less. This policy was followed with the Gemini award, with additional funding authority sought at the time the increased limits under the Delegation had been reached. As an initial step toward earlier involvement of higher levels of management, and increased oversight, the PAM now includes provisions for notification of the Director prior to proceeding with the funding increases allowed under Delegation of Authority.

In addition, we have identified other existing awards that may go above the NSB approved limit into the discretionary authority range, and have requested that the cognizant Program Managers provide to the Office of the Director a notification outlining the circumstances under which the NSB limit has been or will be exceeded. We will also examine ways to put a system in place to check award size, and alert programs to notify the Director before exceeding the NSB approved limit.

- *OIG Recommendation: Provide training to all NSF staff engaged in MRE projects on the fund control and project management procedures necessary to effectively manage these programs, including compliance oversight procedures.*

NSF Response:

NSF makes awards primarily to organizations representing the academic community to undertake management and operations of laboratories and facilities. We agree that it is very important that trained and skilled NSF staff be involved in the general oversight of these projects. We also believe the education of our awardees about their responsibilities can be helpful. Currently, the BFA staff who are involved in these projects have background in large project management -- both training and actual job experience. However, there is a need to formalize clear Foundation-wide guidance and procedures for administering such projects. BFA has assigned an experienced senior Grants and Agreements Officer to begin to develop such guidelines. In addition, the BFA Senior Advisor for Management, Operations and Policy is developing an overview of compliance principles, which at a minimum will be used to develop modules for both external and internal outreach and training.

We believe it is important to provide more training to all NSF staff who are engaged in planning and managing large projects. This task goes beyond any single organization within NSF, and we will work with appropriate offices across the agency, at all levels, to help ensure proper training -- including training on the functions of the MRE and R&RA accounts. We also believe there continues to be a critical need for more resources in the form of permanent FTE's with project management experience, training and travel funds in order to strengthen the management of large infrastructure projects. We will continue to seek these resources.

The decentralized nature of NSF's current organizational structure does not readily lend itself to having a cadre of qualified managers for large projects. We will examine a range of options for more efficient and effective approaches, ranging from a facilities planning and management function across BFA grants and contracting activities, to a central organization within NSF for managing such endeavors.

3. Partners Encounter Difficulties Meeting Agreed Contributions to Operations

OIG Report: *Partner Contributions Vary Significantly from GIA*
NSF Provides Contributions to Meet Shortfalls
NSF Needs Realistic Cash Plan for Operations
(pp.25-29)

NSF Comments:

We believe that the Gemini Project has broken new ground in scientific cooperation. Establishing the unprecedented international partnership was an enormous challenge, bridging different national interests and conditions. We note that an alternative to what has developed over the past decade might have been a U.S.-only project at much higher cost, or a failed international partnership. Trust is fundamental to maintaining such a partnership. We believe all partners have acted in good faith, sometimes in the face of unstable and difficult budgetary and larger economic and political circumstances.

The draft report cites concerns about achieving the full percentage funding shares of the Gemini partners. It also raised concerns about shortfalls, and the purchase of future observation time.

We note that the intent for NSF to provide 50% of the funding for Gemini (construction and operations) contains no provisions that this must occur on an annual basis. For example, the original contribution schedule for construction shows NSF payments beginning in 1991, U.K. in 1992, Canada in 1993, Chile not until 1995, and so on.[10] Our partners' payments were not to be completed until 2001. The varying funding profiles of the partner nations have a large effect on the annual percentage composition of the funding. When Congress appropriated the lump-sum balance ($41 million) of the U.S. payment in 1995, the NSF was immediately put in the position of having paid 77% of the cumulative contributions by that year and was still at 53% of the cumulative total in 1999. By 2001 we expect the U.S. to be at 50% for construction.

The current operations budget planning through 2005 shows that at the end of this period NSF's share will be 50%. This payment schedule was approved by the Gemini Board and represents a commitment on the part of our partners. This approach is appropriate under the GIA and has been part of NSF planning since the inception of operations payments.[11]

We agree that there needs to be a five-year operations plan, and such a plan is under review in the consideration of the AURA proposal for renewal of the cooperative agreement to manage Gemini. An assessment of partners' abilities to meet commitments is part of the fiscal planning of the partnership.

With respect to the purchase of future observation time, we believe that this has allowed the Project to sustain the participation of valued partners having difficulty with full contributions. In exchange for telescope time, partners continue to play a role in the project. The availability of this option helps to provide a stable operating environment for Gemini. It is also an investment of significant benefit to the U.S. user community. The NSF purchase of additional observing time was recommended by the U.S. Gemini Science Advisory Committee, as a way to maintain strong scientific ties with partners while also addressing a need for increased U.S. telescope time in the face of greatly oversubscribed excellent proposals.[12]

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[10] Annex F to the Gemini International Agreement

[11] This approach was discussed with the NSF Office of the General Counsel; e-mail record January 29-30, 1996.

[12] Letter from Chair, U.S. Gemini Science Advisory Committee to Division Director, NSF Division of Astronomical Sciences, April 12, 1999.

OIG Report: Several Factors Affected Partner Contributions (pp. 26-27)

NSF Comments:

We believe all partners have acted in good faith. In the face of difficult economic and political circumstances, timely partner contributions have sometimes been a challenge. We have extensive files of correspondence and briefings concerning payment and other issues, and efforts to deal with them as the partnership and project matured.[13]

For example, due to the special nature of Chile as the host country for Gemini South (and because of our long-standing, excellent relationship where the Cerro Tololo operations associated with NOAO are concerned), special care has been taken to make every effort to reach amicable solutions to difficult issues. However, even in the case of Chile, the situation eventually resulted in a joint demarche by the U.S., U.K., Canadian, Brazilian, and Argentine Embassies to the Foreign Minister of Chile. We believe that we have made reasonable and timely responses to these difficult issues.

OIG Conclusions and Recommendations (p.30)

The draft report makes several recommendations to NSF's Assistant Director of the Mathematical and Physical Sciences Directorate, and Acting Director of the Office of Budget, Finance and Award Management and Chief Financial Officer, representing the Executive Agency. Our response is provided below:

- *OIG Recommendation: Release to the Project as U.S. contributions the $3.7 million in funds currently held in reserve.*

NSF Response:

These funds offset advanced operations funding provided by NSF when partner contributions were delayed. The funds will reduce NSF's future operations budget obligations. This approach to operations is consistent with the GIA.[14] A plan for such adjustment of payments is built into the Project budget approved each year by the Gemini Board. MPS and BFA will consider the OIG recommendation in light of the projected operations budgets for the next five years.

- *OIG Recommendations: Work with the Gemini Board to ensure that a realistic assessment is conducted of each partner's ability to meet its percentage share commitment and develop a five-year plan for operations for 2001-2005. Safeguards established to meet cash shortfalls should spread the risk of meeting cash shortfalls equitably among the partners, and not rely primarily on NSF.*

NSF Response:

A five-year operations plan is under review in the consideration of the AURA proposal for renewal of the cooperative agreement to manage Gemini. During this review the projected budget will receive an independent examination, external to NSF and to Gemini, in order to establish its credibility. Assessment of partners' abilities to meet commitments is part of the fiscal planning of the partnership. The Gemini Board has expressed resolve to enact the provisions of the GIA regarding default. NSF participates in these discussions through its Board members.

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[13] NSF Division of Astronomical Sciences Gemini files, including documents of the NSF Office of the Director; Assistant Director, MPS; Department of State.

[14] This approach was discussed with the NSF Office of the General Counsel; e-mail record January 29-30, 1996.

We agree that the risk should not fall primarily on NSF, although we note that the U.S. is the primary partner in the Project, and, as such, carries a heavier responsibility than the other partner countries. We also believe that NSF, as the Executive Agency for the partnership, must show financial, diplomatic, and scientific leadership.

- *OIG Recommendation: To the extent that this plan indicates funding shortfalls on the part of some countries, the NSF may wish to seek the approval necessary to exceed the fifty percent funding cap.*

NSF Response:

We believe that NSF's 50% share of operations is a clear intent, although not necessarily a formal or legal cap. We agree that any actions that would increase NSF's share should be carefully reviewed, including appropriate notifications and discussions. For example, this path was explored within NSF at the time of the possible Chilean default. The decision at that time was to continue the 50% approach. Should another emergency arise, this path will be examined again.

cc: [redacted]

Attachments:

A: Analysis of OIG Estimate of Construction and Commissioning Costs
B: Analysis of R&RA Funding through Amendments to Gemini Cooperative Agreement
C: Annotated List of Gemini International Agreement - Annex A: Project Description
D: Gemini Project Funding FY 1991 – FY 2000 (August 3, 2000)

Attachment A

Analysis of OIG Estimate of Construction and Commissioning Costs

Analysis of OIG Estimate of Construction & Commissioning Costs

	OIG Draft Audit	NSF Analysis				
Description	**Construction & Commissioning Costs**	**Added Capability not in GIA**	**Upgrade to Base System in GIA**	**Continuing Operational Costs**	**Other Operations Expenses**	**Summary of Detailed Notes**
a) Instrument Development Fund (IDF)						
Gemini Multi-Object Spectrograph (GMOS)	875,000	875,000				Addition of Integral Field Unit
Small Gemini Multi-Object Spectrograph (GMOS)	99,000	99,000				Spares for operation
Near Infrared Arrays	500,449			500,449		Detector arrays continually upgraded in astronomy research
Near Infrared Spectrograph (NIRS)	607,227		607,227			Enhancements for use in shorter red wavelengths
Near Infrared Spectrograph IFU (NIRS)	354,340		354,340			Fiber optic bundle to produce data cube - new technology
Polarization Modulater	677,000	677,000				Enhancement enabled by improved calibration, measurement techniques
Near Infrared Arrays (OIWFS)	250,000		250,000			Technological advances in wave front sensing instruments
Near Infrared Arrays (OIWFS)	39,000		39,000			Smaller arrays not available when GIA written
Near Infrared Imager (GRISMS)	90,571		90,571			Added optical element for low resolution spectrum
Mid Infrared Imager (TRECS)	1,258,000			1,258,000		Next generation instrument
High Resolution Optical Spectrograph (HROS)	3,175,000		3,175,000			Conceptual design only contained in construction
Flamingo Visitor Instrument Support	100,000				100,000	Temporary operations for another organization's equipment
Subtotal IDF	**$8,025,587**					
b) Facilities Development Fund (FDF)						
La Serena Lab	35,775				35,775	Lab at base saves costs; technology allows remote control
Calibration Unit	521,000	521,000				Common calibration unit for more reliable data comparison
Array and Controller Development (ALTAIR)	2,312,231			2,312,231		Detector arrays continually upgraded in astronomy research
Rework Contingency	1,847,141				1,847,141	Classification of rework as operations consistent with GIA
Adaptive Optics Upgrade	2,399,999 NIS		2,399,999			Upgrade to use sodium laser guide star
Adaptive Optics System North (ALTAIR)	300,000		300,000			Design change to use new technology
Laser Beacon Adaptive Optics System South	12,539,512 NIS	12,539,512				In planning stage; not yet approved by Gemini Board
Visitor Instrumentation Support (HOKUPPA)	100,000				100,000	Temporary operations for another organization's equipment
Subtotal FDF	**$20,055,658**					
Other Items						
c) Hilo Base Facility	4,382,000 NIS				4,382,000	Funded through R&RA as Operations, with Congressional agreement
d) Southern Base Facility	1,500,000 NIS	1,500,000				Not included in original scope with lab facilities
e) Other - Internet Connection	1,300,000 NIS	1,300,000				Funded by CISE, Intellectual Infrastructure Funds, MPS
f) Integration and Test Commissioning	17,566,892			17,566,892		Includes labor buildup costs for technical staff
Subtotal Other Items	**$24,748,892**					
Total Gemini Operations Funds Identified by OIG as Construction and Commissioning	**$52,830,137**	**$17,511,512**	**$7,216,137**	**$21,637,572**	**$6,464,916**	
					$52,830,137	

NIS - Not in Scope: The OIG Audit Report noted that these expenditures were not included within scope of the original agreement.

Attachment B

Analysis of R&RA Funding through Amendments to Gemini Cooperative Agreement

Amendments to Gemini Cooperative Agreement (AST-9414257) Funded through R&RA

Proposal	Amend #	Date	Dollars	Purpose
AST-9641662	7	5/20/96	$217,444	Near Infrared Imager - critical component of the auxiliary instrumentation required to commission and debug the telescope $652,331 over three years - work package to University of Hawaii
AST-9643474	8	9/9/96	$3,600,000	"These funds are provided in support of Gemini Operations and AURA shall account for these funds separately from the Gemini construction funds." Hilo sea level facility previously intended to be funded by the University of Hawaii. Initially assumed that rent would be charged to operations account. emails indicate OLPA staff discussed this w/ Senate & House staffers See also the NSF Director memo to the Appropriations Committee 9/5/96.
AST-9741512	11	6/3/97	$5,100,000	These funds are provided in support of operations of the Gemini project $250,000 for a spare secondary mirror - design, analysis and tests appropriate to charge to operations
AST-9742745	12	7/11/97	$217,444	Near Infrared Imager - 2nd increment to U of Hawaii (amendment 7)
AST-9842032	18	5/29/98	$5,417,469	Funding includes $5,100,000 for Operations, $217,444 for 3rd year of Near Infrared Imager, and $100,025 for the Mid Infrared Imager (year one of three) Diary note states - In addition to the contribution for Operations, funds excess costs of US workpackages for NIRI and MIRI instruments.
AST-9842917	20	9/10/98	$298,000	Funds provided in support of Operations for the Gemini 8 Meter Telescope project. Diary note states - This action provides $298,000 from Operations account to be used to accelerate outfitting of the Hilo Base facility with laboratory and instrument support hardware and complete construction of the building.
AST-9940722	27	3/12/99	$6,249,600	These funds are being provided in support of Operations of the Gemini Project. Diary note states - $100,000 for 2nd MIRI installment is included
AST-9941453	28	3/23/99	$600,000	These funds are being provided in support of Operations of the Gemini Project. Supplement to FY 99 base budget from MPS as Intellectual Infrastructure Funds. Provide for capital equipment required to implement high-performance conneti (bandwidth-intensive web and video-conferencing) between Gemini Noth (Hawaii) and the mainland. Cost sharing w/ U of Hawaii to supplement. Provide high speed internet connection for large format cameras and instrumentation.
AST-9942675	35	7/2/99	$850,400	These funds are being provided in support of the MIRI instrument and Operations of the Gemini project. 3rd installment of $100,000 for MIRI.
AST-9941879	37	8/26/99	$350,000	These funds are being provided in support of Operations of the Gemini project. funding is provided as a supplement in response to proposal to connect the NSF owned facility to the high speed network known as vBNS. Gemini South at Cerro Tololo will be connected. Uses ANI funds.
AST-0040573	43	12/28/99	$5,866,313	These funds are provided in support of Operations of the Gemini Project.
AST-0040279	45	3/1/00	$350,000	This amemdment increases the funds available under the cooperative agreement by $350,000 and provides the remainder of funds for FY 2000 for connectivity as specified in Amendment No. 037. These funds are being provided in support of Operations of the Gemini Project. Completes funding for Gemin/CTIO connectivity in Chile that was begun with ANI funds.
	Subtotal		$29,116,670	

Attachment C

Annotated List of Gemini International Agreement - Annex A: Project Description

Gemini Agreement Annex A: Project Description

The Gemini Project has as its goal the construction of two 8-meter telescopes. The first will be located on Mauna Kea in Hawaii, and the second will be built in Cerro Pachon in Chile.

At the completion of construction, the Gemini Project will supply the following on Mauna Kea:

Elevation-over-Azimuth telescope with monolithic primary mirror with an 8-meter usable aperture	DONE
Infrared f/16 secondary with tip/tilt and chopping capability	DONE
Low order adaptive Optics system for use in the near infrared	DONE
Imager for 1-5 microns	DONE
Multi-aperture optical spectrograph	IN PROCESS anticipated to be complete at the end of this year
Optical Imager	DONE (acquisition camera)
Cooled grating spectrometer for wavelength range 1-5 microns	IN PROCESS
Rotator and instrument mounting	DONE
Telescope enclosure	DONE
Thermal control system for the enclosure	DONE
Primary mirror handling equipment	DONE
Sputtering plant capable of coating primary mirror	DONE
In-situ system for cleaning of the primary mirror	DONE
Program to develop the method for depositing a protected silver coating on the primary mirror	DONE
Building to house control room and other support facilities	DONE
Dormitory facilities for observers at Hale Pohaku	DONE
Capability for remote observing at sea level in Hawaii	DONE
Computers and software for controlling the telescope and for initial data acquisition	DONE
Realign the road and utilities to the CFHT and to move the UH 24-inch telescope	DONE

("Excluded from the project budget is the cost of the sea level headquarters in Hawaii.")

In Chile the project will provide:

Elevation-over-Azimuth telescope with a monolithic primary mirror with 8-meter usable aperture	DONE
Aluminum coated secondary at f/16 with tip/tilt and chopping capability	DONE
Optical Imager	DONE
Guiding and wavefront sensor at the Cassegrain focus	DONE
Rotator and instrument mounting at the Cassegrain focus	DONE
High resolution optical spectrograph	Design study only funded under construction. Higher scientific priority assigned to second GMOS, enhanced AO capability and thermal IR camera study
Telescope enclosure	DONE
Thermal control system for the enclosure	DONE In addition to the passive ventilation mentioned, the dome includes day time air-conditioning and a complex set of computer controlled vents to draw air through various areas to bring the dome into thermal equilibrium as fast as possible. This includes double walls on the enclosure shell, with insulation on the interior and ventilation through the observing floor.
Primary mirror handling equipment	DONE
Sputtering plant capable of coating the primary mirror with aluminum	DONE
In-situ system for cleaning the primary mirror	DONE
Building to house control room and other support facilities	DONE
Capability for remote observing at sea level in La Serena	DONE
Computers and software for telescope control and data acquisition	DONE
Road to Cerro Pachon	DONE one of the earliest construction needs
Power and water lines to Cerro Pachon	DONE
Construction camp, which can be converted to a small number of bedrooms for use by observers	DONE
Construction of office space in La Serena	IN PROCESS

"It is assumed that, while observers may choose to sleep on Cerro Pachon, primary meal service and additional sleeping quarters will be provided by CTIO, with staff and observers driving daily as needed."

"The base budget includes funds to develop the processes required to deposit protected silver coatings on the primary mirror of the Mauna Kea telescope and to provide a coating chamber that can deposit an aluminum coating (base budget) and can be upgraded to provided (*sic*) the capability for protected silver coatings. The Gemini board (*sic*) has agreed to consider including the upgrade to the coating chamber in the Gemini budget after technical feasibility is established."

- PROCESS DEVELOPMENT UNDER BASE BUDGET WAS SUCCESSFUL
- UPGRADE OF THE COATING CHAMBER WAS INCLUDED IN THE $8 MILLION INCREASE FROM $176 MILLION TO $184 MILLION

Attachment D

Gemini Project Funding FY 1991 – FY 2000 (August 3, 2000)

GEMINI PROJECT FUNDING FY 1991-2000

(August 3, 2000)

Fiscal Year	R&RA Estimate in Congressional Request	R&RA Estimate Revised in Subsequent Year Congressional Request	R&RA Obligations	MRE Request	MRE Appropriations	MRE Obligations	Trust Fund Obligations	Total Obligations
1991	$ 4,000,000	$ 4,000,000	$ 3,815,000	$ -	$ -	$ -	$ -	$ 3,815,000
1992	16,000,000	12,000,000	12,062,785	-	-	-	-	12,062,785
1993	17,000,000	14,000,000	14,000,000	-	-	-	-	14,000,000
1994	17,000,000	17,000,000	17,120,000	-	-	-	16,518,186	33,638,186
Sub Total 1991-1994	**54,000,000**	**47,000,000**	**46,997,785**	**-**	**-**	**-**	**16,518,186**	**63,515,971**
1995	-	-	-	**20,000,000**	**41,000,000**	**41,000,000**	**5,592,005**	**46,592,005**
1996[1]	3,500,000	3,600,000	3,817,444	-	-	-	1,095,000	4,912,444
1997	5,100,000	5,360,000	5,317,444	-	-	-	8,290,635	13,608,079
1998	6,260,000	6,260,000	5,715,469	-	4,000,000	4,000,000	24,669,986	34,385,455
1999	6,980,000	7,130,000	8,050,000	-	-	-	12,607,474	20,657,474
2000[2]	7,250,000	8,050,000	6,216,313	-	-	-	8,025,725	14,242,038
Sub Total 1996-2000	**29,090,000**	**30,400,000**	**29,116,670**	**-**	**4,000,000**	**4,000,000**	**54,688,820**	**87,805,490**
Total	**$ 83,090,000**	**$ 77,400,000**	**$76,114,455**	**$ 20,000,000**	**$ 45,000,000**	**$45,000,000**	**$76,799,011**	**$197,913,466**

[1] $3.5 million was not included in FY 1996 request, funding was a result of a reprogramming letter to the Congressional Appropriations Committee dated September 5, 1996.

[2] R&RA has an available balance of $2.2 million and the Trust Fund has an available balance of $22.6 million.

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