REPORT TO THE CONGRESS

Achievements, Cost, And Administration Of The Ocean Sediment Coring Program B-171989

National Science Foundation

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

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COMPTROLLER GENERAL OF THE UNITED STATES
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To the President of the Senate and the
Speaker of the House of Representatives

This is our report entitled "Achievements, Cost, and Administration of the Ocean Sediment Coring Program." The program is administered by the National Science Foundation.

Our review was made pursuant to the Budget and Accounting Act, 1921 (31 U.S.C. 53), and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

Copies of this report are being sent to the Director, Office of Management and Budget, and the Director, National Science Foundation.

Comptroller General
of the United States

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ABBREVIATIONS

GAO	General Accounting Office
JOIDES	Joint Oceanographic Institutions for Deep Earth Sampling
NSF	National Science Foundation

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D I G E S T

WHY THE REVIEW WAS MADE

Because of interest expressed by committees and members of Congress in the Ocean Sediment Coring Program which provides information about the history, age, and structure of ocean basins and evolution of marine life, the General Accounting Office (GAO) has reviewed the achievements, cost, and administration of the program.

Background

The program, a major oceanographic and earth sciences endeavor of the National Science Foundation (NSF), has two major phases: (1) deep sea drilling to obtain core samples and (2) detailed analyses of the core materials.

The drilling phase, known as the Deep Sea Drilling Project, is carried out by Scripps Institution of Oceanography, University of California, San Diego, California, under a negotiated cost contract with NSF. The contract covers the 10-year period from June 1966 through June 1976, and the contract cost is estimated at about $68.3 million.

Scripps' responsibility includes obtaining cores of sediments by conventional drilling methods from the Atlantic, Pacific, and Indian Oceans and adjacent seas; preparing preliminary descriptions of the core materials; storing the cores; and distributing core samples to qualified investigators for detailed analyses. Scripps has subcontracted with an offshore drilling company to provide the ship and to perform the coring.

Detailed analyzing of core samples is a principal means of developing fundamental knowledge concerning the constitution and history of the deep ocean basins. The analyses are primarily the responsibility of individual scientific investigators. Funding for detailed analyses is available to scientific investigators through NSF research grants.

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2 NSF and Scripps believe the drilling project has contributed to the understanding and knowledge of processes in earth sciences and oceanography. (See pp. 15 and 16.)

FINDINGS AND CONCLUSIONS

Opportunity to enhance program accomplishments

Opportunities exist to enhance the accomplishments of the program through more timely distribution of core samples for detailed analyses and through more effective dissemination of the results of such analyses to potential users.

The policy for distribution of cores provided that samples of cores would be available to interested scientists for detailed analyses 1 month after

the preliminary core descriptions are published. Because the preliminary core descriptions have not been published on a timely basis, distribution of core materials to scientists for study has been delayed.

More timely publication of core descriptions and distribution of core materials would permit earlier publication of the scientific results of the analyses of core materials--a major phase of the program. (See pp. 17 to 20.)

Under the sample distribution policy, scientists must submit to Scripps copies of papers on detailed core analyses published in scientific journals. These copies will provide a central record of the results of such analyses. No record was maintained on unpublished research results.

A record on all research results, including those not published in scientific journals, could facilitate the dissemination of such results to potential users.

According to the National Council on Marine Resources and Engineering Development, if the complex nature of the marine environment is to be understood and if practical objectives are to be achieved, marine science information must be both developed and made available to meet a wide variety of user needs.

The National Academy of Sciences and the National Academy of Engineering expressed the need for circulation of substantive scientific information not scheduled for formal publication. (See pp. 23 and 24.)

Cost of program

The cost of the Ocean Sediment Coring Program has increased substantially above initial cost estimates. NSF's fiscal year 1966 budget submission to the Congress showed that the program would cover a 20-month period and that its estimated total cost would be $5.4 million. The major portion of the program cost is incurred under NSF's contract with Scripps, which, according to NSF's most recent estimates, will cover the 10-year period from June 1966 through June 1976 and will cost about $68.3 million.

The increases in the estimated cost of the program can be attributed, in large part, to extensions of the contract period. (See pp. 27 to 29.)

NSF has been concerned with rising costs and has taken steps to strengthen its administration of the Scripps contract. (See p. 29.)

NSF should improve its accounting for program costs so that all costs related to the program are included. An estimated $1.8 million was incurred for predrilling site surveys and detailed analyses of core materials, but this amount was not shown on NSF's accounting records as a program cost.

If all costs directly applicable to the program are not charged to the program, cost information about the program will not be accurate and complete and its usefulness to the Congress and NSF management

will be limited. (See pp. 31 and 32.)

Need for more effective procedures for negotiating subcontract

NSF and Scripps need to determine the reasonableness of prices being paid for the services of the drilling subcontractor by obtaining and analyzing certified cost and pricing data and evaluating such data by audit.

In negotiated procurements, such as the subcontract for the drilling ship, fully effective competition may be lacking as a basic safeguard to the purchaser and the prices are based largely on costs incurred or estimates of costs to be incurred. In these circumstances, it is important for a purchaser to have all available and significant information on the vendor's probable cost for use in negotiations.

Scripps did not obtain such cost information for use in negotiations with its drilling subcontractor. The estimated cost of the subcontract through June 1976 is about $38.8 million. (See pp. 34 to 36.)

Contrary to the requirements of law, NSF, Scripps, and the subcontractor agreed not to provide for GAO's access to records on the fixed prices being paid for the subcontractor's services. The legislation providing GAO with the right to examine contractors' and subcontractors' records on negotiated contracts was intended to afford a means to inform the Congress of any excessive or unreasonable prices negotiated and to serve as a deterrent to the making of contracts providing for unreasonable prices. (See p. 37.)

RECOMMENDATIONS OR SUGGESTIONS

GAO proposed that NSF should:

--Implement the procedures needed to reduce the time required to publish core descriptions and distribute core materials to interested scientific investigators. (See p. 21.)

--Implement procedures to insure that the results of all studies on core materials are maintained in a manner which will allow ready access to the scientific community. (See p. 26.)

--Take the necessary steps to insure that the policies needed to adequately control costs are established and implemented. (See p. 30.)

--Develop procedures to require that costs which are directly related to the Ocean Sediment Coring Program be charged to the program. (See p. 32.)

--Require Scripps to determine that the prices negotiated for a subcontract extension are fair and reasonable on the basis of certified cost and pricing data. (See p. 39.)

AGENCY ACTIONS AND UNRESOLVED ISSUES

The Director of NSF confirmed that the delay in publishing the core descriptions had been of concern and that NSF had implemented procedures and developed a new core distribution policy to minimize the time required to publish the core descriptions and to distribute core materials for study. (See pp. 21 and 22.)

The Director said that, because of the large volume of important scientific information being developed, an automated data base and retrieval system was being designed and that an analysis would be made to determine whether additional procedures and efforts need to be implemented. He noted, however, that it would be an impractical and uneconomical task to collect unpublished studies of core materials. (See p. 25.)

The measures being taken by NSF to collect and maintain published research data on the core materials should facilitate the dissemination of such data; however, these measures would not fulfill the need, expressed by the National Academy of Sciences and the National Academy of Engineering, for circulation of substantive scientific information not scheduled for formal publication.

Because of the overall cost of the project and the fact that the unpublished studies could be incorporated into existing Federal scientific information systems, GAO does not agree with NSF and is therefore recommending that NSF implement procedures to insure that core study results are accessible to the scientific community. (See p. 25.)

The Director advised GAO that both NSF and Scripps had taken measures to improve their contract management, including control over contract costs. (See p. 30.) He indicated that costs for site surveys and detailed core studies were not charged to the program because they were not considered an integral part of the direct program costs. (See pp. 32 and 33.)

Because the site surveys are performed when needed to select drilling sites and because the detailed studies of the core samples constitute one of the major phases of the coring program, the costs of these activities are both necessary and directly related to fulfilling the program objective. These costs should therefore be charged to the program; otherwise the program costs shown in NSF's budget and financial reports would be understated. GAO is therefore recommending that NSF charge all related costs to the program. (See p. 33.)

The Director stated that Scripps and NSF had followed GAO's recommendations in negotiating the most recent extension to the drilling subcontract. (See p. 39.)

MATTERS FOR CONSIDERATION BY THE CONGRESS

This report should provide useful information about one of NSF's major scientific endeavors in the oceanography and earth sciences areas.

CHAPTER 1

INTRODUCTION

The National Science Foundation (NSF) is authorized by the National Science Foundation Act of 1950 (42 U.S.C. 1861) to develop and encourage the pursuit of a national policy for the promotion of basic research and education in the sciences and to support such research through contracts and grants. Among its major activities, NSF supports the scientific study of the oceans and the earth which involves all relevant disciplines, such as chemistry, geology, geophysics, and biology.

One of NSF's major endeavors in oceanography and earth sciences is its Ocean Sediment Coring Program, which is intended to increase man's knowledge of the history, age, and structure of the ocean basins and the evolution of marine life. The program objective is to be accomplished by the scientific analyses of samples of sediments obtained by drilling into the floors of the oceans.

The drilling phase, known as the Deep Sea Drilling Project, is carried out by the Scripps Institution of Oceanography, University of California, San Diego, California, under a negotiated cost contract, effective June 24, 1966, with NSF. Under the terms of the contract, Scripps is reimbursed for all allowable costs but receives no fee and is responsible for providing all services, materials, and facilities necessary for obtaining cores of sediments by conventional drilling methods from the Atlantic, Pacific, and Indian Oceans and adjacent seas. Scripps is responsible also for preparing preliminary descriptions of the core materials, storing the cores, and distributing core samples to scientific investigators.

An advisory group known as the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES) advises Scripps in the planning of the drilling project. The membership in JOIDES includes Scripps, the Woods Hole Oceanographic Institution, the Rosenstiel Institute of Marine and Atmospheric Sciences of the University of Miami, the Lamont-Doherty Geological Observatory of Columbia University, and the University of Washington.

JOIDES functions through an executive committee which provides policy direction to the project, a planning committee which is responsible for proposing technical and scientific activities, and certain panels established by the executive committee which provide advice on specialized scientific and technical subjects.

As of June 1972, the estimated cost of the contract with Scripps, as amended, was $68.3 million and the contract covered the period June 24, 1966, through June 30, 1976. The contract provides for 84 months of drilling operations, of which 47 months had been completed.

CHAPTER 2

OPERATIONS UNDER THE OCEAN SEDIMENT CORING PROGRAM

The Ocean Sediment Coring Program is a national research program in which all interested and qualified scientists may participate and have access to the information and material developed under the program. The program has two major phases: (1) deep sea drilling to obtain core samples and (2) detailed analyses of the core materials.

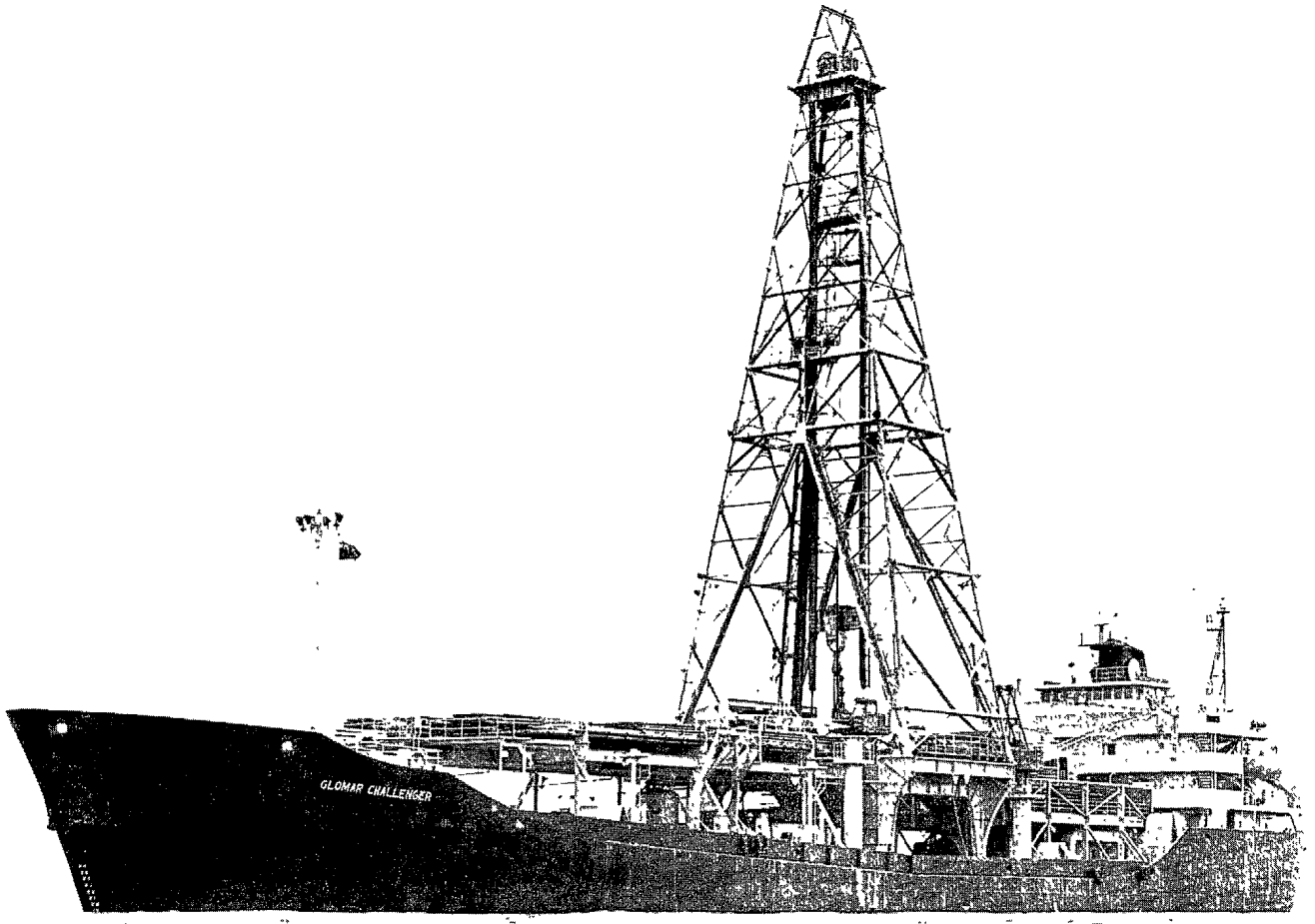
DRILLING OPERATIONS

Scripps, which is responsible for the drilling phase of the program, subcontracted with an offshore drilling company to provide the drilling ship and to perform the actual drilling and coring operations. The subcontract, dated November 14, 1967, provides for fixed daily rates for operation of the ship and for reimbursement of costs plus a fixed fee for certain items not included in the daily rates. The subcontractor provided a newly constructed drilling ship, the Glomar Challenger (see photo on p. 8), which was launched in March 1968 and began drilling operations in August 1968.

Characteristics of the drilling ship

The Glomar Challenger was the first of a new generation of heavy drilling ships capable of conducting drilling operations in the open ocean. The ship is 400 feet long, has a displacement of 10,400 tons, and has a million-pound hookload capacity drilling derrick which stands 194 feet above the waterline. The Glomar Challenger carries sufficient fuel, water, and stores to enable it to remain at sea for 90 days without replenishing.

The Glomar Challenger has drilled in water depths to 20,483 feet and has penetrated to 4,265 feet into the ocean floor. During drilling operations, the vessel has the capability to maintain its position within a 40-foot radius circle with 35- to 40-knot winds and 10- to 12-foot waves. During the first 47 months of its operations, the Glomar Challenger spent 18,047 hours, or 53 percent of the time, drilling and coring and 12,591 hours, or 37 percent of the time, cruising. During the remaining time, the ship either was



Portside view of the drilling ship Glomar Challenger. Photograph was furnished by Scripps.

undergoing maintenance or was in port for crew changes and resupply.

Special features of the Glomar Challenger include a dynamic positioning system, a tank stabilizing system, a satellite navigation system, shipboard laboratories, and a hole reentry system.

Dynamic positioning system--This system maintains the ship's position over the drilling site. The system employs four tunnel thrusters, two in the lower bow and two in the lower stern, each of which is capable of producing 17,000 pounds of thrust. The thrusters, operated in conjunction with the ship's main propulsion units, enable the ship to move in any direction. While on the drilling site, four hydrophones are extended below the hull. They continually receive signals transmitted from a sonar beacon implanted on the ocean floor. The signals are fed into a computer which calculates the ship's position relative to the beacon. The computer automatically controls the thrusters and main propulsion unit to maintain the ship's location over the drilling site.

Tank stabilizing system--This system, which is located amidships, controls the roll and pitch of the ship during drilling operations. The system is gyroscopically controlled to maintain the pitch-and-roll motion of the ship within acceptable tolerances.

Satellite navigation system--This system enables the Glomar Challenger to fix its geographical position anywhere in the world, day or night, regardless of local weather conditions. It provides the Glomar Challenger with access to precise navigational information that is continuously transmitted from the satellites of the U.S. Navy Navigation Satellite System which consists of four satellites in polar orbit, tracking stations, injection stations, and a computing center.

Laboratory facilities--The Glomar Challenger contains laboratory and office facilities, a library lounge, a drafting room, and an electronics laboratory. The laboratories are designed for core receiving and general

processing and contain the necessary scientific equipment to make selected analyses of the core material obtained during the cruises. Eight refrigerated storage vans are provided in the cargo hold of the ship for core storage until the vans are off-loaded at convenient ports for shipment to the core repositories.

Hole reentry system--This system provides the project with the capability of withdrawing a worn bit from a hole, replacing the bit, and reentering the same hole. (See photo on p. 11.) This permits the complete penetration of the sedimentary layer when drilling operations encounter layers of chert, a very hard flintlike rock. The reentry system was first used in December 1970.

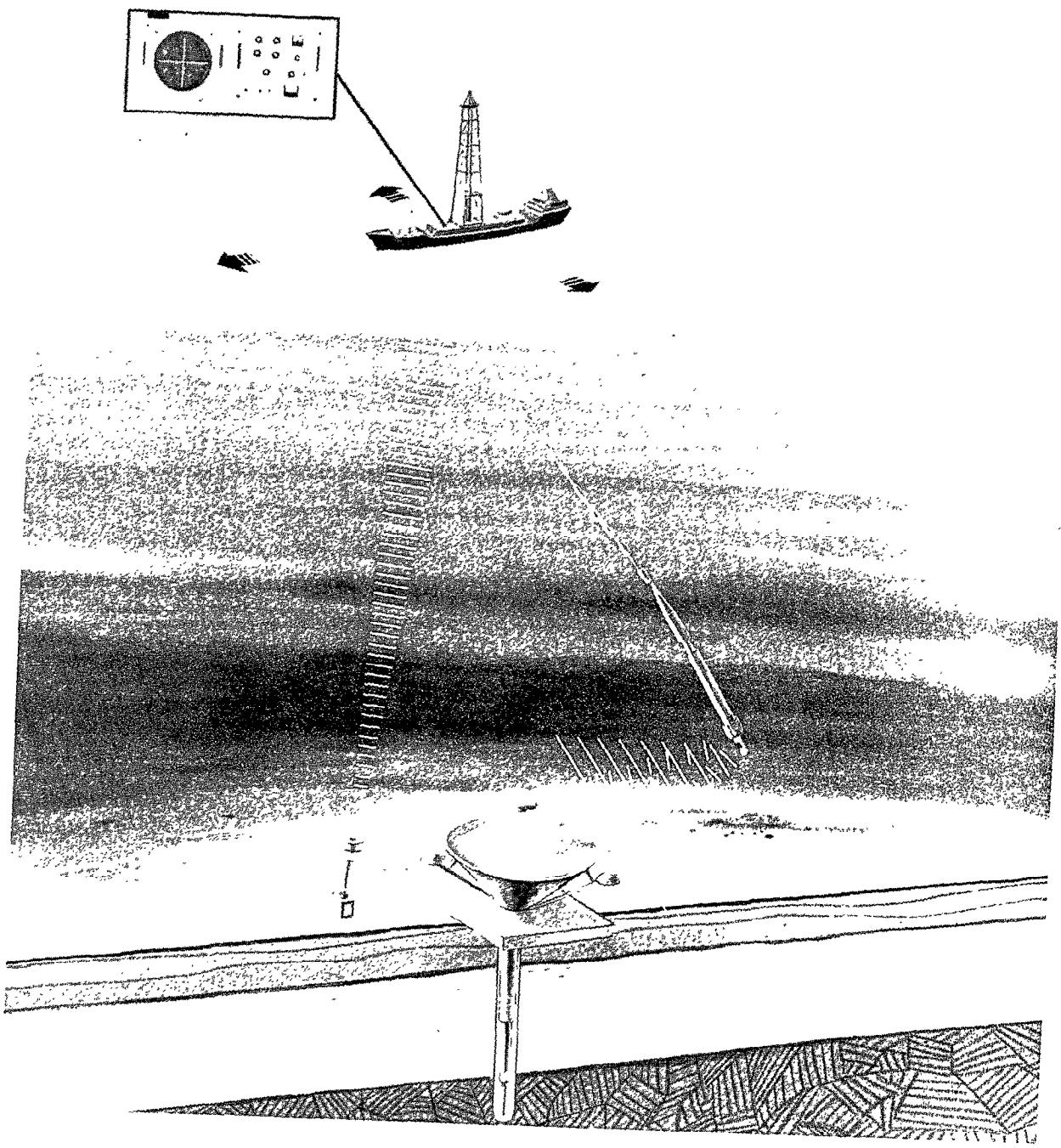
Cruise participants

At about 2-month intervals, the Glomar Challenger begins a new cruise to conduct drilling operations. A different team of scientists participates in each cruise, and teams of subcontractor personnel who perform the actual drilling and coring operations and laboratory technicians generally participate in alternate cruises.

Scientists from the United States and numerous foreign countries have participated in the cruises. Through April 1972, 50 scientists from 16 foreign countries served as members of the scientific teams aboard the drilling ship. The countries represented include Canada, France, West Germany, Italy, Switzerland, the United Kingdom, and the Union of Soviet Socialist Republics. The cruise scientists are selected on the basis of their interest, fields of research, scientific reputation, availability, and leadership qualities.

Site selection and coring operations

The appropriate JOIDES advisory panels select the approximate drilling sites and establish cruise routes on the basis of the sites selected. (See map on p. 13 for cruise routes.) The drilling sites, located at various intervals along the routes, are approved by NSF. The actual drilling locations at the sites are selected by the Cruise Chief



REENTRY FOR DEEP-SEA DRILLING--The illustration shows a sharp bit being guided into a subsea exploratory core hole, using a high resolution scanning sonar probe. The reentry cone, with its casing "stinger," was set on the ocean bottom during previous drilling at a site. The ability to reenter the same hole and continue drilling makes it possible to penetrate through hard layers of sediment and deep into hard rock. Photograph was furnished by Scripps.

Scientist on the basis of the recommendations of the JOIDES advisory panels, predrilling site survey information, and geophysical studies made by scientists aboard the Glomar Challenger during its final approach to the drilling site.

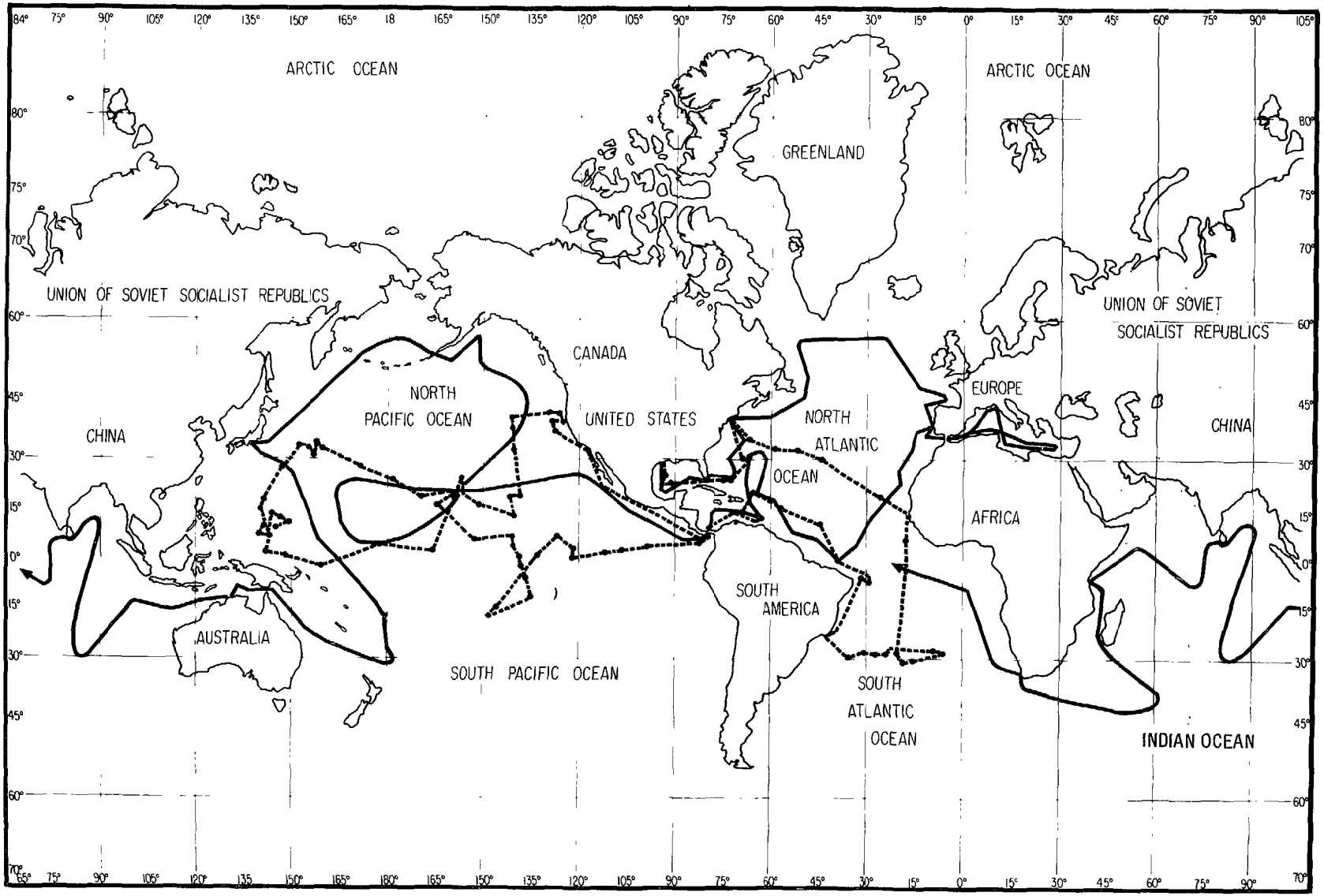
To drill, the subcontractor's crew lowers the drill pipe through the center well of the ship to a maximum length of 22,500 feet to the ocean floor. Drilling continues to the depth below the ocean floor where coring is to begin, and a 30-foot long core barrel is dropped, inside the drill pipe, to the ocean floor. After a 30-foot depth is cored, the core barrel, with the core materials, is retrieved aboard the ship. Additional core barrels are dropped in place to continue the coring operation.

To prepare preliminary descriptions of the cores, the cruise scientists and technicians study the core samples in the ship's laboratories. After each cruise, selected core samples are sent to various shore laboratories for additional studies and analyses. The remaining cores are off-loaded at suitable ports for shipment to the core repositories.

The results of the studies are consolidated and published in bound volumes entitled "Initial Reports of the Deep Sea Drilling Project." The purpose of the report is to provide core descriptions for assisting interested scientists in selecting sample core materials for detailed studies. One report is prepared for each cruise and contains a description of the drilling site and the core materials recovered, results of studies performed aboard ship and at shore laboratories, and relevant comments or observations by participating scientists.

Core storage

As of June 1972 a total of 72,351 linear feet of core materials had been collected, mostly on a selective basis, and much of which was stored at the two core repositories. Cores obtained from the Pacific and Indian Oceans and adjacent seas are stored at Scripps, whereas those obtained from the Atlantic Ocean and adjacent seas are stored at Lamont-Doherty Geological Observatory in Palisades, New York.



DRILLING ROUTES--Hatched lines show the route for the initial 18 months of drilling which ended in February 1970, and the solid lines show the drilling route for the subsequent period to August 1972. Photograph was furnished by Scripps.

The 2-1/2-inch diameter cores are stored in 150-centimeter lengths split longitudinally. One half is designated the "working half" and the other the "archive half." Samples from the working half of the core are available for distribution to scientists for detailed analyses. The archive half is stored and will not be sampled until all of the working half has been distributed for detailed analyses.

DETAILED ANALYSIS OF CORE MATERIALS

Scientific investigators who wish to analyze the core material may request samples from the Deep Sea Drilling Project curator at Scripps on the basis of information developed through the preliminary studies and published in the Initial Reports. Scientists are required, as part of their requests, to indicate the nature of the proposed research; the quantities of core materials requested and the possibility of returning residues to the curator; the estimated time to complete and publish the results of the analysis; and the availability of funding, equipment, and space necessary to conduct the research. Funding for detailed studies of core samples is available to scientists through NSF research grants.

The curator may distribute samples of up to 10 cubic centimeters per meter of core length to any qualified investigator who requests them. The curator must refer requests for larger samples to a sample distribution panel consisting of two NSF program officials and four non-NSF scientists.

As of April 1, 1972, 224 requests for core samples had been approved and a total of 7,311 samples had been distributed from cores collected during the first nine cruises for which Initial Reports had been published.

Investigators receiving samples are responsible for (1) publishing any significant results of their analyses, (2) acknowledging in the publications that NSF supplied the samples, (3) furnishing four copies of the published results to the Deep Sea Drilling Project, (4) notifying the curator of any additional work done on the samples which was not stated in the original request, and (5) returning the remaining samples after termination of the research if so requested by the curator.

SCIENTIFIC ACHIEVEMENTS AND TECHNOLOGICAL DEVELOPMENTS

Information developed during the first 34 months of the drilling operations (August 1968 through May 1971) which was considered by Scripps to be of significance in studying the history of the oceans includes:

--Evidence of seafloor spreading and continental drift which supports the theory that the continents were once joined together in a supercontinent which split, the pieces of which have been drifting apart.

--Verification that the ocean basins are, for the most part, relatively young features, younger than 200 million years (generally less than one-tenth to one-twentieth of the ages attributed by scientists to the oldest portions of the continents).

--Indication of the presence of oil deposits at great depths in the Gulf of Mexico which, according to Scripps, should have a profound impact on geological thinking and technological development for exploring and exploiting deep sea petroleum resources.

--Evidence of minerals forming in deep sea sediments, which raises the possibility that ores can be mined when the proper technology is developed.

--Discovery of abundant chert in the North Atlantic and Pacific Oceans, which Scripps considers to be one of the greatest surprises to come from the project, in addition to one of the most difficult barriers to deeper drilling in some areas.

--Determination of the rates of formation of deep sea sediments.

NSF advised us that the scientific discoveries had contributed to the understanding and knowledge of processes in the earth sciences and oceanography and that this knowledge would assist in understanding the major systems and phenomena of the earth, such as climate, earthquakes, volcanism, and resources.

According to NSF, the drilling project has contributed to important technological developments which are being adopted by the offshore drilling and mining industry. NSF pointed out that the Glomar Challenger was the first ship to demonstrate the feasibility of dynamic positioning and borehole reentry in the deep ocean and that several dynamically positioned ships had been built or were under construction for drilling oil or recovering other mineral resources.

CHAPTER 3

OPPORTUNITY TO ENHANCE PROGRAM ACCOMPLISHMENTS

The detailed analyses of core samples, one of the two major phases of the Ocean Sediment Coring Program, is a principal means of developing fundamental knowledge concerning the constitution and history of the deep ocean basins. NSF, in its most recent budget justification to the Congress, has stated that the detailed studies of the core materials will have a significant impact on nearly all areas of investigation in marine geology and geophysics.

Core samples are available for distribution to scientific investigators for detailed study following publication of the Initial Reports describing the core materials collected. Samples are distributed on the basis of unsolicited requests from qualified investigators who, in turn, are responsible for having any significant results of their studies published in scientific journals.

Our review showed that opportunities exist for more timely distribution of core samples for detailed studies and for more effective dissemination of the results of such studies to potential users, which, we believe, would enhance the accomplishments of the program.

DELAYS IN DISTRIBUTION OF CORE MATERIALS FOR DETAILED STUDY

The policy for distribution of core materials provided that samples of core materials obtained under the program would be available to interested scientists for detailed analyses 1 month after the preliminary core descriptions are published. Because the preliminary core descriptions have not been published on a timely basis, distribution of core materials to scientists for study has been delayed. More timely publication of core descriptions and distribution of core materials would permit earlier publication of the scientific results of the analyses of core materials--a major phase of the program.

Publication of the initial core descriptions

The program plan, which describes how Scripps is to conduct operations under the contract and which was approved by NSF, provides that Scripps prepare for each cruise a preliminary description of the cores obtained. The descriptions, as noted earlier, are published in the Initial Reports which serve as a mechanism whereby scientists can quickly recognize matters of interest to them and can define clearly and efficiently their programs of research so that core samples can be selected for analyses as soon as possible.

The Initial Reports are based, in part, on core descriptions developed through preliminary studies of the core materials by scientists who participate in the cruises. According to NSF and Scripps officials, significant delays in publishing the Initial Reports resulted because participating scientists did not always submit data on core descriptions promptly after the cruises.

Although publication of the reports is dependent on core description data submitted by cruise scientists, neither Scripps nor NSF had established a formal requirement for the timely submission of such data. Such a requirement would help insure that cruise scientists are aware of the need for prompt submission of the descriptions of the cores to enable early publication.

The program plan for the initial drilling period, dated October 23, 1967, provided that the core descriptions would be published within 4 months after completing the drilling cruises. This goal was intended to prevent the scientific work required to prepare the core descriptions from encroaching on the area of pure research because the program plan stated that the core descriptions, in themselves, were not intended to be research programs and that research on the core materials was to be done by interested scientists.

Before completing the first 18 months of drilling, Scripps determined that preparing core descriptions for publication within 4 months was not feasible. A new publication goal was established in May 1970, which stated that camera-ready copies of core descriptions should be ready for publication in 6 or 7 months. The JOIDES planning committee,

in November 1970, suggested to Scripps that the core descriptions could be published within 8 months after completing the cruises.

As of June 1971, 17 cruises had been completed. Of these cruises, 13 had been completed for more than 8 months but core descriptions for only six had been published. The core descriptions were published between 14 and 20 months after completing the cruises. Through the first 17 cruises of the Glomar Challenger, a total of 44,116 linear feet of core materials had been obtained; however, in accordance with the program policy of distributing core materials for detailed study only after core descriptions are published, samples of only 9,838 linear feet of core materials obtained during the first six cruises were available for distribution.

Scripps' officials told us that the prime factor contributing to the delays was that some cruise scientists were late in presenting their written material to Scripps for further processing. They advised us that one reason why some cruise scientists were not presenting their material on a timely basis was that, in most cases, the scientists were not employees of the project and consequently had obligations to their employers which limited the amount of time they could devote to preparing core descriptions after completing cruises.

NSF's Field Project Officer also noted in his comments dated July 9, 1970, on Scripps' program plan covering the drilling period from July 1970 through June 1973 that serious delays in publication of the initial core descriptions were being experienced and that such delays were due, in part, to the fact that participating cruise scientists were not submitting core descriptions on a timely basis for publication. He believed that (1) the participating scientists had not allocated sufficient time in their schedules to complete their additional studies and comments and (2) no evidence existed that scientists had been advised of any publication schedules.

A member of the scientific community, in a September 1970 letter to the JOIDES executive and planning committees, stated that, if the distribution of core samples continued to be delayed, interest in the project would wane and the scientific returns would be diminished.

Advantage of cruise scientists over other scientists

NSF's policy is to make the core samples available to all qualified scientific investigators for detailed studies on an equal basis. Cruise scientists, however, are permitted to take core samples with them to their respective institutions after the cruises to perform additional studies and tests for inclusion in the core descriptions. Unless requested otherwise, these scientists are not required to return the samples to the project repositories.

In our opinion, this practice, contrary to NSF's policy of equal access, gave cruise scientists an advantage over other scientists through access to core samples for significant periods of time before the core descriptions were published. As a result, cruise scientists had an opportunity to perform more extensive research than was intended to prepare the core descriptions.

We noted that, in one instance, the results of such research by a scientific member of one cruise were submitted to a scientific journal approximately 4 months before the Initial Report for the cruise was published.

In another instance, a cruise scientist who prematurely submitted a paper on the results of his core studies to a scientific journal was requested by a Scripps project official, who became aware of the matter, to withdraw, at least temporarily, his paper. The Scripps official informed the scientist that it was an NSF policy that papers stemming from research on the core samples should not be submitted to scientific journals before publication of the appropriate Initial Reports.

The intent of this policy, according to the Scripps official, was to insure that publication of the core descriptions preceded subsequent detailed investigations and to allow researchers, other than shipboard scientists, to share in the early research of the cores.

Procedures for imposing strict deadlines for the submission of core descriptions to Scripps for publication in the Initial Reports would, in our opinion, better insure effective implementation of NSF's policy of equal access to core materials by all interested scientists.

Proposal and agency action

In a draft of this report transmitted to NSF for comment, we proposed that NSF implement the procedures needed to minimize the time required to publish core descriptions and distribute core materials to interested scientific investigators.

The Director of NSF, in a letter dated May 31, 1972, advised us that NSF was concerned by the delay in publishing the Initial Reports and that NSF was trying to insure publication as soon as practicable after a cruise. He said that, in addition to the failure of shipboard scientists to submit manuscripts and data for the reports on a timely basis, changes in the scope and quality of the Initial Reports were factors contributing to delays in publishing the reports.

According to the Director, the reports originally were envisioned to be a list of the cores with very brief descriptions of their physical characteristics and a minimum of interpretation. However, he stated that, to make the reports more useful and meaningful to scientists, additional interpretative results had been incorporated, improvements had been made in the report format, and new procedures had been implemented to minimize the number of errors in the reports.

The Director pointed out that the publication of a report for each cruise that incorporates the scientific data obtained is an important aspect of the Ocean Sediment Coring Program. The Initial Reports, according to the Director, are unique and valuable scientific references, and most earth scientists and oceanographers interested in the program are strongly in favor of maintaining the reports at the present level of detail and length. Therefore NSF believes that the high quality of the reports should not be sacrificed by hasty publication.

The Director stated, however, that both NSF and Scripps had recognized the need to make core samples available to interested scientists at the earliest possible date; therefore, NSF had implemented procedures and developed a new core distribution policy to minimize the time required to

publish core descriptions and distribute core materials to scientists for study. The Director explained that NSF's new procedures provide for, among other things (1) a uniform format to facilitate data compilation aboard ship, (2) the assignment of science editors to the cruises to collect and edit manuscripts, and (3) a more forceful effort and followup to insure that cruise scientists honor their commitments to allocate the time necessary after the completion of cruises to meet production schedules. NSF's new distribution policy is designed to make core samples available to researchers 12 months after the cruises regardless of whether the Initial Reports have been published. This time frame will, according to the Director, make core samples available earlier.

ALL RESEARCH RESULTS SHOULD BE MAINTAINED

The purpose of the Ocean Sediment Coring Program is to develop new fundamental knowledge in oceanography and earth sciences through the detailed analyses of core materials obtained from the deep oceans. The core repositories keep a record of the samples of core materials distributed, the names of the receiving scientists, and the objectives of the research to be performed. Procedures have not been established, however, for collecting and maintaining information centrally on the results of all detailed studies of the core materials.

Under the Ocean Sediment Coring Program, geological and geophysical data is collected during drilling operations and from the initial analyses of the core materials. The data is published in the Initial Reports. Some of the measurements and observations obtained during drilling activities or through the initial analyses, however, are not included in the Initial Reports but are maintained at the core repositories and are available to potential users after publishing the Initial Reports.

NSF's sample distribution policy requires that scientists submit copies of papers on the results of their detailed core studies which are published in scientific journals. Under this policy, no record is maintained on research results which are not published. According to NSF officials, only research results considered most significant are published due to space limitations in pertinent scientific journals.

A ready record on all research results, including those not published in the scientific journals, could facilitate the dissemination of such results to potential users. The National Council on Marine Resources and Engineering Development, which was responsible for assisting the President in developing a coordinated Federal program of marine science activities, stated in its annual report to the Congress dated March 1968 that marine science information must be generated and made available to meet a wide variety of user needs if the complex nature of the marine environment is to be understood and if practical objectives are to be achieved.

The Committee on Scientific and Technical Communication of the National Academy of Sciences and the National Academy of Engineering, in its report entitled "Scientific and Technical Communications--A Pressing National Problem and Recommendations for Its Solution," noted the need for circulation of substantive scientific information not scheduled for formal publication and stated that it was highly desirable that such information be indexed and accessible in a central depository to potential users.

Information on the results of studies of core materials could be incorporated into one of the existing information systems maintained by other Federal agencies. The primary Federal repository for oceanographic data is the National Oceanographic Data Center which was established in 1960. The Data Center receives oceanographic information from both domestic and foreign sources and processes and makes the information available to U.S. and foreign organizations concerned with ocean-related affairs. In the area of marine geology and geophysics, the Data Center collects descriptions of ocean rock and sediment samples and depth and geophysical measurements of the ocean floor.

The Acting Director of the Data Center advised us that the results of the core analyses which are not published would be of value to other scientists. The official said that a summary of the methodology and a synopsis of the research should be collected in an information system to enable potential users to contact the researcher and obtain details of his work.

We discussed with Scripps' chief scientist for the project the feasibility of collecting and centrally maintaining all research results. He told us that he believed it was feasible and that he would consider studying the matter to determine whether any revisions would be necessary to the present policy to insure that the results of detailed studies are collected.

Because the Ocean Sediment Coring Program is a national research program for the benefit of all interested scientists, we believe it is particularly important that procedures be implemented to insure that information on the results of all research involving the core materials is collected and maintained for ready access.

Agency comments and our evaluation

The Director of NSF advised us that NSF had always emphasized the need to insure that results of studies involving core materials would be readily accessible to the scientific community. He pointed out that the volume of important scientific information was reaching such proportions that a data search or synthesis on a particular subject was beyond the capability of individual investigators. He informed us that an automated data base and retrieval system was being designed. The data base for the system will be derived from the principal categories (for example, geophysical and geochemical) of the Initial Reports and is expected to increase the scientific value of the reports and to save investigators a significant amount of preresearch. The Director said that such an automated system would contribute significantly to marine geology and that interfaces of the system with other geologic data facilities, particularly the National Oceanographic Data Center, had been investigated.

The Director stated that a careful analysis would be made to determine if additional procedures need to be implemented. One area that will be considered is the dissemination in one document of all published studies involving core materials. The Director noted that it would be an impractical and uneconomical task to collect information on unpublished studies of core materials.

Although the measures described above should facilitate dissemination of certain research data on core materials, such measures would not fulfill the need, expressed by the National Academy of Sciences and the National Academy of Engineering, for circulating substantive scientific information not scheduled for formal publication. It appears to us that the cost of obtaining from the researchers the results of their unpublished studies of the core material would be insignificant in comparison to the overall cost of the Ocean Sediment Coring Project. To minimize the cost of collecting and maintaining unpublished research results, such data, as pointed out earlier, could be incorpotated into one of the existing Federal information systems. Accordingly, we do not agree with NSF that it would be impractical to do so.

Recommendation to the Director, NSF

NSF should implement procedures to insure that the results of all studies on core materials are maintained to allow ready access to the scientific community.

CHAPTER 4

STEADILY RISING COSTS OF THE OCEAN SEDIMENT CORING PROGRAM

The cost of the Ocean Sediment Coring Program has increased substantially above the initial cost estimate. NSF's fiscal year 1966 budget submission to the Congress showed that the program would cover a 20-month period at an estimated total cost of $5.4 million. However, according to NSF's most recent estimates, the contract with Scripps, which accounts for the major portion of the program costs, will cover the 10-year period June 1966 through June 1976 and will cost about $68.3 million.

The following table shows the contract costs through fiscal year 1976.

Fiscal year	Annual amount	Cumulative amount
1967-68	$ 1,690,000	$ 1,690,000
1969	6,648,000	8,338,000
1970	7,597,000	15,935,000
1971	8,229,000	24,164,000
1972-76 (estimated)	44,136,000	68,300,000

The increases in the estimated cost of the program can be attributed, in large part, to extensions of the contract period. Our review showed that NSF was concerned with rising costs and had taken steps to strengthen its administration of the contract with Scripps.

NSF should improve its accounting for program costs so that all costs related to the program are included. Otherwise, cost information about the program will not be accurate and complete and its usefulness will be limited.

COST GROWTH

In June 1966 NSF awarded a letter contract in the amount of $5.4 million to Scripps. In January 1967 NSF awarded Scripps a definitized cost contract which superseded

the letter contract and which included an estimated cost of $6.7 million. The contract covered the period June 24, 1966, through December 31, 1969, and provided for 18 months of drilling in the Atlantic and Pacific Oceans.

The program plan for the contract period, which Scripps submitted to NSF in October 1967, showed that the estimated cost of the project would be $12.6 million, about $6 million more than the estimated cost of the contract. The plan described in greater detail the tasks to be performed under the contract and provided a revised estimate of the cost of the drilling subcontract. Scripps requested an increase in the estimated contract cost and an extension of the period of performance to allow time to complete the drilling activities under the proposed subcontract. NSF amended the contract on December 21, 1967, to increase the estimated cost to $12.6 million and to extend the period of performance to June 30, 1970.

On November 20, 1968, Scripps submitted a revised cost estimate of $13.5 million to complete the work relating to the 18 months of drilling and requested that the contract be amended accordingly. Scripps submitted a new proposal to NSF on April 21, 1969, to extend the contract for 3 years to June 30, 1973, and to provide for 30 months of drilling over the 3-year period. Scripps proposed that the total estimated contract cost be increased to $34.8 million which included the $900,000 increase it had requested on November 20, 1968.

NSF amended the contract on October 8, 1969, to extend the contract period through June 30, 1973, which increased the estimated cost of the contract from $12.6 million to $34.8 million, and to expand the area of drilling operations to the Indian Ocean and the Mediterranean Sea. The estimated cost was increased further by $490,000 under an amendment dated March 5, 1971, to develop, install, and test the hole reentry system, which increased the total estimated contract cost to $35.3 million.

On October 21, 1971, the contract was extended again for 3 years through June 30, 1976, which increased the estimated cost of the contract to $70 million. (The estimated cost was subsequently revised downward to $68.3 million.)

The extension provides for an additional 36 months of drilling, or a total of 7 years of drilling during the 10-year period.

NSF CONCERN OVER INCREASED COSTS

Regarding the October 8, 1969, amendment to the contract providing for an additional 36 months of operations, Scripps submitted its program plan for this extension to NSF for approval on June 2, 1970. NSF, in a letter dated January 15, 1971, approving the program plan, expressed concern over the increasing project costs and placed certain conditions on Scripps which, among other things, required Scripps:

--To establish a policy governing the employment of personnel in the project. During the initial period of drilling activities, the number of project personnel increased from 38 to 85 which, according to NSF, resulted in a substantial increase in personnel costs. Pending development of an employment policy, NSF set a ceiling of 86 equivalent full-time employees for the project.

--To define actions that constitute significant departures from the program plans. The NSF Field Project Officer had noted that the operating procedures at a core laboratory had been revised to delete X-raying of cores and that the X-ray equipment had been removed from the Glomar Challenger without prior NSF approval. Actions to be defined by Scripps included changes in areas of proposed drill sites, changes in operational capabilities, and the addition or deletion of scientific programs.

--To establish a policy governing the authorization of travel. The Field Project Officer had noted that travel expenses had become a substantial portion of the administrative and scientific costs of the project. Travel under the contract included travel (1) to foreign ports to change scientific teams at the end of each drilling cruise, (2) between east and west coast laboratories, (3) by members of the advisory committees and panels, and (4) for staff relocations.

Proposal and agency action

Because policies governing employment and travel and definitions of actions that constitute significant departures from the program plans had not been submitted to NSF for approval as of March 1972, we proposed in a draft of this report that NSF take the necessary steps to insure that the policies needed to adequately control costs are established and implemented.

The Director, NSF, informed us that NSF had taken the necessary steps to insure that contract costs were effectively controlled. He explained that the program plan for the 3-year period ending June 30, 1976, will be the principal mechanism which NSF will use to control costs. NSF has received a draft of the program plan for this period, which included policies for employment of personnel and authorization of travel and definitions of significant departures from the program plan. The policies and the definitions will, according to the Director, be in the program plan which NSF expects to approve soon. Also the Director pointed out that NSF's representative at Scripps, who is responsible for insuring that the project is conducted effectively, efficently, and within the bounds of the program plan, had been delegated limited contracting authority to improve his effectiveness in carrying out his responsibilities.

In addition, the Director advised us that Scripps had modified its organization along functional lines and had improved its administrative procedures. Scripps was also establishing improve methods of segregating costs and was implementing improved procedures for controlling and reporting costs.

RELATED COSTS NOT CHARGED TO PROGRAM

In analyzing the program costs, we found that NSF was not charging certain pertinent costs to the program. NSF allocates its appropriated funds to its various programs. Program costs are accumulated by the program under which the grants and contracts were awarded. As a result, some costs pertinent to the Ocean Sediment Coring Program which were funded through grants awarded under other NSF programs were not accumulated and reported as a part of the total cost of the coring program nor were they readily identifiable from NSF's accounting records. Accurate and complete cost information is important to both the Congress and NSF management in making assessments and decisions on the program.

Examples of major cost elements which were funded under other NSF programs and were not charged to the Ocean Sediment Coring Program involve predrilling site surveys and detailed analyses of core materials obtained during drilling. Although NSF has not maintained specific cost information for these activities, it has estimated that such costs for fiscal years 1971 and 1972 totaled about $1.8 million.

Predrilling site surveys, which NSF considers necessary, provide geophysical information that is used to select drilling sites where core materials are expected to yield maximum scientific information. These site surveys have been made by various oceanographic institutions, including Scripps, Lamont-Doherty Geological Observatory, Woods Hole Oceanographic Institution, University of Hawaii, University of Washington, and Oregon State University. Although the surveys have generally been made as part of the programed oceanographic research activities of these institutions, the surveys involved time and effort on the part of the institutions' research teams and ships beyond that required for their normal research programs.

Much of the oceanographic research of these institutions has been funded through NSF grants awarded under its oceanographic ship operations support and oceanography research project support programs. Although NSF has not separately identified the cost of the site surveys made by the institutions, it estimated such costs to be about $750,000

in 1971. To cover these costs, NSF transferred $750,000 from the Ocean Sediment Coring Program--$550,000 to the oceanographic ship operations support program and $200,000 to the oceanography research project support programs. During fiscal year 1972, NSF awarded three grants totaling $121,600 under the oceanography research project support programs to finance site survey costs.

It is NSF's policy to distribute samples of core materials to scientists who are interested in performing detailed analyses and in having the results published in appropriate scientific journals. Funds for core analyses are provided through research project grants awarded under NSF's oceanography research project support programs.

Through June 1972, NSF had awarded 20 grants, totaling $923,000, almost exclusively for research on the core materials. A number of other scientists had received NSF grants totaling about $2.2 million for research projects involving, to some extent, the core materials.

Although it may be difficult to determine in all cases the cost of activities supporting the Ocean Sediment Coring Program, we believe that, where such costs can be readily identified, they should be charged to the program. Otherwise, cost information concerning the program will not be accurate and complete and its usefulness to the Congress and NSF management will be limited.

Proposal, agency action, and our evaluation

We proposed in a draft of this report that NSF develop procedures to require that costs which are directly related to the Ocean Sediment Coring Program be charged to the program.

The Director stated that NSF considers that the costs directly related to the coring program are those identified in the NSF budget. According to the Director, other costs associated with the program, such as site surveys and scientific research project support for detailed studies of core samples, are not considered an integral part of the direct program costs. He noted that the site survey work performed by academic institutions under oceanographic ship operations

support grants was considered to be a service function when needed and that NSF's policy was to have all costs for academic oceanographic ship support budgeted and controlled in one office. The Director stated that grant proposals for detailed studies of core samples must compete with grant proposals for oceanographic research not related to the coring program.

Since the site surveys are performed when needed to select the most desirable drilling sites and since detailed studies of core samples constitute one of the major phases of the Ocean Sediment Coring Program, costs incurred for these activities are, in our opinion, necessary and directly related to fulfilling the program objective. NSF's fiscal year 1973 budget, for the first time, identifies by reference the costs for detailed core studies, although it does not account for such costs and the costs for the site surveys as coring program costs. NSF's financial report of program operations in its annual report to the Congress also does not account for these costs as coring program costs. As a result the costs for the coring program in the NSF budget and financial report are understated.

Recommendation to the Director, NSF

To provide the Congress and NSF management with information necessary for assessing program costs and achievements and to strengthen the administrative control over program costs, we recommend that NSF develop procedures to require that costs funded by NSF which are directly related to the Ocean Sediment Coring Program, and readily identified as such, be charged to the program.

CHAPTER 5

MORE EFFECTIVE PROCEDURES NEEDED TO NEGOTIATE SUBCONTRACT FOR DRILLING SERVICES

Our review indicated the need for NSF and Scripps to determine the reasonableness of prices being paid for the services of the drilling subcontractor by obtaining and analyzing certified cost and pricing data and evaluating such data by audit. In negotiated procurements, fully effective competition may be lacking as a basic safeguard to the purchaser and the prices are based largely on costs incurred or estimates of costs to be incurred. In these circumstances, it is important for the purchaser to have all available and significant information on the vendor's probable cost for use in negotiations. Scripps did not obtain such cost information for use in negotiating with its drilling subcontractor.

The Congress has enacted specific legislation providing GAO with the right to examine contractors' and subcontractors' records relating to contracts awarded through negotiation procedures. We learned that NSF, Scripps, and the drilling subcontractor, in the negotiation of subcontract terms, had agreed not to provide for GAO's access to certain subcontractor records.

NEED FOR CERTIFIED COST AND PRICING DATA AND AUDITS

Most of the expenditures under NSF's contract with Scripps have been for services provided under a negotiated subcontract for drilling and coring operations. These services are considerably different from those usually provided by offshore drilling contractors and include certain operational requirements that had not been attempted before the project.

It is expected that, of the estimated contract cost of $68.3 million, $38.8 million will be incurred under the drilling subcontract. The subcontractor is paid on the basis of various fixed daily rates depending on whether the

ship is in a drilling, cruising, standby, or other status. In addition, the subcontractor is paid his costs plus a fixed fee for certain items not included in the daily rates.

Although the request for proposals which led to the award of the subcontract stated that the price proposal should contain data on direct labor, overhead, general and administrative rates, and profit, none of the three proposals, which Scripps considered responsive, included the requested data. Scripps selected the subcontractor because it proposed, in Scripps' estimation, the best technical approach at the lowest cost for meeting the subcontract requirements. Scripps accepted the subcontractor's proposed rates and NSF approved the subcontract without the supporting detailed cost estimates.

NSF officials advised us that they did not obtain cost and pricing data because they believed that fair and reasonable prices would result from the competitive nature of the award. They further believed that, although excessively high contingency factors may have been included in the proposed prices because of the untried technology involved in subcontract performance, the competitive aspects of the award kept the contingency factors within reason.

Option clause

The subcontract contained an option clause whereby Scripps could extend the subcontract for specified periods ranging from 6 to 30 months beyond the 18 months in the initial subcontract. Scripps and the subcontractor were to renegotiate the daily rates for any extension; if agreement could not be reached, maximum daily rates set forth in the subcontract for each extension period would apply. The maximum rates in all cases were equal to or less than the applicable rates for the initial subcontract period.

Although it may have been difficult to develop an accurate cost estimate before awarding the subcontract because certain operational requirements had never been attempted, the costs incurred by the subcontractor during the initial operating period would have furnished a sound basis for evaluating and establishing fixed daily rates for an extended period of the subcontract.

Scripps, in advising the subcontractor on March 11, 1969, of its intention to exercise the option, cited the provision of the subcontract that the rates be renegotiated and requested the subcontractor to submit detailed data on costs experienced during the initial operations under the subcontract and to certify that the data was accurate, complete, and current. The subcontractor did not provide the requested data because, as it advised Scripps, it was not its policy to disclose such cost information. Scripps amended the subcontract on June 10, 1970, to provide for 30 additional months of drilling to August 1972 without renegotiating the daily rates on the basis of current cost experience.

Because the provision for renegotiation gave both Scripps and NSF an opportunity to reevaluate the pricing structure of the subcontract, we believe that they should have obtained information on operating costs and contingencies, available to the subcontractor at the time the option was exercised, and should have evaluated it through an audit of the subcontractor's records before renegotiating the daily rates for the extended period of operation. The availability of such data to both parties to the negotiation would seem to be a condition precedent to arriving at daily rates that could be considered reasonable, especially in view of the aforementioned risks and uncertainties that were present at the time of the initial subcontract award.

NO PROVISIONS FOR AUDIT OF SUBCONTRACTOR'S RECORDS

Prime responsibility for the procurement function rests with the procuring agency and its prime contractors. The Congress has authorized GAO to review the discharge of these responsibilities and has expressly provided for GAO's right to examine contractors' and subcontractors' records on contracts awarded by negotiation procedures. The applicable legislative history of such acts clearly discloses that the legislation was intended, among other things, to afford a means whereby the Congress could be informed of any excessive or unreasonable prices negotiated and to deter unreasonably priced contracts.

Because NSF's contract with Scripps cited the Federal Property and Administrative Services Act of 1949 (41 U.S.C. 252) as authority for awarding the contract on a negotiated basis, the pertinent statutory requirement (41 U.S.C. 254(c)) providing for the right of the Comptroller General or his representatives to examine any records directly related to the contract or subcontract applies. The contract further contained a requirement that Scripps include in all subcontracts awarded under the prime contract a suitable clause providing for the right of the Comptroller General to examine subcontractors' records.

In discussions and correspondence with Scripps and the drilling subcontractor, we attempted to arrange for an audit of the records relating to the subcontract. We considered it necessary to examine these records because the estimated cost of the subcontract is a significant portion of the total estimated cost of the NSF contract with Scripps.

Both Scripps and the subcontractor advised us that, in negotiating subcontract terms, they had agreed to not provide for our access to subcontractor records on fixed daily rates. The NSF contracting officer, in a letter dated April 26, 1971, advised Scripps that NSF agreed to omit adequate examination and audit provisions from the subcontract. NSF procurement officials advised us that NSF intended to preclude the Comptroller General's right of access to certain subcontract records.

NSF RATIONALE FOR SUBCONTRACTING PRACTICES

By letters dated June 9 and July 7, 1971, we brought to the attention of the NSF Director the matters of obtaining and auditing cost data before extending the subcontract and GAO's access to the subcontractor's records on the fixed-price portion of the subcontract.

The Director advised us in his letter dated July 22, 1971, that NSF and Scripps had decided to adhere as nearly as possible to the principles of advertised procurement and to award, to the extent practicable, a firm fixed-price drilling subcontract. He said that it was NSF's and Scripps' intent to rely principally on the element of free competition and that the prospective subcontractor assumed a significant part of the total risk to furnish the motivation for maximum performance at the lowest subcontract price.

The Director stated, in reference to obtaining cost data, that the wording of the option clause was somewhat unfortunate and did not convey Scripps' intent. The primary purpose of the option clause, according to the Director, was to permit downward negotiation of the daily rates in unforeseen circumstances; for example, a change in performance specifications. The Director stated, however, that Scripps, in planning for another extension of the subcontract, had requested, and expected to obtain from the subcontractor, certain cost and pricing data to assist it in negotiating reasonable fixed rates for continuation of the work. NSF will also review the basis for extension of the subcontract and the terms under which it is to be extended.

It was Scripps' and NSF's judgment, according to the Director, that an access-to-records provision did not need to be included in the subcontract pertaining to the fixed daily rate portion of the work because that portion of the subcontract was handled similar to an advertised procurement and because it was the industry's practice to not disclose detailed elements of cost, because of its proprietary nature, in preparing competitive bids. The Director stated, however, that NSF subsequently recognized that it should have consulted with the Comptroller General on whether its judgment in approving the subcontract without the appropriate access provision was acceptable.

PROPOSAL AND AGENCY ACTIONS

We proposed to the Director of NSF that (1) before approving any extension of the drilling subcontract, Scripps determine that the prices negotiated for a subcontract extension are fair and reasonable on the basis of certified cost and pricing data, (2) NSF's Audit Office examine subcontract costs to determine their reasonableness and acceptability for negotiating further subcontract amendments, and (3) NSF require an acceptable examination-of-records clause in all subcontracts issued under negotiated prime contracts, as contemplated by statute (41 U.S.C. 254(c)).

The Director advised us that Scripps and NSF had followed our recommendations for negotiating the 36-month extension to the drilling subcontract. He informed us that, before negotiating the subcontract extension, Scripps had obtained certified cost and pricing data from the subcontractor and NSF had arranged for the Defense Contract Audit Agency to audit the subcontractor's proposal for the extension period. The Defense Contract Audit Agency auditor, according to the Director, participated as an advisor to Scripps in negotiating the subcontract extension.

We noted that the negotiated daily rates for operating the ship in a drilling and cruising status (which has accounted for 90 percent of the time the ship has been in operation under the subcontract) are 9 percent lower than the rates proposed by the subcontractor.

A provision for the examination of records by the Comptroller General has been included in the subcontract.

CHAPTER 6

SCOPE OF REVIEW

Our review was directed toward evaluating NSF's administration of its national Ocean Sediment Coring Program, including the Deep Sea Drilling Project, carried out by Scripps Institution of Oceanography, University of California, San Diego, under contract NSF-C482. Our review was conducted at NSF headquarters in Washington, D.C., and at Scripps.

We reviewed pertinent program files and other records of NSF and Scripps and interviewed NSF and Scripps officials concerned with the administration of the program. We also reviewed NSF Audit Office and Defense Contract Audit Agency reports on the program.

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D C 20550

OFFICE OF THE
DIRECTOR

May 31 1972

Mr. Philip Charam
Associate Director
Civil Division
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Charam:

Your letter of March 16, 1972, forwarded to the National Science Foundation the draft of your proposed report to the Congress on the achievements, cost, and administration of the Ocean Sediment Coring Program (OSCP). The Deep Sea Drilling Project (DSDP) is a major element of this program, and it is being managed by the Scripps Institution of Oceanography, University of California, San Diego, under contract NSF-C482 with the Foundation.

As you suggested, we forwarded copies of your draft report to cognizant officials of the prime contractor, the University of California, San Diego, for review. Their comments have been incorporated in this reply.

The DSDP has been one of the most successful and significant national scientific programs in enabling us to learn more about the planet on which we live. Nationally and internationally, it has received extensive support from the scientific community. The scientific discoveries have made immense contributions to the understanding and knowledge of processes in the earth sciences and oceanography. This knowledge not only provides proof of past theories, but will assist in understanding the major systems and phenomena of the earth, such as climate, earthquakes, volcanism, and resources.

In addition to its important scientific accomplishments, the project has contributed to important technological developments which are being adopted by the offshore drilling and mining industry. For example, GLOMAR CHALLENGER was the first ship to demonstrate the feasibility of dynamic positioning and borehole reentry in the deep ocean. Several dynamically positioned ships have been built or are under construction for oil drilling or the recovery of other mineral resources.

APPENDIX I

As you know, we have extended the project for a four-year period from August 1972 until June 1976. We approved recently the contract between the University of California and Global Marine, Inc., for the extension of services of GLOMAR CHALLENGER from August 1972 until August 1975. The scientific results expected during this period should be even more noteworthy and revealing than those obtained in the earlier phases of the program. In particular, drilling and coring operations planned for the Antarctic and Arctic regions are of the greatest importance in developing an increased understanding of the tectonic and climatic history of the earth.

The DSDP is a unique undertaking. From the beginning, many problems had to be overcome and special management arrangements had to be developed. Over the past 4-1/2 years, the contractor's management organization has continued to evolve and improve. With continued control and guidance by the Foundation, Scripps' performance is expected to remain at a high level.

Our comments on your draft report, in the areas of greatest significance, are summarized in the text that follows. In the enclosure, we have listed your recommendations and suggestions followed by summary comments.

Publication of Results

The publication of an Initial Report for each cruise that incorporates the scientific data obtained is one of the important aspects of this research effort. The Initial Reports are unique and valuable scientific references; they are the scientific historical reports on the program. We expect that noteworthy research will result from the individual and systematic examination of the preserved core material that is so thoroughly catalogued and described. Most earth scientists and oceanographers interested in the program are strongly in favor of maintaining the reports at the present level of detail (and length). We believe that their high quality should not be sacrificed by hasty publication.

The delay in publication of the Initial Reports has been of concern to NSF, and we have made continued efforts to ensure their publication as soon as practicable after the completion of a cruise. Factors that have contributed to the delays include:

1. Change in scope of the reports. An examination of the original program plan (October 1967) indicates that at the beginning of the project,

these reports were envisioned to be merely a list or catalog of the cores with a very brief description of their physical characteristics and a minimum of interpretation. With the beginning of coring operations, however, it became apparent that additional study of the cores was required and interpretive results were needed in order to make these volumes more useful and meaningful to scientists.

2. The steps taken to improve the quality of the volumes. These steps have included incorporation of more interpretive results, addition or deletion of certain types of data, improvement in format, and error control. Also, contributing authors now are being sent galley proofs before publication to permit them to correct errors that may exist. This has resulted in additional time required to prepare the information for publication.

3. The failure of contributors to submit manuscript and data within the time requested. We noted that the DSDP project staff had difficulty in insuring that participating scientists adhere to publication deadlines. The schedule for publication is usually outlined in the correspondence with prospective participants in the cruises; however, proper emphasis has not been given to this matter and no binding commitments have been obtained from the scientists to complete their work within the allotted time. It is difficult to insist that the scientists do their work within the scheduled time since the majority of these scientists are not employees of the University of California and not under its control. Steps are being taken to improve the situation, however. For example, more binding commitments from participants are being sought, and payment of services, when applicable, may be withheld pending receipt of manuscript.

Steps have been taken to standardize the format for recording data aboard ship, which will expedite preparation of the report. In addition, there is now a policy of having one Scripps' staff member aboard each leg designated as the science editor. His prime responsibility is to collect and edit the manuscripts. Production techniques have been developed within the project office to reduce the length of time required to publish future volumes. To assist in this effort, the Foundation has obtained the services of a publication specialist through an interagency agreement with the Twelfth Naval District Printing Office. This individual is assigned to the Scripps' project management staff as publication production manager. The target, for

early 1973, is to have camera-ready copy of the Initial Report available 12 to 14 months after the completion of a leg, as compared to 20 to 24 months at present. It takes approximately 2 months for the Government Printing Office to print the report after receipt of camera-ready copy. Detailed production schedules are being developed for the remainder of the calendar year so that volumes 10 through 19 can be completed as rapidly as possible.

Distribution of Core Material

Both the Foundation and Scripps have recognized the need to make core samples available to interested scientists at the earliest possible date. A new core distribution policy is being developed by the Foundation under which samples will be made available to all researchers 12 months after completion of a leg, regardless of whether the Initial Report has been published. The new distribution policy will make samples available earlier than they have been in the past. There is an inherent delay in samples being ready for distribution. For example, cores must be transported from remote areas to the repository under refrigeration. Core shipments from GLOMAR CHALLENGER to the repository can be made only from ports that have good ocean freight service so that the refrigerated cores can be transported to the United States with a reasonable assurance of proper handling during shipment. Delays sometime amount to 6 months. At the repository additional time must be allowed for the cores to be split and catalogued.

[See GAO note 2.]

[See GAO note 2.]

Contract Administration

During the past 4-1/2 years, an experienced organization has been developed to manage a program of the size and nature of the DSDP. During the past year, the project organization at Scripps has been modified along functional lines, and the organization has been strengthened by the appointment of a deputy project manager with extensive project management experience and by improvements in administrative procedures. Improved methods of segregating costs are being established, and improved financial reporting and controls are being implemented.

The GAO report states the amount of the letter contract awarded in June 1966 and the subsequent amendments thereto, and correctly notes that the increases in the estimated costs of the program are largely attributable to the extensions of the program period--from the initial 20-month period to the current 10-year period.

[See GAO note 2.]

Contract Negotiations

The GAO recommends that the Foundation obtain assurance of the adequacy of measures taken by Scripps in satisfying itself that the prices negotiated for a subcontract extension are fair and reasonable, based on certified costs and pricing data, prior to the approval of any extension of the drilling subcontract.

Prior to negotiations for the 36-month extension of the drilling subcontract, the university obtained a certificate of cost and pricing data from Global Marine, Inc.

The GAO recommends that NSF provide for examination by its audit office of costs incurred under the subcontract to determine reasonableness and acceptability for the negotiation of further amendments or extensions of the subcontract.

The NSF arranged for an audit of GMI's costs incurred and an evaluation of GMI's firm-fixed-price proposal for the modification of day rates

applicable to an extension of the subcontract by the Los Angeles Branch Office of the Defense Contract Audit Agency (DCAA). The audit report was made available to and utilized by the University of California personnel during contract negotiations. Furthermore, the DCAA auditor who performed the audit participated during the negotiations as an advisor to the University of California personnel.

The GAO recommends that the Foundation take appropriate action to include an acceptable examination of records clause in all subcontracts negotiated in accordance with statutory requirements.

The FPR article entitled "Examination of Records by the Comptroller General" has been included in the amendment to the drilling subcontract between the University of California and GMI for the 36-month extension.

I hope that the comments of this letter and the discussions that NSF staff members have had with representatives of GAO have answered your questions and have provided a satisfactory review of your draft report. Again, I appreciate your efforts in reviewing this important and successful scientific program. We shall be pleased to furnish any additional information that you may require.

Sincerely yours,

H. Guyford Stever
Director

Enclosure

SUMMARY OF GAO RECOMMENDATIONS AND SUGGESTIONS

The following is a summary of actions and comments on the recommendations and suggestions listed in the draft report:

1. Implement the procedures needed to minimize the time required to publish core descriptions and distribute core materials to interested scientific investigators.

The following procedures have been implemented to minimize the time between the completion of a scientific cruise and the publication of the Initial Report volume for that cruise. The Foundation will initiate additional procedures, if required, in order to achieve a reasonable time interval of 12 to 14 months.

(a) The Foundation, through an interagency agreement with the Twelfth Naval District Printing Office, has obtained the services of a publication specialist who is assigned to the Scripps' project management staff as publication production manager.

(b) A uniform format has been developed to facilitate data compilation aboard ship.

(c) A project scientist is assigned to each leg with the specific responsibility of organizing and editing the preliminary scientific results with the objective of meeting the production schedule.

(d) A schedule of report-writing meetings and manuscript deadlines is established before the end of each leg.

(e) A more forceful effort and follow-up is being undertaken to assure that cruise scientists honor their written commitment to allocate the time necessary after the completion of the cruise to meet the production schedule.

(f) The assignment of overall responsibility to a chief science editor.

ENCLOSURE

A new sample distribution policy is being prepared and is expected to be approved by the Foundation in June 1972 for inclusion in all subsequent Initial Reports. This policy will divorce the distribution of samples from the publication of the reports and will permit qualified scientists to request core samples from repositories as soon as they become available. The time estimate is 12 months after the completion of a cruise.

[See GAO note 2.]

3. Implement procedures to ensure that the results of all studies involving core materials are maintained in a manner which will allow ready access to the scientific community.

The Foundation always has emphasized the need to assure that results of studies are readily accesible to the scientific community. A careful analysis will be made to determine if additional procedures and efforts over and above those in being need to be implemented. One area that will be considered is the dissemination in one document of all published studies. With regard to unpublished data from independent researchers, it would be an impractical and uneconomical task to collect such information.

An information accessibility and data retrieval system has been proposed by Scripps. The volume of important scientific information is reaching such proportions that a data search or synthesis on a particular subject is beyond the capability of individual investigators. An automated data base and retrieval system is being designed that will have a multi-parametric response. The data base will be derived from the principal categories of the Initial Reports, i.e., paleontological, sedimentological, geophysical, and geochemical; and the detailed parameters will be catalogued by centimeter depth increments within specific sections and cores. This data base will provide a systems approach to scientific parameters in the reports and will increase greatly the scientific value, saving investigators a significant amount of preresearch effort.

Interfaces with other geologic data facilities, particularly the National Oceanographic Data Center (NODC), have been investigated, and such an automated system will make a significant contribution to marine geology.

4. Take the necessary steps to insure that the policies needed to adequately control contract costs are established and implemented.

The Foundation has taken the necessary steps to insure that contract costs are effectively controlled. Other than the items previously mentioned, the program plan for the proposed four-year extension will provide the principal control mechanism. The Foundation has received the draft program plan for this extension and the policies developed during the existing term of the contract, including employment of personnel, significant departures from the program plan, and authorization for travel, will be incorporated in this program plan. The objective is to approve this program plan by July 1972. The DSDP monthly report provides NSF with the latest status, and, most important, the Foundation has an experienced representative at Scripps who is responsible for assuring that the project is conducted effectively, efficiently, and within the bounds of the program plan. He has been delegated limited contracting officer authority and field project management responsibilities. All correspondence requiring Foundation action is routed via him. His management on behalf of NSF is a principal means of assuring that the project stays within the authorized cost estimates.

5. Develop procedures to require that costs funded by NSF which are directly related to the Ocean Sediment Coring Program, and readily identified as such, be charged to the program [See GAO note 2.] to provide the Congress and NSF management with information necessary for assessing program costs and achievements.

The Foundation considers that the costs directly related to the OSCP are those identified in the NSF budget. Other costs associated with the program, such as ship site surveys and scientific research project support, are not considered an integral part of the direct program costs. The site survey work is considered to be a service function when needed, and the policy of the Foundation is to have all the costs for academic oceanographic ship support budgeted and controlled in one office. In the case of scientific research project support, the policy of the Foundation is to support the research community on competitive and quality levels. Within the priority of funds established for scientific disciplines, those investigators proposing research on the DSDP cores must compete for research support.

[See GAO note 2.]

6. Obtain assurance of the adequacy of measures taken by Scripps in satisfying itself that the prices negotiated for a subcontract extension are fair and reasonable based on certified cost and pricing data prior to approving any extension of the drilling subcontract.

(See comment below item 8 on page 5.)

7. Provide for examination by NSF's Audit Office of costs incurred under the subcontract to determine their reasonableness and acceptability for negotiation of further amendments or extensions to the subcontract.

(See comment below.)

8. Take appropriate action to assure that an acceptable examination of records clause is included in all subcontracts issued under negotiated prime contracts, in accordance with statutory requirements.

The University of California and the Foundation have followed the GAO recommendations with regard to negotiating the recent 36-month extension. NSF arranged for DCAA to perform an audit of the GMI proposal for the extension period and a DCAA auditor participated as an advisor to the university in the negotiations for the contract extension. The university obtained certified cost and pricing data from GMI. Further, GMI obtained approval from the Price Stabilization Board, through the Internal Revenue Service, for the price negotiated and has certified that the new day rates are in compliance with existing regulations. A provision has been included in the amendment to the drilling subcontract extension between the University of California and Global Marine, Inc., for GAO access to the records.

GAO notes:

1. Contract documents show that the project was extended for a 3-year period through June 1976.
2. Deleted comments refer to material contained in draft report but omitted from final report.

PRINCIPAL OFFICIALS

OF THE NATIONAL SCIENCE FOUNDATION

RESPONSIBLE FOR ACTIVITIES

DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
DIRECTOR:		
H. G. Stever	Feb. 1972	Present
R. L. Bisplinghoff (acting)	Jan. 1972	Jan. 1972
W. D. McElroy	July 1969	Jan. 1972
L. J. Haworth	July 1963	June 1969
DEPUTY DIRECTOR:		
R. L. Bisplinghoff	Oct. 1970	Present
Vacant	June 1970	Oct. 1970
L. Levin (acting)	Oct. 1969	June 1970
Vacant	July 1968	Oct. 1969
J. T. Wilson	July 1963	July 1968
ASSISTANT DIRECTOR FOR ADMINISTRATION (note a):		
T. Jenkins (acting)	Dec. 1971	Present
B. Sisco	Oct. 1969	Dec. 1971
ASSISTANT DIRECTOR FOR RESEARCH (note b):		
E. C. Creutz	June 1970	Present
Vacant	Oct. 1969	June 1970
DEPUTY ASSISTANT DIRECTOR FOR RESEARCH (note c):		
E. P. Todd	Jan. 1970	Present
R. M. Robertson	Nov. 1961	Jan. 1970

	Tenure of office	
	From	To
ASSISTANT DIRECTOR FOR NATIONAL AND INTERNATIONAL PROGRAMS (note b):		
T. B. Owen	June 1970	Present
Vacant	Oct. 1969	June 1970
DEPUTY ASSISTANT DIRECTOR FOR NATIONAL AND INTERNATIONAL PROGRAMS (note a):		
T. O. Jones	June 1970	Present
T. O. Jones (acting)	Oct. 1969	June 1970

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[a]Position established October 1969.

[b]These positions were authorized by Public Law 90-407 which amended the National Science Foundation Act of 1950, effective July 18, 1968, but were not established until October 1969 at which time responsibility for the Ocean Sediment Coring Program was transferred from the Assistant Director for Research to the Assistant Director for National and International Programs.

[c]Before October 1969, this position was designated as the Associate Director, Research.

U.S. GAO, Wash., D.C.

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