The original documents are located in Box 7, folder "9/4/74 HR13999 NSF Appropriation Authorization 1975" of the White House Records Office: Legislation Case Files at the Gerald R. Ford Presidential Library.

APPROVED
SEP 4 - 1974

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

AUG 28 1974

MEMORANDUM FOR THE PRESIDENT

Postal 9/4

Subject: Enrolled Bill H.R. 13999 - NSF appropriation authorization, 1975
Sponsor - Rep. Teague (D) Texas, and 24 others

Jo Archino 9/5

Last Day for Action

September 4, 1974 - Wednesday (Recommend that this bill be acted on before H.R. 15572, also enrolled, for reasons set forth in the paragraph at the end of this memorandum.)

Purpose

Authorizes appropriations for fiscal year 1975 for activities of the National Science Foundation.

Agency Recommendations

Office of Management and Budget	Approval
National Science Foundation	Approval
Department of the Treasury	No objection (Sec. 4)

Discussion

This is the annual appropriations authorization bill for NSF. It contains certain undesirable substantive provisions described below. Several were carried in earlier NSF authorization bills, and NSF does not believe they will create any significant new problems.

H.R. 13999 would authorize appropriations of $807.5 million for fiscal year 1975 in 12 line-item categories. In addition, it would authorize appropriations of $5 million in excess foreign currencies for expenses incurred outside of the United States. The two authorizations total $812.5 million

or $24.3 million more than the Administration's proposed 1975 budget request of $788.2 million. However, H.R. 15572, which is now enrolled, carries total appropriations of $768.15 million for NSF for fiscal year 1975, or more than $20 million below the 1975 budget request.

The Administration proposed a lump-sum authorization of appropriations for NSF. The line-item earmarking in H.R. 13999, while undesirable, has been a part of NSF authorization acts since fiscal year 1972, and has not greatly affected the agency's activities. Within the line-item earmarking, however, the enrolled bill also establishes certain "floors"; i.e., providing that "not less than" certain specified amounts shall be available for particular program categories. However, the bill requires only that funds from the appropriation be made available for these "floors," not that they be obligated.

We have opposed such floors in the bill since they tend to divert funds from higher priority programs and to reduce NSF's overall flexibility in programming its appropriation, which is usually lower than the authorization.

Several language provisions in H.R. 13999 might be noted briefly.

(1) One provision requires that no transfers of funds amounting to more than 10 percent of any line item may be made unless the Congress is notified 30 days in advance. A transfer could be made before the 30 days has elapsed if each committee with jurisdiction has indicated in writing that it does not object. This provision, while undesirable, was included in earlier NSF authorization acts and should pose no new problems.

(2) One provision in this bill which caused us serious concern when it was first included in the NSF authorization act for 1970 requires NSF to keep the appropriate substantive committees "fully and currently" informed with respect to all of its activities. At that time, the President issued a signing statement which expressed his concern that "voluminous reporting of detailed day-to-day activities...can be unduly burdensome without providing significant assistance to the Congress in discharging its legislative responsibilities." He indicated that the provision could raise a constitutional issue of separation of powers but that he believed that NSF

could comply with it in a constitutionally acceptable way. The provision was dropped in the 1971, 1972 and 1973 authorization acts but reinstated in the 1974 act. We understand that NSF has not experienced any particular problem with the provision.

In its views letter on H.R. 13999, NSF makes the following recommendation on the order of signing the bills which contain its appropriations authorization and actual appropriations:

> "Because the Enrolled Bill, H.R. 13999, and H.R. 15572 (the Appropriation Enrolled Bill) contain differing minimum and maximum requirements and dollar amounts, it is very important that the President approve H.R. 13999 first, and that he approve H.R. 15572 on a day following approval of H.R. 13999."

OMB's General Counsel concurs in this recommendation.

Wilfred H. Rommel

Assistant Director for
Legislative Reference

Enclosures

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

OFFICE OF THE
DIRECTOR

August 27, 1974

Mr. Wilfred H. Rommel
Assistant Director for
Legislative Reference
Office of Management and Budget
Washington, D. C. 20503

Dear Mr. Rommel:

This is in reply to your request of August 23, 1974, for the comments of the National Science Foundation on Enrolled Bill H. R. 13999, the "National Science Foundation Authorization Act, 1975."

The Enrolled Bill, H. R. 13999, authorizes an appropriation of $812.5 million, including $5.0 million in excess foreign currencies, for the NSF for FY 1975. This compares to the $788.2 million, including $5.0 million in excess foreign currencies, that would have been authorized by H. R. 12816, the Administration's bill as introduced by Congressman Teague. While the Enrolled Bill thus contains an authorization in excess of that provided in the President's Budget, H. R. 15572, the Appropriation Bill containing the NSF appropriation, which has already passed both Houses, provides for total appropriations of $666.35 million, including $4.85 million in excess foreign currencies. The Energy R&D Appropriation Act, (P. L. 93-322) additionally appropriates to the Foundation $101.8 million for FY 1975. This results in a total FY 1975 appropriation to the Foundation in the amount of $768.15 million, or $20.05 million below the President's Budget.

As it has for the last several years, the NSF Authorization Act contains a number of minimum dollar amounts to be available for specified purposes. Limiting the use of funds to not less than certain amounts for particular purposes, provisions which we have consistently opposed, has two major undesirable effects. It forces the increase in expenditures for some of the NSF program elements above the levels considered appropriate by the Foundation. The second effect is that when the appropriation act is passed, which is invariably below the total originally requested, we are forced to

divert from programs not subject to minimum expenditure requirements to make up the difference between the budget estimate and statutory minima. The result of these two effects is that some important science is penalized in order to over-support other programs initially considered less important. The Foundation is further constrained by the introduction in its appropriation acts of specific maximum expenditure limits as well as minimum expenditure limits which differ from those in the authorization act. These limits exacerbate the effects of the minimum limitations contained in the authorization act by further distorting the balance and interrelationships of our programs.

Another provision which we have had in authorization acts for the last three or four years is found in Section 6 of H.R. 13999. This provision limits the transfer of funds from one of the 12 line-items to another to ten percent of the transferree or ten percent of the transferor item whichever is less. Provision is made for a formal request to the Congress for transfers in greater amounts. However, to effect a transfer a report with justification for the requested transfer must be transmitted to the Speaker of the House and the President of the Senate, as well as to the NSF Oversight Committees in both Houses. If no action is taken by either Committee within 30 days, or if specific approval is given sooner, then the transfer can be effected.

Despite the existence of these statutory minimum requirements and the limitation on transfer of funds between line-items, we recommend that the President approve H.R. 13999.

Because the Enrolled Bill, H.R. 13999, and H.R. 15572 (the Appropriation Enrolled Bill) contain differing minimum and maximum requirements and dollar amounts, it is very important that the President approve H.R. 13999 first, and that he approve H.R. 15572 on a day following approval of H.R. 13999.

A section-by-section comparison of the Enrolled Bill and the Administration Bill, H.R. 12816, is enclosed.

Sincerely yours,

Lowell J. Paige
Acting Director

August 27, 1974

SECTION BY SECTION COMPARISON

ENROLLED BILL H.R. 13999	ADMINISTRATION BILL H.R. 12816
Section 1: This section authorizes by line item amounts (12 line items) NSF appropriations for FY 1975 totalling $807.5 million.	Section 1: This section authorizes NSF appropriations for FY 1975 in the amount of $783.2 million (with no line item amounts).
Section 2: This section sets minimum amounts to be available for certain NSF programs, as follows: Of the total amount authorized under §1 of the Enrolled Bill, not less than $10 million for "Institutional Improvement for Science," not less than $15 million for "Graduate Student Support," and not less than $70 million for "Science Education Improvement;" of the amount authorized in §1(2), "National and Special Research Programs," not less than $1.6 million for "Experimental R&D Incentives" and not less than $4 million for "Ship Construction/Conversion;" of the amount authorized in §1(6), "RANN", not less than $1 million for "Fire Research" and not less than $8 million for "Earthquake Research and Engineering;" and of the amount authorized in §1(10), "Science Education Improvement," not less than $1.5 million for "Science Faculty Fellowships for College Teachers," not less than $3.8 million for "Student Programs" (including "Undergraduate Student Projects" and "Student Originated Programs") and not less than $2 million for "High School Student Projects."	No comparable section.
See §5, below.	Section 2: Identical to §5 of the Enrolled Bill.
Section 3: This section permits appropriations made pursuant to the Act to be used in amounts not to exceed $5,000 for official consultation, representation, or other extraordinary expenses, to be expended at the discretion of the Director.	Section 3: Identical to §3 of the Enrolled Bill.

ENROLLED BILL H.R. 13999	ADMINISTRATION BILL H.R. 12816
Section 4: This section authorizes, in addition to funds authorized by section 1, an authorization not to exceed $5 million for FY 1975 for expenses of the Foundation incurred outside the United States, to be financed from foreign currencies which are determined to be in excess of the normal requirements of the United States.	Section 4: Identical to §4 of the Enrolled bill.
Section 5: This section provides that appropriations made pursuant to sections 1 and 4 shall remain available for obligation and expenditure for the period of time specified in appropriations acts.	Section 2: Identical to §5 of the Enrolled Bill.
Section 6: This section provides that no funds may be transferred to or from any line item listed in section 1 from or to any other line item in section 1 if the total so transferred would exceed 10% of either, unless: A. 30 legislative days have passed after the Director has notified, in writing, the Speaker of the House, the Vice President, and the Senate and House NSF Authorization Committees of the nature of the transfer and the reason therefor, or B. each authorization committee, before the above 30 day period expires, has notified the Director in writing that the Committee has no objection to the proposed action.	No comparable section.
Section 7: The Director of NSF is required to keep the NSF Congressional oversight committees "fully and currently" informed of all NSF activities.	No comparable section.
Section 8: This section cites the title of the authorization act, "The National Science Foundation Authorization Act, 1975."	Section 5: Identical to section 8 of the Enrolled Bill.

THE GENERAL COUNSEL OF THE TREASURY
WASHINGTON, D.C. 20220

AUG 28 1974

Director, Office of Management and Budget
Executive Office of the President
Washington, D.C. 20503

Attention: Assistant Director for Legislative Reference

Sir:

Your office has asked for the views of this Department on the enrolled enactment of H.R. 13999, "To authorize appropriations for activities of the National Science Foundation, and for other purposes."

The only provision of the enrolled enactment of interest to this Department is section 4 which would authorize the appropriation of not to exceed $5 million for expenses for the National Science Foundation incurred outside the United States to be paid for in foreign currencies which the Treasury determines to be excess to the normal requirements of the United States.

The Department would have no objection to a recommendation that the enrolled enactment be approved by the President insofar as section 4 is concerned.

Sincerely yours,

Richard R. Albrecht

General Counsel

AUG 23 1974

Director, Office of Management and Budget
Executive Office of the President
Washington, D.C. 20503

Attention: Assistant Director for Legislative Reference

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Sincerely yours,

(Signed) Richard R. Albrecht

General Counsel

AUG 26 1974

Director, Office of Management and Budget
Executive Office of the President
Washington, D.C. 20503

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Reference

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The Department would have no objection to a recommendation that the enrolled enactment be approved by the President insofar as section 4 is concerned.

Sincerely yours,

(Signed) Richard R. Albrecht

General Counsel

THE WHITE HOUSE
WASHINGTON

8/28/74

TO: WARREN HENDRIKS

RDL
Robert D. Linder

THE WHITE HOUSE

ACTION MEMORANDUM WASHINGTON LOG NO.: 548

Date: August 29, 1974 Time: 10:00 a.m.

FOR ACTION: Michael Duval
Phil Buchen
Bill Timmons

cc (for information): Warren K. Hendriks
Jerry Jones

FROM THE STAFF SECRETARY

DUE: Date: Tuesday, September 3, 1974 Time: 2:00 p.m.

SUBJECT: Enrolled Bill H.R. 13999 - NSF appropriation authorization, 1975

ACTION REQUESTED:

____ For Necessary Action

____ Prepare Agenda and Brief

____ For Your Comments

XX For Your Recommendations

____ Draft Reply

____ Draft Remarks

REMARKS:

Please return to Kathy Tindle - West Wing

PLEASE ATTACH THIS COPY TO MATERIAL SUBMITTED.

If you have any questions or if you anticipate a delay in submitting the required material, please telephone the Staff Secretary immediately.

K. R. COLE, JR.
For the President

THE WHITE HOUSE

WASHINGTON

September 3, 1974

MEMORANDUM FOR: MR. WARREN HENDRIKS

FROM: WILLIAM E. TIMMONS

SUBJECT: Action Memorandum - Log No. 548
Enrolled Bill H. R. 13999 - NSF appropriation authorization, 1975.

The Office of Legislative Affairs concurs in the attached proposal and has no additional recommendations.

Attachment

THE WHITE HOUSE

ACTION MEMORANDUM WASHINGTON LOG NO.: 548

Date: August 29, 1974 Time: 10:00 a.m.

FOR ACTION: Michael Duval
Phil Buchen
Bill Timmons

cc (for information): Warren K. Hendriks
Jerry Jones

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____ For Your Comments

____ Draft Remarks

REMARKS:

Please return to Kathy Tindle - West Wing

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Warren K. Hendriks
For the President

THE WHITE HOUSE

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ACTION REQUESTED:

____ For Necessary Action

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____ Prepare Agenda and Brief

____ Draft Reply

____ For Your Comments

____ Draft Remarks

REMARKS:

No objection
M.C.

Please return to Kathy Tindle - West Wing

PLEASE ATTACH THIS COPY TO MATERIAL SUBMITTED.

If you have any questions or if you anticipate a delay in submitting the required material, please telephone the Staff Secretary immediately.

Warren K. Hendriks
For the President

THE WHITE HOUSE

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ACTION REQUESTED:

____ For Necessary Action

XX For Your Recommendations

____ Prepare Agenda and Brief

____ Draft Reply

____ For Your Comments

____ Draft Remarks

REMARKS: OK

Mike Duval
8/29

Please return to Kathy Tindle - West Wing

PLEASE ATTACH THIS COPY TO MATERIAL SUBMITTED.

If you have any questions or if you anticipate a delay in submitting the required material, please telephone the Staff Secretary immediately.

Warren K. Hendriks
For the President

93D CONGRESS } HOUSE OF REPRESENTATIVES { REPORT
2d Session } { No. 93-995

AUTHORIZING APPROPRIATIONS TO THE NATIONAL SCIENCE FOUNDATION

APRIL 15, 1974.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

Mr. TEAGUE, from the Committee on Science and Astronautics, submitted the following

REPORT

together with

ADDITIONAL VIEWS

[To accompany H.R. 13999]

The Committee on Science and Astronautics, to whom was referred the bill (H.R. 13999) to authorize appropriations for activities of the National Science Foundation, and for other purposes, having considered the same, report favorably thereon without amendment and recommend that the bill do pass.

PURPOSE OF THE BILL

The purpose of the bill is to authorize appropriations to the National Science Foundation for fiscal year 1975 in the amount of $783.2 million out of money in the Treasury not otherwise appropriated and $5 million in foreign currencies which the Treasury Department determines to be excess to the normal requirements of the United States.

CONTENTS

SUMMARY OF COMMITTEE RECOMMENDATIONS

BUDGET REQUEST

The President's budget included a request for $788.2 million for the National Science Foundation. This represents an increase in the Foundation's budget over FY 1974 obligations of $142.0 million, the bulk of which is associated with new initiatives in energy-related research and development.

COMMITTEE RECOMMENDATIONS

The Committee on Science and Astronautics recommends that the full amount of the authorization request, $788.2 million be authorized. H.R. 13999 authorizes that sum, but with certain adjustments within the twelve budget categories.

INCREASES IN BUDGET CATEGORIES

Reflecting the Committee's desire to adjust the priorities reflected in the recommended budget, the following increases in five of the twelve line items contained in Section 1 of the bill were made:

Science Education. The Committee added a total of $15 million to the three line items covering science education. This increase is distributed as follows: for Institutional Improvement for Science, an increase of $7 million bringing the total to $10 million; for Graduate Student Support an increase of $.5 million, bringing the total to $13.2 million; and for Science Education Improvement an increase of $7.5 million, bringing the total to $68.9 million.

Experimental R. & D. Incentives. The Committee increased the program category "National and Special Research Programs" by $1.2 million in order to provide $2.2 million for the Experimental R. & D. Incentives Program.

Science Information Activities. The Committee restored $3.3 million to this category bringing the total authorized to $8.3 million.

DECREASES IN BUDGET CATEGORIES

To offset the increases which total $19.5 million, the Committee made the following reductions which also total $19.5 million in two of the line items:

Scientific Research Projects. The request for this program category was reduced by $9.7 million to $354 million. This leaves an increase in the Scientific Research Project Category over last year of $62.7 million.

Research Applied to National Needs (RANN). The request for this program category was reduced by $9.8 million to $139.1 million. This leaves an increase in the RANN category over last year of $64 million.

MINIMA FOR HIGH-PRIORITY PROGRAMS

The Committee, in order to insure that certain program activities which are judged to be of high priority be funded, placed the minima in the amounts shown on the following items:

	Millions
Institutional improvement for science	$10.0
Graduate student support	13.2
Science education improvement	68.9
Experimental R. & D. incentives	2.2
Fire research	2.0
Science faculty fellowships	1.5
College student science education	3.8
High school student projects	2.0

NSF FUNDING HISTORY

The history of authorizations and appropriations for the NSF in the previous 5 years is contained in the table below:

NATIONAL SCIENCE FOUNDATION FUNDING HISTORY

[In millions of dollars]

	Fiscal years—					
	1970	1971	1972	1973	1974	1975
Authorizations:						
Administration request	[1] 490.000	[2] 500.000	[1] 622.000	[3] 653.000	[1] 582.600	[11] 788.2
House committee recommendation	[1] 480.605	[2] 527.630	[1] 622.000	[3] 680.800	[1] 612.9	[11] 788.2
House authorization	[1] 480.605	[2] 527.630	[1] 622.000	[3] 680.800	[1] 612.9	----------
Senate committee recommendation	[1] 490.150	[2] 550.000	[1] 706.500	[3] 727.000	[1] 646.1	----------
Senate authorization	[1] 490.150	[2] 550.000	[1] 706.500	[3] 727.000	[1] 646.1	----------
Total authorization	[1] 480,605	[2] 539.730	[1] 655.500	[3] 703.900	[1] 635.6	----------
Appropriations: [4]						
Administration request	[1] 500.000	[2] 513.000	[1] [5] 623.150	[3] [10] 687.318	[1] 582.600	[11] 788.2
House committee recommendation	[2] 420.000	[2] 497.000	[1] 585.000	[3] [7] 652.320	[1] 564.6	----------
House appropriation	[2] 420.000	[2] 497.000	[1] 585.000	[3] [7] 652.320	[1] 564.6	----------
Senate committee recommendation	[1] 461.000	[2] 513.000	[1] 623.150	[3] [8] 639.160	[1] 594.6	----------
Senate appropriation	[1] 461.000	[2] 522.500	[1] 648.150	[3] [8] 639.160	[1] 594.6	----------
Total appropriation	[2] 440.000	[2] 513.000	[1] 622.000	[3] [9] 645.740	[1] 569.6	----------
Obligations	[2] 462.618	[2] 496.400	[1] 600.720	[6] [9] 615.001	[12] 577.4	----------

[1] Includes $3,000,000 excess foreign currency.
[2] Includes $2,000,000 excess foreign currency.
[3] Includes $7,000,000 excess foreign currency.
[4] Includes national sea grant program obligations: fiscal year 1970, $8,974,000; fiscal year 1971, $13,188,000; fiscal year 1972 and following: None.
[5] Greater than authorization request due to Federal salary increase of $1,150,000.
[6] Includes $5,000,000 excess foreign currency.
[7] Includes $26,320,000 for 4 Antarctic airplanes in supplemental.
[8] Includes $13,160,000 for 2 Antarctic airplanes in supplemental.
[9] Includes $19,740,000 for 3 Antarctic airplanes in supplemental.
[10] Includes $1,418,000 due to Federal salary increase, and $32,900,000 for 5 Antarctic airplanes in supplemental.
[11] Includes $5,000,000 excess foreign currency.
[12] Includes $3,000,000 excess foreign currency plus $2,657,000, prior year carryover in this category.

EXPLANATION OF BUDGET CATEGORIES

1. SCIENTIFIC RESEARCH PROJECT SUPPORT $354,000,000

Authorization, fiscal year 1975

Atmospheric Sciences	14,200,000
Earth Sciences	13,300,000
Oceanography	15,500,000
Biological Sciences	83,100,000
Physics	43,600,000
Chemistry	36,100,000
Astronomy	11,200,000
Mathematical Sciences	16,600,000
Social Sciences	28,300,000
Engineering	36,900,000
Materials Research	44,200,000
Computing Activities	11,000,000
Total	354,000,000

The major objectives of the Scientific Research Project Support (SRPS) program are to strengthen the scientific research potential of the Nation, to promote the progress of science, and to help to provide the broad base of scientific understanding needed to address major problems confronting the Nation such as energy, environmental quality, and others. These objectives are achieved by supporting a substantial portion of the Nation's fundamental research in the various fields of science.

The *Scientific Research Project Support* program serves to:

Augment our stock of knowledge and understanding of natural laws and phenomena, fundamental life processes, fundamental processes that influence man's environment, and the forces impacting on man as a member of society, as well as on the behavior of his societies.

Support a general purpose national capability in all fields of science by providing for continuing research on the frontiers of knowledge, by modernizing instrumentation, and by developing research resources.

In FY 1975 the *Scientific Research Project Support* activity will provide support for the physical, environmental, biological, engineering, computing, and social sciences. In each of these scientific areas special attention will be given to that fundamental research that shows promise of augmenting our knowledge of energy sources, processes, and uses.

The basic reason for support of scientific research projects is to augment our stock of knowledge and keep our country in the forefront of human understanding, so that it will be better able to deal with the changing problems of a modern industrialized society. Such knowledge is a fund of capital from which information can be drawn for applications leading to future payoffs and the avoidance or mitigation

of mistakes in all fields of human endeavor. Scientific research is undertaken to expand the general competence of the Nation's people to use and live with nature, and to obtain the answers to specific questions regarding natural and social phenomena. Studies of phenomena, whose understanding has some potential for improving our discovery, production and thoughtful utilization of energy, are among the specific questions addressed in this research program.

While scientific research is undertaken to answer questions about phenomena and unknowns in man's natural and social environment, new knowledge is also relevant to his present and future needs. New products, new processes, and new applications do not emerge full grown. Basic science is a long-term investment in the national welfare and has a continuing payoff. Some short-term payoffs result, but more important are the longer-term payoffs that result from the accumulation of permanent additions to our stock of knowledge. These payoffs are founded on new principles and new conceptions which in turn are painstakingly developed by research in basic science.

Fundamental research is important not only to provide solutions to some specific or general class of scientific problem, but also to increase the options that decision makers can apply in the future.

The National Science Foundation is the only Federal agency charged with maintaining the general overall health of the science enterprise of the United States. The *Scientific Research Project Support* activity provides support for the most outstanding research proposals submitted from universities, colleges, and other research oriented institutions located throughout the U.S. The individual scientists and groups of scientists provide an effective capability to capitalize on new scientific understanding, to be ready for the new problems the future will bring, and to exploit new scientific knowledge generated throughout the world. Because of this strong research base we are in a position to expand our short and long range efforts on important energy-related problems.

The FY 1975 Budget for *Scientific Research Project Support* is based on a considered judgment on opportunities and priorities identified by the National Science Board and the scientific community which have been evaluated in the light of recent Administration and Congressional guidance. These considerations have served to emphasize the priority of *Scientific Research Project Support* as a whole and have helped establish current priorities among the various fields of science. Among the considerations were important needs for more fundamental research to help solve energy-related problems, new and unusual scientific opportunities, and the problems of maintaining a high quality of research in the several disciplines on a national scale as the shorter range needs of other agencies for research in these disciplines change.

The fundamental inquiries undertaken through general research have a key role to play in the Administration's goal of achieving a national self-sufficiency in energy requirements. Research efforts will be conducted which have potential relevance toward solving both short-term and long-term energy-related problems. The long range investment of energy-related general research to be supported in this program complements our shorter range efforts. Such research will open up new options. Existing technologies cannot keep up with the

habits and demands of the population. We cannot afford to gamble that either our short- or long-term energy needs will adequately be covered by even the most clever use of presently known materials and processes.

Several technologies for energy which are "nearly" developed still depend crucially on a few pieces of information or on special materials not now available. Other processes depend on discoveries which we hope will be made in the course of a planned research program. A reliable coal liquefaction program, for example, cannot be developed without concurrent vigorous studies of catalysis, organic chemistry, sulphur chemistry, chemical kinetics, thermodynamics and materials. Fusion reactors depend on behavior of plasma under conditions not yet established in the laboratory. We must increase our understanding of the behavior of people under various kinds of incentives or regulations and different types and supply of energy. Furthermore, we must increase our understanding of the impacts of various energy supply and utilization patterns on world economic, ecological, and environmental systems.

While the *Scientific Research Project Support* activity supports research usually related to many objectives, a more selective approach will be used in FY 1975 to orient some of the research to those inquiries evaluated as most likely to have a potential impact or promise on energy resource discovery, production, conservation and use. Parallel research will be conducted on environmental effects.

Energy-related general research support in this Budget Activity will be directed to the following areas as recommended in the report to the President, *The Nation's Energy Future:* Materials research; chemical, physical, and engineering studies bearing on energy; basic biological research; plasmas; mathematical and social studies; pollutant characterization, measurement, and monitoring; environmental transport systems; and environmental effects and assessment.

Today's strong technology has been made possible by research done years ago. The future health of the nation's economy depends on an appropriate investment in research today.

The various modes of research support include: grants supporting individual scientists, coherent area groups, large-scale organized projects, instrumentation centers and biological research collections; and support provided for visiting scientists at National Research Centers. The more aggregative modes of research support are utilized when the nature of the science makes team or organized approaches beneficial. Also many grants to individual scientists enable them to utilize the facilities of observatories, accelerators, and other laboratories. Research by individual scientists is expected to continue to be the major type of research support because of its appropriateness for much of the science proposed, its inherent flexibility, and its broad suitability to the academic environment.

The *Scientific Research Project Support* program in FY 1975 will provide $354.0 million in research projects to extend scientific understanding. In FY 1975 some 4,500 research projects will have shown such progress as to warrant continuation. About 35 percent of the program or some 2,500 new research efforts will be initiated. Each year as projects are completed some older and less competitive facilities are

also phased out. In this way the program is geared to the continual production of new knowledge. Some recently completed research projects are listed in the sections that follow along with new program thrusts and emphases.

The 6,790 research grants to be awarded in FY 1975 will support 5,500 scientific man-years and about 8,700 graduate students. In addition some $28.6 million will be provided for purchase of permanent equipment and modern instrumentation.

At present, support of projects by the *Scientific Research Project Support* activity is concentrated in academic institutions and in certain non-profit research institutions which function essentially as a part of the academic science community. Most of the research supported is basic in character, although a few research projects of a more applied nature are also supported, especially in disciplines such as environmental science and engineering, where the boundary line between basic and applied research is even less definite than that in most areas of science. Even here, however, the *Scientific Research Project Support* program generally supports research for application to a class of problems, not for a solution to a specific problem.

Although most industrial research is more directed to product development rather than to the fundamental and methodological research supported in this Budget Activity, every effort is being made, through such instruments as workshops and conferences, to insure that research, in such areas as engineering, include studies of unknowns and problems that industry foresees but does not find profitable to study currently because of pressures for immediate and near term payoffs. Furthermore, efforts will be undertaken to expand industrial participation in energy research both because of energy's direct importance to industry and because of certain special capabilities applicable to energy problems.

The National Science Foundation's activity of *Scientific Research Project Support* for 1975 helps to achieve the important national objectives of science previously stated. The activity also helps accomplish specific research goals that have been identified by the National Science Foundation and the scientific community for the various major science disciplines. These goals are set forth in the detailed statements that follow.

ATMOSPHERIC SCIENCES $14,200,000

The objective of the Foundation's Atmospheric Sciences research program is to build a base of fundamental knowledge about the atmosphere to encompass the entire range of atmospheric phenomena. Research includes studies of the atmosphere from the surface of the sun to the surface of Earth as well as the atmosphere of other planets.

In FY 1975, the research emphasis in the lower atmosphere will continue to be on the dynamics of regional scale weather and the physics of clouds including some energy related reseach. In the upper atmosphere, research will begin on work related to the International Magnetospheric Study proposed for 1976–79. The International Magnetospheric Study (IMS) is a developing international cooperative research effort designed to gain a thorough understanding of the dynamical processes operating in the plasma and field environment of the

earth. The IMS would be a broad scale coordinated research program of observations made from the ground, aircraft, balloons, and rockets. As a cooperative interdisciplinary program, IMS would constitute by far the largest element in the total effort in Solar Terrestrial research for the rest of the decade.

Considerable atmospheric sciences research is energy related. Additional climatological research efforts are needed for better utilization of our natural systems as energy sources. The climatic effect of air pollutants is a long-term problem about which there is much discussion and speculation. The perturbation caused by man-made pollutants may well be an important item. One of the critical assessments of environmental concern for decision making regarding energy is that of regional climatic trends. More must be known of the most effective ways to use improved weather prediction for energy use. Research studies are required on the turbulent mixing in the atmosphere and in the oceans, variations in solar radiation, and the reduction of solar input by clouds and precipitation.

Aeronomy

The objective of the Aeronomy program is to develop an understanding of the upper atmosphere of the earth and the other planets. In the upper atmospheric region the ionosphere controls radiowave propagation, spectacular displays of northern lights occur, and the night sky glows. To gain understanding of the many complex physical phenomena involved, the program supports a broad spectrum of laboratory, theoretical, and field studies, involving processes of ionization, recombination, chemical reaction, photoemission, and transport. Investigations of atmospheric composition and plasma instabilities are supported. Funds are provided for research on the coupling of the ionosphere to the magnetosphere above and to the denser atmosphere below.

Meteorology

The Meteorology program supports a broad spectrum of research on the dynamics, physics, and chemistry of the lower atmosphere and stratosphere. The objective of the Foundation's Meteorology program is to increase fundamental knowledge on the behavior of the lower atmosphere and the stratosphere of the earth and the atmospheres of other planets. Studies in the related fields of fluid dynamics, chemical reactions, remote measuring techniques, radiative transfer and nucleation are also supported when the results will clearly be applicable to the advancement of our knowledge of the behavior of the lower atmosphere.

The program supports studies of cloud physics including the mechanisms of rain, snow, and hail formation and of lightning production. The major reason for the increase in FY 1975 is to strengthen the national program in cloud physics research by university groups. Several cloud physics programs that previously were funded under weather modification projects will be included.

The Meteorology program also supports several energy-related studies. Examples are the chemical studies involving sulphur dioxide reaction, the formation of aerosols, and the global increase in trace

gases such as carbon dioxide. Also energy-related are climate studies, including both global and regional climate. Understanding the basic mechanism of climate change is an important factor for predicting energy requirements and water availability.

Solar-Terrestrial

Solar-terrestrial research is concerned with the particle, field and radiation environment of the sun and earth, their origin, interactions, and the dynamical processes involved. The objectives of this research are:

To achieve a physical understanding of the quiet and disturbed sun, its transfer of matter, energy, and fields into interplanetary space, and the resultant effects on the terrestrial environment.

To increase the level of quantitative knowledge about the cause-and-effect relationships among the dynamical processes which occur in the earth's magnetosphere, its coupling to the ionosphere below and to interplanetary space above.

To utilize the earth's magnetosphere as a unique space laboratory for observing fundamental plasma processes which are difficult to simulate in terrestrial laboratories.

EARTH SCIENCES $13,300,000

The earth is limited in size and total resources. We must, therefore, conserve and utilize its resources for the benefit and survival of man. Research in the earth sciences is predicated on the principle that the more we know about the earth the better we will be able to use it without destroying it or making it uninhabitable. Thus, the objective of the Earth Sciences program is to provide a better understanding of our planet, for both scientific and very practical reasons.

During the past few years, the science of geology (or Earth Sciences) has undergone a major revolution. Commonly referred to by terms such as "sea-floor spreading" or "plate tectonics," this revolution has provided us for the first time with a working model for the earth as a whole, with a working hypothesis of how the major features of the earth's surface have been formed and changed, why mountains are where they are, how they relate to earthquake zones and ore deposits and, more importantly, a possible key to the basic driving forces that regulate the dynamic processes affecting the outer crust of the earth. The concept has enormous scientific and economic potential to explore the origin and locations of earthquakes, volcanoes, faulting, and the formation of mineral deposits.

This concept holds that the earth's outer shell is made up of a small number of very large plates that move relative to each other. They diverge at ocean ridges where new material rises from the depths to fill the void. In areas like Alaska they collide and the old lithosphere is underthrust. In California they slide horizontally against each other.

Recognizing the potential of this new theory, the International Union of Geodesy and Geophysics (IUGG) and the International Union of Geological Sciences (IUGS) joined in 1970 in proposing an international scientific effort, the International Geodynamics Program. This program has been endorsed by the International Council of Scientific Unions, and some 45 nations are participating.

Because the new plate tectonics theory (and the International Geodynamics Program) involves the most fundamental bases of geologic thinking, it is all-pervasive in the Foundation's Earth Sciences program, and is easily subsumed under the old rubrics such as structural geology, earthquakes, ore deposits, volcanism, etc. But the focus of many projects is now on how these studies fit or do not fit the new theory, where the theory is accurate, and where it misses the mark.

The plate tectonics theory has given us a fundamental understanding of the global aspects of earthquakes. This new knowledge, coupled with a rapidly increasing knowledge of the mechanism of earthquakes and the properties of rocks has rekindled optimism that it may someday be possible to predict earthquakes accurately.

Much of the current Earth Sciences program is related to the investigation of phenomena that bear on the plate tectonics theory. About $2.5 million is so directly focused on major components in FY 1974 that it can be considered a part of the proposed U.S. International Geodynamics Program. $1.9 million of the increase for the FY 1975 program will be used almost entirely in support of new projects that also would be suitable for a possible International Geodynamics Program plus projects in the closely related field of earthquake study and prediction.

Research in the earth sciences contributes to the energy program in providing a better understanding of vital energy-related environmental problems (i.e. the siting of dams and power plants, transport of pollutants through the near surface environment) as well as contributing to a fundamental understanding of the occurrence of such natural energy resources as fossil fuels and geothermal energy.

The Foundation's research program in the Earth Sciences is subdivided into three programs, Geology, Geochemistry, and Geophysics. These three subfields are parts of an integrated whole, all of which is pervaded by the new plate tectonics theory.

Geology

The objective of the Foundation's Geology research program is to increase understanding of the rocks of the earth's crust and the processes that formed them. The studies range from investigations of the most ancient rocks in the centers of continents to modern environments along present-day beaches, rivers, glaciers, and volcanoes. An increasing emphasis in geological research is on studies providing data of direct bearing on the testing of plate tectonics theory.

The Geology research program also supports a variety of investigations that attempt to model or duplicate in the laboratory certain natural geological phenomena. Such research is aimed at gaining a better understanding of complex and important environmental problems such as, for example, those involving stream erosion and sedimentation.

Many of the Geology program field-oriented studies bear importantly on problems involving our natural resources—where ore deposits occur, why they occur where they do, and how they came into being. In addition, studies of modern and ancient environments are revealing a fundamental understanding of natural energy resources by providing data not only with regard to ancient strata as energy

reservoirs but also to processes by which certain materials (plant debris) are transformed into energy resources (coal).

Geochemistry

The objective of the Geochemistry program is to apply chemical theory and methods to problems in earth science, in order to determine the compositions, ages, histories, and origins of natural materials, and experimental studies in order to understand such problems as the melting of rocks deep within the earth, the formation of ore deposits, and the cycles of chemical species through the earth. Practical results from these studies help to understand present-day volcanoes and geothermal systems, to find and develop ore deposits, and to detect, trace, and control hazardous pollutants in the biosphere.

Major progress in geochemical research has resulted from the spectacular improvements in instrumental and analytical capability during the past few years. Chemical elements whose concentration is less than a part per million can now be measured and used as chemical tracers to understand natural processes. Isotope ratios of elements can be determined precisely enough to give accurate measurements of the ages of rocks or of the temperatures at which they were formed. New advances in equipment design now allow scientists to reproduce in the laboratory the pressures and temperatures prevailing deep within the earth. Studies with such equipment will contribute to our knowledge of plate tectonics.

The Geochemistry program supports basic studies which contribute to energy utilization and pollution control: new instrumental techniques for pollution analysis; studies of hydrothermal and ionic solutions; transport of pollutants through the near-surface environment.

The Geophysics program supports research concerned with physical properties of the solid earth—its dimensions, structure, force fields and dynamic processes. Interpretation of field magnetotelluric measurements, seismic wave velocities, and of gravity and heat flow delineate the structure and physical properties of the earth at depths below which we cannot drill. Seismicity studies outline the plates that make up the earth's surface and trace the descending portions to great depths beneath the surface. Magnetic studies determined the rate of sea floor spreading whereas paleomagnetic studies determine the latitude and orientation of the plates in the past. Laboratory studies of the physical properties of earth materials at the pressures and temperatures existing deep in the earth are a necessary complement to field measurements. Conduct of the above studies, which would constitute the heart of the proposed International Geodynamics Program, is a major objective of the Geophysics program.

Earthquake research constitutes the second major objective of the Geophysics program. Plate tectonic theory, together with rapidly increasing knowledge of earthquake mechanisms and rock properties now make earthquake prediction a possibility.

Studies of continental heat flow, geothermal noise, magnetotelluric studies in thermal areas, and volcanoes are fundamentally related to the exploration for geothermal energy. In the environmental effects area, seismicity and earth motion studies are directly related to the siting of large dams, nuclear power plants and other such installations.

OCEANOGRAPHY ---------- $15,500,000

The Foundation's research program in Oceanography provides support for basic research projects that promote the understanding of the origins of ocean basin features and marine life and that promote the discovery of the natural laws that govern the movement and chemical transformation of ocean waters and sediments. Physical Oceanography research extends from mathematical description of global ocean circulation down to small scale processes that determine the character of bays and coastal ocean areas. Chemical Oceanography research ranges from studies of processes in seawater to the basic chemical reactions involved in man-made alterations of bays and harbors. Submarine Geology and Geophysics cover the history of the ocean basin, including sea floor spreading and plate tectonics, as well as processes that produce mineral deposits. Biological Oceanography research is concerned with analysis of food chain dynamics and ecosystem energetics and studies of life cycles and ecology of individual species.

In Fiscal Year 1975, the oceanography research program will emphasize selected aspects of the various sub-fields. An increase in support is planned for studies of physical and chemical processes in coastal areas. Support for studies of geological materials from polar regions will also be increased. These increases represent an effort to build on recent advances. The increases will also take advantage of recently obtained samples of the cores obtained through the Foundation's Deep-Sea Drilling Project (Ocean Sediment Coring Program) and will permit a greater scientific return from these valuable samples.

Adaptations of marine organisms to the high pressures in the oceanic depths will be studied and new instruments will be developed to detect and capture organisms living at mid-depths in the oceans.

An increase in support is planned for energy related basic research and for studies of environmental effects. These studies will include processes controlling pollutant movements, physical properties and geochemistry of sediments, and biological effects of toxic substances.

Physical and Chemical Oceanography

Research activities in physical and chemical oceanography are concerned with the physical properties, chemical composition and transformations, and the movements of waters in the oceans and large lakes.

Specific objectives of this program are to support research on:

Physical processes of the ocean and air-sea interaction.

Physical and chemical processes in large lakes.

Chemical processes in seawater, involving naturally occurring and man-made compounds.

Transport processes controlling thermal and other pollutants in coastal and estuarine waters.

Submarine Geology and Geophysics

The research program in marine geology and geophysics seeks to add to man's understanding of the history of seawater and the ocean basins, the sediment deposits in them, and of ancient marine life. Marine geophysical research contributes to the knowledge of the oceans, ocean basins, and deposits using various physical techniques.

The major objectives of this program are to provide support for research on:

Physical, chemical, and biological processes involved in the formation and alteration of the sediments of the ocean floor and continental margins.

Crust and upper mantle in ocean basins with emphasis on plate tectonics and interactions between the plates.

The correlations between variations in the geomagnetic field strength, climatic variations, volcanic activity, and abrupt evolutionary changes in marine micro-organisms.

Biological Oceanography

Biological oceanography supports basic research on the nature and distribution of life in the ocean and marine ecosystems as well as studies of interactions between organisms and the marine environment.

The objectives of this program are to support research on:

The kinds of organisms living in the ocean and their distributions, behavior, interaction, and nutrition.

Interactions between marine organisms and their environment.

Functioning of marine ecosystems and development of simulation models that can predict the behavior of marine ecosystems.

Rates and mechanisms of transfer of metals and other toxic substances into organisms and adaptations and tolerances of organisms and ecosystems to toxic substances and thermal stresses.

BIOLOGICAL SCIENCES $83,100,000

The Biological Sciences program supports research and research-related activities that have among their principal objectives:

Advancing understanding of the structure-function relationships of biological molecules and their organization in cells which underlie the activities of living organisms. Such studies are especially pertinent for a full understanding of enzyme catalysis, energetics and metabolism.

Advancing understanding of the properties and interactions of cells and their changes with time. This knowledge is fundamental for providing insights into such complex problems as gene expression, the immune response, neural behavior, and aging.

Advancing understanding of organisms and their interactions and organization at population, community and ecosystem levels. Insights from this research are applicable to environmental pollution, food production and the effective use of resources in energy production and conservation.

Within the broad scope of the programs presented in the following section, the environmental areas will receive a major increase in funding for population biology, tropical ecology and evolution, the biological bases for the control of pests, and research needed to assess productivity and environmental impacts of energy production schemes. The support of research collections and genetic stock centers will be augmented. In the cell area, funding for biosynthesis, for assembly and function of organelles and for work on plant, animal and human cells will be increased. Major increases will be provided for research on molecular studies of enzymes to extend our understanding of catalysis and on mechanisms of photosyntheses and energy capture and utilization in plants and microbes.

Cellular Biology

The program emphasizes research which will augment our understanding of how cellular components are organized to form a coordinated but flexible unit—the cell. We can think of different classes of cells as being programmed to express certain capabilities. The broad objectives are to understand these programmed capabilities and the dynamic control of their expression. They are promoted through research in three primary areas: Genetics, which emphasizes mechanisms of genetic transmission and expression; Developmental biology, which focuses on mechanisms underlying cell changes in organisms as they pass from the embryonic to adult state; and Human Cell Biology, which examines features of animal cells in culture with special emphasis on human cells.

Ecology and Systematic Biology

The program encompasses research to develop a thorough knowledge of organisms, mechanisms of evolution, and ecological systems. Essentially all of the research in systematics and ecology is oriented toward understanding the ecosystem and hence underpins our knowledge of environmental changes associated with energy production.

An effective policy of energy production and utilization must take into account the many factors that operate in the ecosystem. Assessment of the consequences of disturbing natural systems, changing the physical environment, or introducing new or increased amounts of chemicals must be based on a knowledge of the plants and animals originally present and of the way in which these are influenced by each other and by environmental factors. Knowledge presently available has proved to be inadequate, and will become increasingly so as greater attention is given to solving the nation's energy problem. Consequently, an increase in the level of the collective research efforts described below is required to provide the framework from which energy and natural resource problems can be approached more effectively.

In Systematics work will be done on the identification and characterization of biotic diversity and its classification into higher order categories reflecting the evolutionary inter-relationships of organisms. Objectives in supporting Systematics are to:

Continue balanced support of research within the spectrum of organisms through descriptive, experimental, and populational approaches.

Foster projects carefully designed to sample endangered biotas including baseline descriptive accounts focused on improving environmental impact studies.

Expand the base of support for systematic collections and develop a plan for their management and utilization at a national level including increased use of electronic data processing in providing greater accessibility to the vast amounts of data available.

In General Ecology, an understanding of the interactions of component species populations within various terrestrial and inland water

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ecosystems is emphasized. This includes population ecology, community interactions, and regulation of populations within undisturbed and/or man-modified environments. The objectives of general ecology are to promote research on the:

Dynamic attributes of the component species populations; regulatory, behavioral, ecophysiological, and ecogenetic.

Interactions between species populations with regard both to their biochemical basis and their adaptive significance.

Ecosystem dynamics, including the regulation of pest populations in agro-ecosystems, and responses of natural ecosystems to manipulation, biogeochemistry, and paleoecology.

In ecosystem studies, data gathering and analysis center about those things which together form systems—processes and variables in state. Studies of state variables are oriented toward the quantification of the amounts of commodities (e.g. nutrient elements, carbon, and water) present in the system, and how they are partitioned among compartments (e.g., plant and animal biomass, dead material, and soil water). Process studies deal primarily with the manner and magnitude of the flow of the commodities among the compartments and the physical and biological constraints which mediate the flow.

Ecosystems are commonly classified according to their geographic location, the most prominent vegetation, and the amount of water present. The objectives of ecosystems research are to analyze the structure and function of individual ecosystems and compare diverse ecosystems. From the study of system similarities principles will emerge which form the core of ecosystem theory. Analysis of differences can elucidate the nature and implications of specific adaptation and modification of component parts or entire ecosystems to meet the constraints of a particular locale.

Molecular Biology

Molecular Biology is concerned with the chemical and physical properties and complex interactions of molecules involved in biological function. At one end of the spectrum it deals with the isolated and purified molecule, at the other with the aggregation of one or more classes of molecules into complex structures in an attempt to understand the mechanisms whereby cell structures achieve high degrees of internal order and coordinated function. Knowledge from this class of research relates directly to energy transduction and catalytic mechanisms used by living organisms and ultimately should find application in the development of innovative energy-conserving processes. The objectives of the program are to:

Acquire and interpret data to improve our understanding of the chemical interactions of macromolecules.

Improve knowledge of biological catalysis, biochemical reactions, and the energetics of the associated chemical change.

Advance instrumentation and analyses applicable to the study of macromolecular systems.

Physiological Processes

Metabolism constitutes the sum total of all processes of living organisms involved in the building up and destruction of protoplasm. Each of the two phases of metabolism is individually important, but the

pathways and physiological mechanisms by which these processes are integrated and regulated within cells and organisms remain an elusive problem. Most metabolic processes involve chemical changes in which energy is provided for reactions and/or synthesis of new materials utilized in the repair of existing cells or the creation of new cells. Energy is required also for such processes as growth, reproduction, movement, etc. The broad objectives of the program focus on research which has the greatest potential for contributing to our knowledge of the physiological control and energetic processes associated with these phenomena. Such knowledge is required to obtain the maximum net energy yield from managed biological systems.

The adaptiveness and remarkable efficiency of biological systems can be mimicked for innovative energy production and utilization schemes only if adequately understood. Two key examples may be given: use of biological nitrogenfixation can lead to reduced requirements for nitrogen fertilizers and therefore a consequent reduction in energy expenditures required for the removal of nitrogen compounds which accumulate in soil and water. Improved understanding of the basis for differing efficiencies of utilization of solar energy by plants should contribute to reduction in the energy required for agricultural production.

Psychobiology and Neurobiology

How does a homing pigeon find its way home? How does a rat learn to avoid poisoned bait? How different are the cognitive abilities of apes from those of man? How can we solve problems requiring the visualization of objects not physically present? How can we enhance children's learning abilities or the techniques used to teach them? Increasing our knowledge of such behavioral phenomena is the objective of the Psychobiology program, which supports field and laboratory research of human and animal behavior. Such research is leading to exciting new conceptions of the psychological processes and physiological mechanisms underlying behavior, of the genetic and environmental determinants of behavior in the individual and in the species, and of the role of behavior in adapting individuals to physical, biological, and social aspects of their environment.

Man has long been fascinated with the most complex, and probably least understood of his bodily structures, the brain. Since virtually all activities of the body are regulated or influenced by the nervous system, a fundamental understanding of neural processes is of immense importance. Neurobiology supports research which spans levels of inquiry from the subcellular to the behavioral in order to acquire such understanding. The diversity in the level of inquiry is reflected in the broad array of methods and techniques, e.g., nuclear magnetic resonance procedures, radiotracer and autoradiographic techniques, as well as organ and tissue culture techniques, electron microscopy, and spectroscopic techniques. New methods of surgical and lesioning procedures, electrophysiological recording techniques, and microchemical procedures have been developed. Despite this broad base, neurobiological research is coherent in its relatively narrow focus upon neural functions.

PHYSICS ---------- $43,600,000

The objective of the Physics research program is to continue to increase knowledge and understanding of the basic properties of fundamental forces and elementary constituents of matter. Emphasis is placed on studies of the interactions of the very simplest constituents of matter, as a basis for understanding larger and more complicated systems. These studies range from the elementary few-body interactions of particles and fields to the collective phenomena exhibited by large aggregates of matter. The answers which these investigations yield then provide the understanding of phenomena basic to advances in other sciences, in engineering, and in technology, including energy-related research.

A major increase in this program stems from increased support for user groups at the National Accelerator Laboratory (NAL), the Clinton P. Anderson Meson Physics Facility (LAMPF), the Indiana Cyclotron, the Columbia-Nevis Synchrocyclotron and the Bates Electron Linear Accelerator. Atomic physics research has spawned a few large groups and institutes, each devoted to the various aspects of one field, which will be supported. The Cornell Synchrotron will be upgraded to 15 GeV and there will be improvements in the associated on-line computing facility. Energy-related research will be substantially increased.

Elementary Particle Physics

The objective of the Foundation's program in Elementary Particle Physics is to provide support for research directed toward understanding the most fundamental laws of nature which govern the behavior of particles and fields, the elementary constituents of all matter and manifestations of energy.

The experimental study of three of the four basic forces which underlie these fundamental laws—the strong, electromagnetic and weak—involves the search for new fundamental particles, determination and classification of their characteristic properties, and uncovering of the symmetry principles which govern their interactions. Experimentation in the field is highly dependent upon the availability of very high energy particle probes for the study of particle structure and interactions.

Intermediate Energy Physics

In prior years, this program was a part of the Nuclear Physics program. Significant crystallization of interest in this field, and the development of new major facilities such as the Clinton P. Anderson Meson Physics Facility (LAMPF), the Bates Electron Linear Accelerator, the Indiana Cyclotron, and the Columbia-Nevis Synchrocyclotron have created special opportunities for research which merits separate program status beginning in FY 1975.

The availability of these new facilities with intense beams of electrons, protons, mesons, etc., at intermediate energies, has opened up new domains of research in fundamental laws of particle interactions, nuclear structure and dynamics, and atomic structure. The facilities have in some cases outgrown capabilities of a single university and must be centered at national laboratories. Users groups

from universities now work away from their own campuses at these national or regional facilities. Requirements for support of users groups at such facilities and for the direct support of facilities are expected to increase considerably as they approach their optimum operation level.

Nuclear Physics

The Nuclear Physics program supports the experimental study of atomic nuclei and their interactions. The objective of this study is to establish their relationships with the basic forces of nature. Nuclear phenomena are rich in their diversity. Some are common to all stable nuclei; others appear only in small subsets of nuclei. Some are evident at low excitation energies; others only at higher energies. In order to understand the rules governing such phenomena a panoply of study methods must be used. The intrinsic complexity of nuclei, i.e., their many-particle interactions via complex forces, often requires that a given aspect of nuclear structure be viewed in diverse and complementary ways, if a definite understanding of the particular process is to be obtained. This is an essential attribute of nuclear physics investigations, and it explains the wide variety of nuclear reactions brought to bear on specific nuclear excitations. Nuclear phenomena are also rich in their potential applications. The Nuclear Physics program seeks to stimulate and encourage such applications.

Atomic, Molecular, and Plasma Physics

This program's objective is to support research aimed at understanding the laws governing matter at the atomic level and at increasingly complex levels of aggregation. At the atomic level, the properties of atoms and simple molecules are explored in the regime in which the internal structure of the constituent nuclei does not play a significant role. More complex aggregates of molecules, with long-range coherence and order, are studied as well, involving phenomena in the gaseous, plasma, and liquid states.

A broad and varied program of experimental research, together with accompanying theoretical research and calculations, studies the fundamental aspects of "extra-nuclear" physics over a broad range of conditions and temperatures. Such studies have, at each level of complexity of matter, yielded dramatic new understanding of and control over nature, and have spawned within the last decade entire new sciences (such as parts of chemical physics and laboratory astrophysics) and technologies (the laser).

Theoretical Physics

The objective of this program is to promote a quantitative understanding of the basic building blocks of all matter and of the way in which these building blocks determine the properties of all physical systems, from nuclei to stars.

In his work, the theoretical physicist tries to make sense out of the observations made by experimentalists in the laboratory. The theorist attempts to find a hypothesis about how nature behaves which will explain what is observed. He then uses the hypothesis to predict the results of new experiments, which will test whether the hypotheses or theory represents a correct understanding of nature after

all. Thus, the theorist not only endeavors to interpret the clues which nature has already provided in the past, but also plays an important role in suggesting new directions for research aimed at uncovering new clues.

Gravitational Physics

Gravity, the fourth basic force underlying the fundamental laws of nature, is the weakest of all forces in the universe, yet, paradoxically, it is the only one of literally cosmic importance. Since gravity acts across unlimited distances, it controls the birth and death of stars, like our own sun, of the more exotic pulsars, and even of the vast collection of galaxies which make up the universe. The understanding of gravity is therefore not only fundamental to a basic description of nature, but vital to uncovering both the past and future evolution of the cosmos.

Gravitational physics is now in its most exciting phase since the time of Newton. Experimental measurements, both on the earth and in satellites, have finally begun to supply precise data documenting the failure of Newton's classic theory. This in turn is enormously stimulating to theorists who work at interpreting these experimental advances and extending the consequences to suggest new observations.

This program has as its objectives the support of basic gravitational experiments and theory. The experiments involved measure non-Newtonian gravitational phenomena, while the theoretical investigations supported study the consequences of general relativity or other modern theories of gravity, the properties of matter in enormous gravitational fields, and the cosmological effects of gravitational forces.

CHEMISTRY ---------- $36,100,000

The objective of the Foundation's Chemistry research program is to promote the understanding of the structures, properties, and chemical transformations of matter. By developing these concepts on a molecular basis, chemistry provides a resource for other experimental sciences analogous to that provided by mathematics for quantitative scientific thought.

In addition, it is by application of the knowledge gained from such basic research that, for example, the chemical industry is able to tailor molecules to control disease, alleviate pain, control fertility, and to increase the efficiency of energy conversion.

The major increase in the Chemistry program is $9.2 million for new research that is specifically energy-related.

The remaining increase will be used by individual investigators to replace obsolete equipment and to provide frontier-type instrumentation for general use in outstanding chemistry departments. The increase also will permit an added emphasis on studies of liquids and solutions, and surface interactions. In addition, there will be an explicit increase in the general support of research concerned with improved understanding and better utilization of chemical catalysis. This support will consist of new research projects, as well as assistance in the acquisition of recently developed instrumentation for the characterization of catalytic surfaces.

Much of our present technology is fundamentally dependent on a knowledge of chemistry, since chemical reactions are, directly or indirectly, the principal source of energy for industrial processes. Many of the energy production and utilization processes currently employed, as well as those envisioned for the future, are strictly chemical in nature. Hence, the Foundation will place special emphasis on expanding existing basic research projects, and initiating new ones, that bear directly on the chemical aspects of energy production, utilization and conservation. This will include studies designed to uncover the molecular basis of energy producing reactions, to determine the role of reactive intermediates, to obtain necessary thermodynamic data, to discover suitable catalysts, and to understand separation processes. New studies also will be made of electrochemical reactions, both to discover wholly new energy sources and to create the basic knowledge required to improve existing battery and fuel cell systems.

Chemical Thermodynamics

This program is concerned with thermodynamic and other equilibrium properties of bulk matter. In that sense it does not deal directly with the preparation, structure, or chemical behavior of molecules, except when equilibrium properties are of primary concern.

The objectives of the program include:

Improved understanding of the energetics of chemical change;

Acquisition of data and development of new theoretical approaches which may lead to improved understanding of liquids and solutions;

Advancing knowledge of solid-gas and solid-liquid interfaces, including the chemical reactions that are unique to interfaces; and

Acquiring and interpreting data on the behavior of molten salts and other high temperature systems.

Quantum Chemistry

This program includes the determination of electronic properties of molecules, radicals, and ions; quantum theory; atomic and molecular collisions; and energy transfer.

The objectives of the program include the development of theory that will aid in the interpretation of experiments, suggest the direction of new experiments; and provide reliable information on phenomena not easily accessible to direct experimentation. The purpose of the experimental research is to create new knowledge and understanding, at the most fundamental level, about the electronic properties of molecules, radicals, and ions.

Chemical Dynamics

Chemical dynamics is the study of matter while it is in the process of chemical change. Emphasis is on learning the rates at which reactions occur, the energies involved, and on understanding the factors which affect these rates and energies. More specifically, the objectives of the program include:

Measuring rates of reactions which have critical importance either in developing general laws of chemistry or in providing fundamental data for other disciplines, such as biology or atmospheric sciences;

Developing correlations between molecular structure and reactivity;

Understanding the influence of chemical environment, particularly solvents, energy sources and catalytic species, on the rate and products of chemical reactions;

Developing theories of chemical reactivity which allow generalization and prediction of chemical phenomena; and

Discovering and developing new techniques, methods and instruments to allow the above objectives to be achieved more efficiently and rigorously.

Chemical Analysis

Research in chemical analysis involves the development and discovery of chemical, physical, and instrumental procedures for determining the chemical composition of matter.

The objectives of the program include:

Developing a more fundamental understanding of separation processes so that existing methods can be refined and improved, and new methods can be discovered;

Developing better methods for determining the chemical composition of surfaces, including three dimensional analyses;

Discovering more sensitive and versatile methods for analysis of trace amounts of metals; and

Using computer techniques to deal with problems of sampling, data acquisition, and data interpretation for complex systems.

Structural Chemistry

Research in structural chemistry aims primarily at determining the geometrical relationship between the atoms that compose molecules. Such research is divided into three subfields: diffraction studies, stereo-chemistry and general molecular structure studies using non-diffraction methods.

The objectives of research in structural chemistry include:

Obtaining the basic data necessary to test theoretical molecular structural calculations and thereby to assist the theoretical chemist refine his methods;

Continuing to expand and correlate the experimental information required to understand and predict the chemical and physical properties of molecules; and

Refining existing and developing new experimental techniques in order to meet the increasing need to elucidate the structure and properties of molecules that exist for only very short periods of time. Such molecules can be of great importance in furthering our understanding of chemical reactivity, despite their transient existence.

Synthetic Inorganic and Organometallic Chemistry

Research efforts supported under this program include the preparation of novel inorganic compounds for use as catalysts. This involves the discovery of the structural, energetic, and mechanistic considerations necessary for basing these syntheses on systematic approaches rather than hit and miss ones.

The major objective of the program is to support research leading to the preparation and characterization of new organometallic compounds. These compounds may be useful in chemotherapy or catalysis,

or they may serve as model compounds to aid in the understanding of the role of metals in living systems.

Synthetic Organic and Natural Products Chemistry

Research supported by this program area involves the synthesis and general chemistry of carbon-containing compounds that originate from both man-made and natural sources. The chemistry involves primarily carbon and hydrogen compounds that may also contain oxygen, nitrogen, halogens, sulfur and phosphorus.

The objectives of the program include:

Developing general synthetic methods for complex naturally occurring molecules;

Understanding the relation between composition and chemical properties in order to tailor-make desirable properties; and

Isolating and characterizing naturally occurring molecules and understanding and developing *in vitro* processes paralleling or duplicating those *in vivo* paths occurring in nature.

Chemical Instrumentation

This program activity assists universities and colleges in acquiring major items of chemical instrumentation that are judged to be essential for conducting experimental research in chemistry. Whenever possible, the instruments are used by groups of investigators to ensure maximum use and avoid duplication. Typical types of equipment are: nuclear resonance spectrometers; ultraviolet, visible and infrared spectrometers; diffractometers; electron spin resonance spectrometers; lasers; and electron and ion kinetic energy spectrometers.

The primary objectives of the program are to ensure that major items of equipment that are essential for pioneering research in all branches of chemistry are available to qualified research groups, primarily in American universities and colleges, and to ensure that this equipment receives maximum utilization.

ASTRONOMY ---------- $11,200,000

The objectives of the Foundation's research support program in astronomy are to increase our understanding of the physical nature of the universe, the structure and behavior of stars, the objects and phenomena observed in deep space, and the make-up of the interstellar medium. To achieve these objectives, the Foundation provides support for:

Solar system observations at optical and radio wavelengths and associated theoretical studies of the physical make-up and orbits of bodies in the solar vicinity.

Studies of individual stars, aimed at understanding their interior structures and surface properties and their interactions with each other and with interstellar clouds.

Fundamental measurements of positions, motions, distances and basic charactistics of stars and stellar groups.

Theoretical and observational investigations of the large scale structure of our Galaxy and of distant objects out to the edge of the universe.

Developments of instrumentation for advanced observational research in all portions of the spectrum, including gamma-ray, optical, infrared, and radio.

Areas of increased emphases in FY 1975 include:

Analysis of data from the December 1973 comet, Kohoutek.

Studies of binary stars, now found to occur in many astronomical situations.

Further delineations of the mechanisms which lead to stellar explosions ("supernovae").

Detailed studies of interstellar regions where the interstellar molecules originate (X-ray and gamma-ray).

Millimeter, infrared, X-ray, and gamma-ray studies of our galaxy.

Increased development and use of more efficient instrumentation for existing telescopes.

Solar System Astronomy

The objective of the Foundation's research support program in Solar System Astronomy is to increase our understanding of the physical nature of the sun, the planets and their satellites, the minor planets, the comets and meteors, and the solar wind constituting the interplanetary medium.

The major program areas are:

Solar and planetary radio astronomy in the meter and longer wavelength range.

Photometric, polarimetric, and spectroscopic observations of planetary atmospheres in the optical and infrared wavelength range.

Laboratory investigations of atoms and molecules found in the atmospheres of the major planets under conditions of temperature simulating those of the planetary surfaces and interiors.

Observational and theoretical study of comets.

Stars and Stellar Evolution

The goal of this program is to gain a better understanding of the physical structure and evolution of stars. Research sponsored by the program ranges from the determination of atomic and molecular properties in the laboratory, through observation of stellar brightnesses and spectra and their variations, to theoretical and computer modeling of stellar atmospheres and interiors. All electromagnetic radiation (gamma-rays, X-rays, ultraviolet, visible, infrared, and radio waves) is studied. Current research centers around the birth of stars as infrared sources and the last stages of their life as planetary nebulae, novae and white dwarfs or as supernovae which produce neutron stars (observed as pulsars) or black holes (observable only by their gravitational fields).

Stellar Systems and Motions

The objective of this program is to improve the understanding of binary and multiple star systems and star clusters, emphasizing the field of astrometry. Astrometry is the measurement of precise positions and motions of stars to determine stellar distances and their movement in our Galaxy.

Another major element of this program is dynamical astronomy, which deals theoretically and observationally with the origin and evolution of stellar groups, on a scale small compared with a galaxy, and of planetary groupings around stars.

Galactic and Extragalactic Astronomy

The principal objective of this program is to obtain increased knowledge of the interstellar medium, the Milky Way Galaxy, and distant galaxies and quasars.

The support of research in the radio region of the spectrum is the major cost in the program, including support for individual scientists who may observe at National Observatories as well as for major instruments and scientists at particular universities or observatories.

The most exciting radio work covers the discovery of radiation from interstellar and extragalactic molecules (which includes molecules not found occurring naturally on earth), determination of accurate positions of sources by very long baseline techniques, identification of optical sources, and surveys which show the structure of our Galaxy. The long-term variability and polarization of radio sources require continuous observations over long time intervals.

The optical program element supports research programs which include cosmological studies of faint galaxies whose large red shifts indicate that they are near the edge of the observable universe, galactic distributions of different types of stars (especially observed from the southern hemisphere), physical characteristics of galaxies, supernovae, and metal abundance in the Galaxy.

The gamma-ray, X-ray, and cosmic ray research is conducted almost entirely with equipment carried on balloons. The new detectors and methods have enabled investigators to find new sources and to plan expeditions to look for others. The balloon work is carried on in both hemispheres.

The work on infrared sources continues; a variable X-ray source was identified recently by infrared techniques. Balloon, rocket and airplane based observations need to be continued and expanded.

Astronomical Instrumentation and Development

This program seeks to develop new types of observational and data recording instrumentation and to provide coordination, both within and outside of the Foundation, of all instrument development appropriate to astronomical studies. More specifically, the objectives of this program are as follows:

To develop instrumentation required for conduct of advanced research by observational astronomers, who work today with the entire spectrum of electromagnetic radiation and with particles as well.

To support acquisition of instrumentation already successfully developed, so that as many astronomers as necessary may have access to state-of-the-art equipment.

To foster feasibility and design studies of large or innovative instruments. One example is to continue studies for a millimeter wavelength telescope to extend radio studies as efficiently as possible into this range of the electromagnetic spectrum.

MATHEMATICAL SCIENCES $16,600,000

The objectives of the Mathematical Sciences research program are:

To increase man's knowledge of the mathematical sciences by the creation of new mathematical structures through the extension of extant mathematical theories and by further study and analysis of the relations which exist between them.

To use mathematical knowledge for the better understanding of natural and societal phenomena by applying it to the solution of problems in the physical, social, biological, and engineering sciences.

These two objectives span both core mathematics and applied mathematics. Core mathematics gains insight and inspiration from the applications, while the applications use the tools forged by core mathematics to bring better understanding to real world phenomena. In FY 1975, the Foundation will continue to provide balanced support over the major areas of core and applied mathematics.

A high level of research activity is present in many areas of mathematics. In core mathematics, differential geometry is an area of intense activity, and an increase in funding will be provided for this area. Functional analysis and operator theory will also receive increases in funding, as will the qualitative theories of differential equations. Other dominant areas of current research are in algebra, especially group theory and number theory and these will also receive large increases in funding.

Interest in the application of mathematics to problems in the biological and social sciences in growing and will be encouraged by additional support. An important aspect of the Mathematical sciences research program in FY 1975 is increased emphasis on areas of mathematics that are germane to energy related research in many areas. For example, control theory, statistical mechanics optimization, modeling, and the design of experiments are of relevance to the solution of energy problems and require an underpinning of advanced mathematical knowledge and techniques.

Classical Analysis and Geometry

Although every part of mathematics has made its contribution to the physical sciences, this program, more than any other (except Applied Mathematics and Statistics), supports research in core matematics whose genesis generally lies in those sciences and which is potentially more germane to the explication of their problems. Its objectives include:

The study of the properties and behavior of solutions of ordinary and partial differential equations.

Discovery of new properties of geometric objects and abstract manifolds.

The investigation of relationships between analysis and geometry; in particular, the relations between solutions of partial differential equations and geometric (topological) invariants.

The study of complex functions in one and several variables.

The Classical Analysis program encompases not only the truly classical areas of the theory of complex variables and differential equations, but also the more recently developed fields of Riemannian manifolds, global analysis, harmonic analysis, dynamical systems and approximation theory, With the recent emergence of more powerful techniques, some long unsolved problems of "hard" analysis are now being settled.

The Geometry program also has a broad scope. Euclidean geometry has essentially vanished from the research scene, and the distinction

between research in geometry and research in analysis is sometimes hard to draw. Progress in geometry has also required results from topology and algebra and, in its turn, has generated whole new subfields in these same areas. Geometry has also strongly influenced a wide range of applied areas, including the theory of relativity, statistical mechanics and control theory.

The past year has witnessed an explosion of research in global analysis which involves studies of relations between the geometric properties of manifolds (surfaces) and the analysis of partial differential equations on these manifolds.

Much of the research in these programs provides a mathematical structure for a wide variety of energy related research problems in other sciences, which are often formulated as systems of differential or integral equations.

Topology and Foundations

The objectives of this program are as follows:

To describe and understand the structure of geometric manifolds (geometric figures which can be described in the neighborhood of each point by a system of coordinates similar to those for Euclidean spaces).

To discover new algebraic techniques for determining geometric structure and to simplify those which now exist.

To understand the foundations of set theory, cardinal and ordinal number theory, and related areas of mathematics.

To answer questions of decideability concerning various algebraic structures.

Topology is an offspring of geometry and has largely developed since the turn of the century. It is concerned with properties of geometric objects which are unaltered by continuous distortions. Such properties are very basic indeed, and this accounts for the importance of topology. Despite its abstract character, topology has contributed substantially to the other areas of mathematics and other sciences, including the development of very basic results in dynamical astronomy and important theorems on the qualitative nature of electric fields and flows of fluids.

The Foundations of Mathematics is a highly abstract subject which has to do with logical processes and to the reduction of logical thought to the manipulation of symbols. Because of the esoteric nature of this subject one might think that it is far removed from having relevance to everyday life. But this is certainly not the case, as is evident from the fact that the reduction of mathematical reasoning to mechanical manipulation of symbols according to definite rules prepared the way for the creation of the electronic digital computer. Moreover, two mathematicians (Turing and von Neumann), steeped in mathematic logic, are counted as the most important figures in the development of modern computers. The interplay between logicians and computer scientists continues. Logicians are interested in whether certain problems can be solved by computer algorithms. Computer scientists are interested in the same question, as it relates to the realities imposed by specific machines.

Applied Mathematics and Statistics

The objectives of this program are:

To express in the terminology of mathematics phenomena which occur in man's physical and social environments, to deduce the mathematical consequences of this process, and then to reinterpret the results of the real world. Effectively, this comes down to the application of mathematical techniques to real world phenomena as organized into the physical, biological, social, and engineering sciences.

To develop, when necessary, new mathematical structures for the purpose of implementing the above procedure.

To develop statistical techniques which are increasingly better suited to the analysis of observational and experimental data gleaned from physical and social phenomena.

Research in Applied Mathematics is concerned with developing new mathematical knowledge which will contribute to finding solutions to many problems which have their origin in man's physical and social milieus. It will also be concerned with applying known mathematical theories in novel ways to the solution of such problems. The philosophical (i.e., the non-experimental) aspects of physics, astronomy, engineering, and chemistry are expressed completely in mathematical terms, and it is to problems in these disciplines that mathematics has been, and is, largely applied. In recent years, with the advent of the computer, mathematical theories are emerging which are proving more and more successful in dealing with the biological and social sciences. Thus, projects will be supported in mathematical economics and mathematical biology, as well as in fluid mechanics, solid mechanics, dynamical systems, mathematical physics, control theory, differential game theory, optimization, mathematical programming, and operations research.

A considerable proportion of these projects are related to energy research. Optimization, modelling, systems and control theory, statistical mechanics and magneto-fluid dynamics are directly relevant to problems in utilization of current energy resources and the development of new sources of energy.

Statistics is a well-established branch of the applications of mathematics. Research in this area is concerned basically with the theoretical development and application of methods for extracting as much information as possible about a large number of events from knowledge of a limited number of such events. Statistics is an indispensable tool for the scientist and others in the analysis of data. Moreover, it is useful in the design of experiment. Its applications are manifold: in agriculture, medicine, insurance, industrial production, market research, sociological and demographic studies, and experimental work in engineering and the physical sciences.

The design of experiments, interpretation of data, reliability and control theory, and applications are of relevance to energy related research in many scientific disciplines.

Modern Analysis and Probability

The objective of this program element is to:

Attain a deeper understanding of the mathematical structures and objects which arise naturally out of the abstraction of concepts in

physics, chemistry, astronomy, and other sciences. Among the subfields of mathematics counted to be in this area are functional analysis, harmonic analysis, linear topological spaces, operator theory, topological dynamics, ergodic theory, measure theory, and probability.

Research in Modern Analysis concerns itself with investigations that depend heavily upon mathematical techniques which have been developed since the turn of the century. These techniques have evolved from somewhat more sophisticated notions of the basic tools of mathematics such as set theory, function theory, integration, and the rather technical mathematical concept of "space". Still more recently, there has developed a tendency to use notions from other mathematical disciplines in analysis. Extremely powerful techniques have emerged which are finding application in many phases of applied mathematics (especially questions on the behavior of solutions of differential equations) and, particularly, quantum field theory.

These elements will contribute to energy research. They include quantum field theory and other subareas of functional analysis relevant to physics and chemistry research related to energy problems.

Algebra

The objectives of the Algebra program are to:

Obtain a deeper understanding of algebraic sets and arithmetic on abelian varieties.

Solve the problem of resolution of singularities of varieties defined over fields of non-zero characteristics.

Determine the structure of all finite groups.

Continue the progress on certain long-standing questions and conjectures in the theory numbers.

Construct and exploit new algebraic techniques for applications to questions in mathematics and other sciences.

Research in Algebra has been in ferment for a generation now, and some of the most important and exciting results in mathematics have been accomplished in this field within the last decade. Algebra is one of the oldest branches of mathematics, with significant consequences flowing from it in every era. Attempts to solve algebraic equations in the early nineteenth century led to new concepts such as groups, rings, and fields, and it may now be said that the study of algebra is basically concerned with entities such as these, called algebraic structures. Group theory has long been central to research in algebra, and much of this research has been in the theory of finite groups. Foundation supported researchers have solved several long-standing problems involving finite groups and have paved the way for new and vigorous research in this area. Significant progress is also being made in algebraic geometry and number theory.

SOCIAL SCIENCES $28,300,000

The principal objective of the Foundation's Social Sciences research programs is to foster the development of objectively verifiable knowledge about how human beings interact and about the functioning of societal organizations and institutions.

These programs are almost unique in the United States in being responsible for the growth of fundamental knowledge in the social sciences that will be applicable to the problems of tomorrow as well as of today.

For this reason, major efforts in all programs are directed toward the creation of new and more powerful methods of investigation and of general analytical tools. The attainment of more adequate data bases is another objective, so that findings will be more definitive and generalizable—and so that research costs will be more economical.

Social Sciences programs also support problem-oriented efforts, including the development of social indicators, providing a base for continuity in research on important social and economic problems.

The six major program elements are discussed in detail below. In past years, scientific linguistics research had been supported under Anthropology, Social Psychology, Sociology, and Special Projects. Beginning in Fiscal Year 1974, all this support has been consolidated under the Special Projects Program, along with Geography and History and Philosophy of Science. Fiscal Year 1973 estimates have been adjusted for comparability.

The highlights of increases for FY 1975 research projects are as follows:

Support of development of measures of social change (including effects of energy shortage and redistribution);

Support of studies of language acquisition and the nature of language.

Substantial expansion of fundamental research to adapt and improve economic theory and measurement techniques for purposes of analyzing economic and energy-related problems.

Support of work in international economies, particularly the linkages among national economies into a world system;

Support of U.S. participation in international collaborative scientific efforts, particularly in management sciences.

Some examples of the variety and significance of NSF supported research are described briefly in the following section.

Anthropology

The objective of the Anthropology program area is to obtain perspective on human behavior over more than a million years in time and across the many varied cultures mankind has evolved, in order to have a better grounded science of ourselves and of our fellow inhabitants of the world today.

Economics

The objective of the Economics program is to improve understanding of economic processes and the measurement of economic relationships, especially where the results will be applicable to problems of general interest and importance. Economics has been outstandingly successful in developing scientific analysis of social behavior. The Economics program will continue to assist investigators to develop and test new methods of measurement and new theoretical structures. It is almost unique among U.S. research sponsors in having this reponsibility.

Sociology, Social Psychology, Social Indicators

The objective of these program elements is to increase our understanding of the behavior of human beings as they interact with each other, and of the functioning of organizations and societal institutions.

Sociology is concerned with scientific explanation of the nature and behavior of organizations and social institutions, including the family, social stratification and mobility, and population sizes and composition.

Interpersonal relations are the subject of social psychological research, including group decision-making, communication, and opinion and attitude change.

Social Indicators research involves sociologists, social psychologists, economists and other specialists in an effort to measure social change as objectively as possible. A particular interest is to add "quality of life" dimensions to existing economic indicators, in order to permit weighing of "social" costs as well as costs which show up in the market transactions and can be directly measured in monetary terms.

Political Science, Law and Social Sciences

Scientific understanding of the processes of government, including international relations, political disorder and stability, electoral systems and administrative procedures, is the objective of the Political Science Program. In recent years this program has stimulated increasing use of quantitative methods such as studies of factors related to the outbreak of violence and war. Although development of general theories of political processes is an exceedingly difficult task, because of the complexity of the subject matter, progress is being made.

The focus of the Law and Social Sciences effort of the Foundation is on interdisciplinary studies involving both lawyers and social psychologists, economists, or other types of social scientists. The intention is to accelerate the use of social scientific findings in the legal world, and to use methods of research developed in the social sciences to study legal processes. An example is the analysis of trial processes by techniques social psychologists have used to study small groups.

Special Projects, Geography, History and Philosophy of Science

The objective of the Special Projects program is to make possible social scientific activities that cut across several disciplines, or involve participants from many different institutions. It also supports the operation of a limited number of specialized laboratories, for example, computerized management decision-making research configurations. In cooperation with the Office of Computing Activities this program encourages the development of next-generation software for use in management science and economic analysis. Responsibility for support of scientific research on linquistics was consolidated into the Special Projects program in Fiscal Year 1974.

The geography program is concerned with economic and social geography, including urban studies and regional science.

The History and Philosophy of Science element is directed toward an understanding of the fundamental nature and the processes of development of science and technology.

Science Policy Research

The objectives of Science Policy Research are (1) to improve the processes of conducting and administering scientific research of all kinds, and (2) to understand the impact of science and technology on public policy. The program is directed toward fundamental investigations of long-term significance and is not intended to participate directly in current policy making. Emphasis is on interdisciplinary

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studies of the operation of the scientific community, including the allocation of resources, the dynamics of scientific disciplines, and the ways in which scientific and technological discoveries come to influence foreign and domestic policy.

ENGINEERING ---------- $36,900,000

Engineers and engineering play an unusually important role in our technology-oriented society. Industry depends upon engineers for the development of innovative and competitive processes and products as well as for the reduction of hazardous working conditions. Society depends upon engineers for devising improved methods of utilizing our natural resources, for providing new sources of energy, and for devising improved housing and transportation and communications systems.

The objective of the Foundation's engineering research program is to develop a better understanding of the engineering principles which are common to or required for the solution of future technological and societal problems. The scope of the engineering research program ranges from the development of new data and methodology required for the introduction of new technology or improvement of productivity, to understanding and modifying the impact of new and existing technology on man and his environment. Thus, the Foundation's engineering research program involves all areas of engineering and technology including civil, mechanical, chemical, industrial, electrical, and aeronautical engineering.

In addition to the support of a general research program, a number of innovations have been introduced and are being given continued emphasis in the Engineering program in FY 1975. Among these are:

University-industry workshops. These workshops explore special areas of research interest, serve to improve coordination between universities and industry and identify important research problems and opportunities.

Organized research areas. These are broad problem areas in which there is a unique opportunity for high impact through intensive coordination of research related to a given area or in which there is a serious void in information required to cope with a particular problem area. Often this void exists because of the fragmented nature of involved industrial groups or the lack of specific responsibility of any government agency. Examples of organized research areas include optical communication systems, food engineering, and wind engineering.

Encouragement of young university researchers to develop research programs related to current problems. A special option in the Engineering Research Initiation Program, program permits young faculty members to carry out research activities during the summers in a non-academic environment such as industry or some level of government activity.

The Foundation's FY 1975 engineering research program involves an increase of $8,400,000 over that allocated for FY 1974. These funds will enable the Foundation to increase the activities of research programs which encourage greater interaction between universities and industry. The largest fraction of this increase will be used to place additional emphasis on theoretical, experimental and design oriented

studies which will provide the understanding and data which will enable industry to develop innovative processes that either reduce energy consumption or by-pass high energy consuming steps. Thus increased emphasis will be placed on such problems as the utilization of waste heat, catalysis, combustion, building design, plasma processes, conversion of waste organic material to usable energy, and on pollutant transport processes. The additional funds will also make possible increased emphasis on such important research areas as biomedical engineering, pattern recognition and processing, food engineering, high flux heat transfer, process engineering, noise control, and construction management.

Electrical Sciences and Analysis

The objective of the Electrical Sciences and Analysis research program is to gain better understanding of the various phenomena related to electrical sciences and systems. New discoveries and increased knowledge in electrical and optical sciences and system theory are of the utmost importance if research is to provide knowledge applicable to the highly complex problems of productivity, energy, generation, transportation, health services, communications, and others that plague our technologically dependent society. To meet this challenge, the program supports research in Control and Automation, Devices and Waves, Electrical and Optical Communications, and System Theory and Applications. The research program includes studies in communication and information sciences, large scale networks, signal processing, control theory, automation systems, bioengineering, man-machine interactive systems, system analysis, modeling optimization, devices for communications, automation, electrical energy generation, and environmental systems, wave propagation and radiation. Organized areas of coherent research with strong university-industry interaction are supported in the important areas of optical communication systems and advanced automation.

Engineering Chemistry and Energetics

The objective of the Engineering Chemistry and Energetics program is to stimulate those basic disciplines that are directly and indirectly related to the technological development and economic vitality of major industries in the U.S. utilizing various forms of chemical and physical change. Appropriately selected, these changes influence not only the development of new processes, the manufacture of new or improved products, and the abatement of environmental pollution, but also the means for conserving energy and materials in actual or potential short supply. Research supporting this objective is provided through four general areas and several organized areas. The general areas include Chemical Processes, Heat Transfer, Plasma Dynamics and Nuclear Engineering, and Thermodynamics and Mass Transfer. Added support to these programs is given by the key organized research areas of Process Synthesis, Food Engineering, and Natural Resources Technology.

Mechanics

The objectives of the Mechanics research program are to generate knowledge required for continued improvements in industrial and government activities related to construction, mechanical design and

processing, manufacturing, agricultural technology, water supply and waste treatment, protection from natural hazards, environmental protection, energy and others.

Support is provided through four sub-programs—Solid Mechanics, Fluid Mechanics, Civil and Environmental Technology, and Industrial Technology, and through a number of special organized research areas such as Wind Engineering, Technology Transfer in Machine Design, Ship Traffic Control, Computer Based Technology Transfer, and Planning and Design of Tall Buildings. These special efforts are closely coordinated with other Foundation programs and with activities of other government agencies. Such coordination can be extremely important in areas where the general coverage of ongoing engineering research activities can make specific inputs to more focused programs such as utilizing wind engineering knowledge in wind power generation studies which will be of benefit to the RANN program of wind energy conversion.

MATERIALS RESEARCH $44,200,000

The objective of the Foundation's Materials Research program is to increase fundamental understanding of the optical, chemical, magnetic, thermal, mechanical and electrical properties of materials so that the knowledge gained may be used to benefit mankind. New or improved materials will be needed to meet the Nation's requirements for energy production, conversion, and transmission, as well as in other fields. The Foundation provides support to individual scientists through its project research program as well as to interdisciplinary groups through the Materials Research Laboratories (MRL) and the National Magnet Laboratory (NML).

The Foundation's FY 1975 program in Materials Research will emphasize research aimed at a microscopic understanding of catalytic behavior, a predictive assessment of materials performance is a complex environment, and the development of a now long-period (1 sec) pulsed magnet capable of generating fields in excess of 400 kilogauss.

The behavior of materials plays a central role in defining the limits of efficiency and reliability of any energy conversion system. The aim of the energy related research included in this program is to develop a better understanding of those processes in materials which limit performance of new systems. Examples of basic degradation processes which will be emphasized are fatigue, creep, fracture, corrosion, stress rupture and embrittlement.

Materials also exhibit unique properties which can be exploited and improved if a better basic understanding is developed. These include the following:

Superconductors with higher transition temperature and ease of fabrication.

Solid state electrolytes for batteries or photovoltaic materials for solar energy converters.

Materials requiring high temperature performance (ceramics and metals) for turbines, coal conversion plants, and magnetohydrodynamic (MHD) converters.

Surface studies where better understanding would benefit catalysis development or brittle fracture control.

Thermodynamics and kinetics of reactions involving sulfides, hydrides and carbides which could form in the environments provided by advanced energy conversion systems.

Energy related research is discussed more fully in the appropriate materials research program elements.

Research at the Materials Research Laboratories by groups of investigators who undertake sustained interdisciplinary research in forefront areas will continue to be encouraged. This thrust area research provided by MRL core support complements, but does not substitute for, traditional individual project support.

Solid State and Low Temperature Physics

This program provides support for research essential to the "backbone" of our basic physical knowledge of materials, as well as for individual and multidisciplinary efforts in challenging solid state science problem areas of special interest to the materials community. The objective is to increase our basic knowledge in solid state and low temperature physics, in order to improve the foundation on which a better understanding of the synthesis, properties, and applications of materials can be built.

Engineering Materials

The objective of the Engineering Materials program is to develop an understanding of the various processes that occur in materials and develop physical concepts that may be applied to problems in materials limited areas. The Engineering Materials program provides research support needed to advance our understanding of materials of scientific and technological importance, their structure and properties, and behavior under a variety of conditions.

Solid State Chemistry and Polymer Science

The program deals with basic research on synthesis and structure-property relations in polymeric materials, and on the nature of defects, properties of surfaces, and other basic chemical phenomena in solids. The objective of this program is to increase our fundamental knowledge in solid state chemistry and polymer science in order to broaden the foundation on which a better understanding of the synthesis, properties and applications of these materials can be built.

National Magnet Laboratory

The Francis Bitter National Magnet Laboratory (NML) continues to be the world's leading high magnetic field laboratory. The Foundation assumed responsibility for the core funding of this laboratory from the Air Force Office of Scientific Research in 1971. Fundamental research, applied research, and magnet development are carried out by the Laboratory's experienced staff of scientists and engineers. The NML's objectives are: to maintain a strong versatile program of basic and applied research in magnetism, superconductivity, magneto-optics, plasma physics, and high resolution resonance spectroscopy; to provide visitors and collaborators with not only the use of the facilities, but also the benefit of expert scientific and technical assistance necessary to setting up and carrying out their experiments; to provide qualified post-doctoral and graduate students an opportunity to work

in high magnetic field research; and to design, develop, and test the next generation of both pulsed and continuous high-field magnets.

Materials Research Laboratories

Core support is provided by the Materials Research Laboratories (MRL) program to a number of major academic materials research laboratories. A significant fraction of this support is devoted to the provision and the operation of central facilities, in which major equipment is available for joint use to several investigators. Support is also provided for research projects directed at identifiable, broad problem areas, usually involving several faculty from different academic disciplines. The development of such projects is strongly encouraged. Finally, some support is provided for individual projects on topics most promising in further development of materials and materials-related research. The selection of the research problems remains the responsibility of the local laboratory management. The NSF's responsibility through the MRL program is in supporting a balanced overall materials research effort based on the most effective individual laboratory contributions. Currently some 350 faculty, 70–80 post-doctoral associates and some 700 graduate students are partly supported.

The primary scientific objective is to support research leading to the development of a better understanding and control of factors determining the properties and the behavior of materials. Directly related to this fundamental objective is the more pragmatic one, namely the development of improved ways of applying such understanding to problems of importance in technology. It is recognized that many that many such problems present significant scientific challenge, and that a progressively increasing interdisciplinary involvement is needed for success in solving these. Such research provides students with a very broad exposure to the many aspects—both scientific and technological—of materials research. Some 50–60 percent of the total Federally funded academic materials research is carried out at the MRL's, and the core support represents some 40 percent of that. Therefore it is imperative that the core support program be properly balanced, as viewed on the national scale, over the whole spectrum from materials-related science through materials engineering. In developing such balance the views of the materials community are of primary importance, and are continuously sought. Changes in the level of support at the various MRL's will depend upon the extent to which each laboratory is successful in developing its research programs in competition with other laboratories, both within and outside the program.

Synchrotron Radiation Facility

The objective of this program is to provide support for the operation and maintenance of a synchrotron radiation facility at Stanford University. The radiation produced by the high energy electrons circulating in the Stanford Positron Electron Asymmetric Ring is an extremely intense continuum of highly polarized, well-focused, nanosecond bursts of photons. Such unique characteristics make possible experiments that are either impossible or infeasible with conventional sources. This is the only facility in the U.S. producing this type of radiation in the X-ray region of the electromagnetic spectrum. Synchrotron radiation is not identifiable with a particular program or discipline of science because it is actually a probe which can be used to study matter in any of its forms. The facility is made available to qualified users on the basis of scientific merit.

COMPUTING ACTIVITIES $11,000,000

The Foundation's Computing Activities Program supports basic research in computer science and engineering, computer applications in research, and research studies on the technological aspects of society's use of computers. The objective is to gain an understanding of the basic principles underlying computing and discover procedures for applying those principles. Even though enormous computing power is employed daily, computer science is in its infancy. Discoveries by scientists will advance our knowledge of computer science while enabling the nation to use computing more effectively in solving national problems.

This program represents a balanced approach to basic computing research. Major emphasis is on the more fundamental aspects of computer science and engineering, but support is also provided for the research required to develop techniques to make the computer more responsive to requirements of the other scientific disciplines. Studies and basic research are supported to identify technical solutions to general questions posed by wide-spread computerization in our society.

The FY 1975 program provides an increase of $1.8 million over FY 1974. Support is increased for research on computer systems and programs which are more reliable and perform correctly in the presence of errors. Support for special projects is also increased for research on problems in privacy and computer system security, the human-machine interface, and energy-related research.

Computer Science and Engineering

This program is the only national program whose prime focus is the support of basic research in computer science. Proposals are considered in three categories: fundamental computer science, software and programming systems, and the principles of computer systems design. The objectives of this program include:

The exploration and development of the underlying foundation and structures of computer science.

The discovery of principles governing the design of computer programming systems.

The enhancement of the reliability, capacity and useability of computer systems through research on the design and organization of computer systems.

Computer Applications in Research

The Computer Applications in Research Program's prime objective is to increase scientific research capability through applications of increasingly sophisticated computer-based systems and resources. Specific emphasis is placed on research leading to innovative applications of computational techniques and methodologies for improved approaches for preparing scientific software. Support is given to studies which will improve the potential of computer networking for science

research and will, in turn, improve the ability to share computational resources. Specific objectives include:

Development of advanced computerized techniques for specific research applications.

Development of procedures to improve the quality of computer software applicable research.

Identification of pertinent organizational, political and economic considerations which are required for the development of computer networks on a national level.

Special Projects

The purpose of the Special Projects program is to encourage the development of new fields of computer science research which are responsive to problems and opportunities arising from the widespread use of the computer. The research projects and exploratory studies will strengthen the foundations of computer science as a discipline and help make the computer a more responsive tool for meeting social needs. The goals of the program are:

To improve understanding of the potential benefits and dangers that the use of the computer is having on organizations and individuals in society.

To stimulate new areas of basic computer science research motivated by new uses of the computer.

2. NATIONAL AND SPECIAL RESEARCH PROGRAMS..... $86,000,000

Authorization, fiscal year 1975

National Research Programs:	
Global Atmospheric Research Program	$4,000,000
International Decade of Ocean Exploration	15,500,000
Ocean Sediment Coring Program	11,000,000
Arctic Research Program	3,500,000
U.S. Antarctic Research Program	25,800,000
Oceanographic Facilities and Support	15,000,000
Subtotal	74,800,000
Special Research Programs:	
Science and Technology Policy Research	$1,500,000
Energy R. & D. Policy Research	4,500,000
National R. & D. Assessment Program	3,000,000
Experimental R. & D. Incentives Program	2,200,000
Subtotal	11,200,000
Total	86,000,000

Research supported by the National and Special Research Programs covers a wide range of activities and scientific disciplines. These programs are coordinated efforts, each designed to achieve specific objectives. The programs are characterized generally by the extensive involvement of program staff in their planning, management, and coordination. Many include a logistic component, and must involve some element of international cooperation.

NATIONAL RESEARCH PROGRAMS

The Global Atmospheric Research Program will be concerned with studies of the physical processes in the troposphere and stratosphere,

in order to gain a better understanding of transient behavior of the atmosphere as manifested in large-scale fluctuations and of the factors that determine the statistical properties of the general circulation of the atmosphere. Increased research efforts will be required in the planned regional subprograms of GARP as well as in climate studies.

The International Decade of Ocean Exploration program is moving forward, with research emphases on the quality of the marine environment, the resources of the ocean, and the role of ocean processes in weather and climate.

The Ocean Sediment Coring Program is moving toward greater participation and increased funding participation by other nations. The amount recommended for this program in FY 1975 assumes that an additional $1,000,000 will be contributed by a foreign participant.

As in the two preceding years, emphasis in FY 1975 in the Arctic Research Program will be on the Arctic Ice Dynamics Joint Experiment. The Man-in-the-Arctic project replaces the Tundra Biome project as the second largest effort in this program.

By the end of the 1973–74 austral season, the U.S. Antarctic Research Program will have three new LC–130 aircraft; the new South Pole Station will be nearing completion; and the USNS *Eltanin*, operated by Argentina on a shared-cost basis, will be available for research in the southern ocean. Emphasis in FY 1975 will be on three large, interdisciplinary projects, but increased attention will be focused on meteorology and oceanography, the latter in cooperation with the International Decade of Ocean Exploration program.

Increased budgets for Oceanographic Facilities and Support in both FY 1974 and FY 1975 over FY 1973 will assure the maintenance of a viable academic fleet in support of the Nation's oceanographic research program.

SPECIAL RESEARCH PROGRAMS

The Science and Technology Policy Research program, in assisting the Director in his role as President's Science Adviser and Chairman of The Federal Council for Science and Technology under Reorganization Plan No. 1 of 1973, will concentrate on studies of the processes and methodologies of science policy formulation as well as special analyses of problem areas, data gathering, and assessing the impacts of potential policy options.

In order to assist the Director, NSF to carry out his role in the energy policy area, the Energy R. & D. Policy Research program will emphasize the development and analysis in a systems framework of national R. & D. energy goals and strategies. Background studies, data collection and ad hoc analytical studies of topical energy-related issues will be conducted. Support, guidance, and analyses will be provided to the Executive Office of the President and the Federal Energy Office. An amount of $4,500,000 is included in the Foundation's program for those efforts which fill an important need for the development of intelligent national energy policies and strategies.

The National R. & D. Assessment program will begin to capitalize on efforts to provide systematic state-of-the-art studies describing relationships and implications, and determination of high priority areas for research that took place during the first two years of the Program.

Concentration in FY 1975 will be on studies to fill critical gaps in policy relevant data, information, and understanding.

Major emphasis in the Experimental R. &D. Incentives (RDI) program will be initiated in FY 1973 and FY 1974. These experiments deal with ways to help cities to take timely advantage of new advances in technology, and incentives that can speed the process of innovation in areas such as the clinical testing of newly developed medical equipment and others. RDI will also initiate additional base line, comparative and evaluate studies to support ongoing experiments, monitor and evaluate natural experiments and disseminate results.

NATIONAL RESEARCH PROGRAMS

GLOBAL ATMOSPHERIC RESEARCH PROGRAM (GARP)----- $4,000,000

The overall objectives of this program are to study those physical processes in the troposphere and stratosphere that are essential for an understanding of:

The transient behavior of the atmosphere as manifested in the large-scale fluctuations.

The factors that determine the statistical properties of the general circulation of the atmosphere.

The successful attainment of the above objectives would lead to more accurate and longer-range weather forecasts and to a better understanding of the physical basis of climate. Utilizing weather information, particularly forecasts, rather than designing out or engineering around the weather, could be worth many millions of dollars per year.

GARP is interdisciplinary in nature, using talent from many scientific disciplines. Seven agencies (AEC, DOC, DOD, DOT, EPA, NASA, NSF) are contributing funds to the program. The National Oceanic and Atmospheric Administration (NOAA) has been designated as lead agency for coordination. The National Science Foundation has responsibilities to (1) support the university community and NCAR in their GARP efforts and (2) support the Observing Systems Simulation Experiments (OSSE) that are required for evaluation of observing subsystems in terms of accuracy, density, and frequency of observations. The responsibility for OSSE has been delegated to the National Center for Atmospheric Research (NCAR).

The success of GARP is dependent in large measure on university participation in the program. The major role of the National Science Foundation is to focus the scientific expertise of university scientists on the problems being addressed by GARP.

Although the observational phase of the GARP Atlantic Tropical Experiment (GATE) will be completed early in FY 1975, a large number of researchers who did not participate in the field phase will need to analyze and use the data. Also increased research is required in the planned regional subprograms of GARP such as the Air Mass Transformation Experiment (AMTEX), the Monsoon Experiment (MONEX) and the Polar Experiment (POLEX). Finally, there will be an increasing effort in climate studies.

INTERNATIONAL DECADE OF OCEAN EXPLORATION------- $15,500,000

Responsibility for the planning, management, and support of the United States' role in the International Decade of Ocean Exploration,

the acceleration phase of the Intergovernmental Oceanographic Commission's Long-Term and Expanded Program of Oceanic Research, was assigned to the National Science Foundation in 1969. Research projects are designed to improve understanding of the influence of the ocean on man's activities and his impact on the marine environment. The four programs and their objectives are:

Environmental Forecasting

The objective of the environmental forecasting program is to provide the scientific basis for improved oceanographic and atmospheric forecasts. Research projects include:

The North Pacific Experiment (NORPAX). NORPAX is a study of large-scale, long-period, ocean-atmosphere coupling in the North Pacific Ocean. Sea-surface temperature anomalies in the mid-latitudes of the Pacific Ocean have been related to winter conditions over North America. To better understand these phenomena, and hence produce improved seasonal forecasts, research is proceeding in five areas: (i) statistical studies of historical data, (ii) monitoring of indices of dynamic processes using moored buoys, island stations and ships of opportunity, (iii) experiments in the physical processes of air-sea interaction in the central North Pacific Ocean, (iv) theoretical studies such as mixed-layer formation and regional numerical modeling, and (v) complementary efforts to develop satellite techniques and a comprehensive ocean model for use in global climate modeling. A first attempt to determine the heat, moisture, and momentum fluxes of the surface layer of the North Pacific Ocean in winter will take place in early 1974.

Climate: Long Range Investigation, Mapping and Prediction Project (CLIMAP). CLIMAP is a study of climatic changes as indicated by the faunal record contained in deep-sea sediment cores. These records can be statistically interpreted to show changes in environmental parameters such as sea surface temperatures. CLIMAP provides data essential for evaluating man-induced environmental changes such as those resulting from the release of CO_2 into the atmosphere from the burning of fossil fuel.

Mid-Ocean Dynamics Experiment (MODE). This is a major theoretical and experimental effort to describe and develop numerical models of medium-scale dynamic processes such as oceanic eddies, and to assess their role in ocean circulation and global climate. In 1973, United States and United Kingdom scientists carried out a four-month field experiment using two aircraft and six ships.

International Southern Ocean Studies (ISOS). ISOS, to begin in FY 1974, focuses on oceanographic processes of the Southern Ocean and their role in weather and climate. These processes include the formation of bottom and intermediate waters and the exchange of water between the oceans affected by the circumpolar current. ISOS is to be conducted jointly by scientists from the United States, Norway, the United Kingdom, and Argentina.

Environmental Quality

This program has two major elements—research on the physical-chemical processes that transport and mix pollutants in the ocean, and research on the deleterious effects of pollutants on marine life. Objec-

tives are to understand oceanic mixing processes, the transport of pollutants into the ocean and within ecosystems, the effect of pollutants on individual marine organisms, and the effect of pollutants on marine ecosystems.

The oceanic mixing studies are a continuing effort to measure the levels of elements and compounds in the open ocean that indicate the rate of movement of substances in the water column. This Geochemical Ocean Sections Study (GEOSECS), started in 1971 after one and one-half years of preparation, consists of north-south transects of the Atlantic and Pacific Oceans, and will involve three additional years of analytical laboratory work. The Atlantic transect, completed in April of 1973, was highly successful from the viewpoint of the significance and precision of the data collected. The Pacific transect is taking place between August 23, 1973, and May 1974, and involves thirty investigators from fifteen institutions.

The pollutant transport and transfer studies consist of individual research projects on the routes by which various chemical pollutants reach the ocean. These studies include investigations of the mechanisms by which pollutants are moved up the marine food chain. Nine scientific investigators from nine institutions are involved in the studies.

Another group of investigators is studying the effects of chemical pollutants on specific levels of marine life. The goal of these studies is to understand the way in which low levels of pollutants, acting over different lengths of time, harm vital functions of organisms and eventually destroy them. Nine projects, based at five institutions, were initiated in FY 1973.

The key element in the study of the effects of pollutants on marine ecosystems is the Controlled Ecosystem Pollution Experiment (CEPEX). CEPEX is designed to determine whether low levels of pollutants, acting over long periods of time, have a harmful effect on marine communities. To accomplish this research, scientists intend to study entire ecosystems which are enclosed in huge plastic bags in their natural environment. CEPEX involves nine investigators at four institutions.

The accelerated development and use of fossil fuels (coal, crude and shale oils) as energy sources will introduce into the atmospheric (subsequently, oceanic) environment new pollutants and higher concentrations of current pollutants (*e.g.*, mercury, lead, arsenic and uranium). The new or additional pollutants, whose identities and impact on marine ecosystems are little known, include beryllium, selenium, fluorine, and their derivatives; toxic nitrogen and sulfur heterocycles; and polynuclear and other carcinogenic hydrocarbons. In FY 1975, a new energy-related research program in the characterization and measurement of fossil-fuel pollutants in the marine environment is planned. It is envisaged that this new program will be developed along the following lines:

(1) A workshop to establish research priorities.
(2) Development and application of methods to characterize new pollutants in the marine environment.
(3) Development of quality assurances for baseline measuring activities.

(4) Baseline data research—regional and world-wide.
(5) Development and application of models to predict the distribution of pollutants in marine ecosystems.

Seabed Assessment

Three major projects are directed toward the assessment of seabed resources:

The continental margin studies involve the basic geological and geophysical research necessary to evaluate the mineral and petroleum resource potential of important unsurveyed continental margins. The objective of the margin studies is to provide the bathymetric, sedimentological, and structural data needed to guide the efforts of resource geologists. Surveys of the southeastern and southwestern Atlantic continental margins were started in FY 1972.

Research into the role of mid-ocean ridges and ocean margin subduction zones in the genesis of useful metallic ore formations will continue in FY 1975. Objectives are to detect metal enrichment at the ridges, to define the mechanisms of transport away from the ridges, and to detect further metal enrichment at the subduction zones and assess their potential to generate massive ore bodies.

Studies of the processes involved in the formation and distribution of manganese nodules, based on research priorities recommended by a comprehensive definition study completed in FY 1974, will continue in FY 1975.

Energy-related aspects of margin studies include geophysical examination of deep structures in the southwest corner of the Gulf of Mexico and thick sediment deposits of the Amazon River Delta and upgrading of the seismic reflection capability of oceanographic institutions to identify potential sites of petroleum and natural gas. In addition, research is supported in the genesis and location of deep-sea manganese nodules which also contain significant quantities of copper, nickel, and cobalt which will contribute to our knowledge of non-fuel resources essential to the energy-producing system.

Living Resources

The objective of this program is to determine the processes and relationships that exist between the biological aspects of marine organisms and the chemical, physical, and geological environment in which they live. The program emphasizes marine ecosystems research through the Coastal Upwelling Ecosystems Analysis (CUEA) project. CUEA seeks to understand the biological and physical factors that govern the coastal upwelling ecosystem so that changes can be predicted by monitoring specific oceanographic or meteorological variables. A major field experiment, JOINT–I, involving the United States and six other nations, will take place off the northwest coast of Africa during the spring of 1974.

General Support

The objective of the support program is to ensure rapid communication of data and results to appropriate government agencies and the international community, and to plan for participation in IDOE programs by other nations.

OCEAN SEDIMENT CORING PROGRAM $11,000,000

The objective of the Ocean Sediment Coring program (OSCP) is to help determine the origin and geologic history of the ocean basins by making available for study samples obtained by drilling into the ocean floor.

The OSCP is achieving this objective primarily through the activities of the Deep Sea Drilling Project, a program managed by the Scripps Institution of Oceanography and funded by the National Science Foundation through a contract with the University of California.

The research ship *Glomar Challenger*, specially equipped to drill and core at ocean depths of 25,000 feet from the ocean surface, has been recovering samples of subsea sediments and rocks since August 1968. As of January 1, 1974, 33 cruises had been completed, each of about two months duration, and cores had been obtained from 468 holes at 318 sites in the Atlantic, Pacific, and Indian Oceans, as well as in the Mediterranean, Caribbean, Bering, and Red Seas, the Gulf of Mexico, and in antarctic waters. During these cruises, 352 scientists, including 113 from 22 foreign countries, participated in the shipboard laboratory analysis of the samples. The results of the shipboard and initial shore-based studies have been published in the *Initial Reports of the Deep Sea Drilling Project*, a volume of which is compiled after the completion of preliminary analyses of the data from each cruise.

The cores are stored in refrigerated repositories in California (Scripps Institution of Oceanography) and New York (Lamont-Doherty Geological Observatory) and are available to qualified scientists for more detailed investigations. To date, OSCP samples have been distributed to more than 300 scientists working on more than 200 separate research projects.

The general reconnaissance of mineral resources contained in seabed sediments is providing a broad evaluation of the global subsea distribution of hydrocarbons. New areas of oil and gas accumulation are detected through constant monitoring by shipboard instruments followed by more thorough core analyses in shore-based laboratories. Development of advanced drilling and coring techniques, many of which have been adopted by commercial petroleum producers, remains a continuing effort of the OSCP.

ARCTIC RESEARCH PROGRAM $3,500,000

The principal efforts of the Arctic Research Program are currently directed toward the following objectives:

Improving the understanding of the arctic pack ice, including its impact on ocean transportation and offshore and coastal zone activities and its influence on weather and climate;

Increasing the knowledge of solar-terrestrial interactions in the Arctic and their effect on communications and global electromagnetic phenomena;

Obtaining information on the delicately balanced arctic ecosystem and predicting its response to resource development activities;

Increasing the understanding of adaptational and structural problems of the rapidly changing economic and social environment of arctic Alaska.

As the lead agency for the extension of Federal arctic research, the Foundation funds research that lies outside the interests of mission agencies. These projects are generally interdisciplinary and multi-institutional. The Foundation also provides for the exchange of research plans and data with other nations sharing common interests in the Arctic. NSF also chairs the Interagency Arctic Research Coordinating Committee (IARCC), which coordinates the research programs and logistic support requirements of the eleven Federal agencies involved in arctic research.

The main research activities of the program are: the Arctic Ice Dynamics Joint Experiment (AIDJEX), a comprehensive study of sea-ice formation and movement and air-ice-ocean interactions; the Man-in-the-Arctic project, a socioeconomic study of Alaska; a follow-on to the Tundra Biome project, a study of temperature-sensitive soils and flora in the Arctic; and the Greenland Ice Sheet Project, a study of prior environmental conditions and of the flow dynamics of the ice sheet.

The Arctic Ice Dynamics Joint Experiment (AIDJEX) will provide an increased capability to predict ice motion and deformation and their effects on shipping and off-shore facilities; the Tundra Biome studies will provide data to assist in managing and controlling the ecological effects of north slope petroleum development; and the analysis of Greenland ice cores will contribute information on the production and global distribution of combustion by-products. In addition, the efforts in the Economic and Social Sciences program focus on economic and social changes in Alaska resulting from petroleum development and production.

Upper Atmospheric Sciences

The objective of the arctic program in upper atmospheric sciences is to obtain high-latitude data on solar-terrestrial effects and to complement and extend the research being conducted at Siple Station in Antarctica. The interactions between the solar wind and the earth's magnetic and charged-particle fields are studies with balloon-borne and ground-based instruments. Simultaneous and coordinated observations of events at the northern and southern ends of the magnetic field lines greatly enhance the scientific value of the investigations. The source of auroral particles is also investigated by measurement of helium-isotope ratios in auroral displays.

Ocean Sciences and Meteorology

The principal activity in this program is the Arctic Ice Dynamics Joint Experiment (AIDJEX), a multidisciplinary, international effort to investigate the dynamic response of the pack ice to the forces exerted by the atmosphere and the underlying ocean. The ultimate objective is to develop mathematical models for predicting the interactions of the fields of motion of the atmosphere, the pack ice and the ocean on the basis of data from a simple network of observing stations. The experiment, to be conducted in the central region of the Arctic Ocean, requires simultaneous measurements of all the principal driving forces, as well as deformations occurring, over a network of four manned stations and a surrounding network of automatic stations. The entire array will be operated for a full year in order to

sample all seasonal conditions. Although aimed primarily at understanding and predicting ice movement and deformation, the unique design of the experiment also permits investigation of fundamental problems of air-sea interaction that apply to other oceans.

The project is jointly funded by several U.S. and Canadian agencies, including the National Science Foundation, the Office of Naval Research, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, and the Maritime Administration in the U.S.A., and the Department of Energy, Mines and Resources and the Department of the Environment in Canada, Foreign participation will also include Japan and possibly the U.S.S.R.

The AIDJEX project will provide information for better prediction of arctic weather and ice conditions, including ice motion and deformation, and their effects on shipping and off-shore facilities. AIDJEX data will also be useful for study of the environmental problems related to petroleum production on the northern continental shelf.

Earth Sciences and Glaciology

The major effort of the program is a study of the Greenland Ice Sheet and reconstruction of past climate variations from the records of climatic and atmospheric conditions "stored" within the ice. Field programs include core drilling on the Greenland ice cap, surface measurements of chemical and physical characteristics, and airborne sounding of ice thickness and subsurface features. Data are obtained for theoretical modeling of ice-sheet properties. Ice samples are analyzed in U.S., Danish, and Swiss laboratories in this international effort.

The objectives are to obtain and interpret a record of prior environmental conditions, and to understand the dynamics and response of the ice sheet to such conditions. Such analysis can provide information on the causes and effects of ice ages and less severe climatic fluctuations, and assist in assessing the effects of man's activities on climate.

Biology

The principal effort of the biology program is the follow-on to the five-year Tundra Biome Project. This multidisciplinary, integrated, cooperative project used a total ecosystem approach to obtain data for the development of mathematical models of temperature-sensitive soils in the Arctic. A principal objective of the Tundra Biome Project was to provide data useful to resource and land management, to the maintenance of environmental quality, and to land-use applications through the development of a predictive understanding of arctic soil degradation and how to maintain and restore cold-dominated, temperature-sensitive tundra soils.

The major task of the follow-on program is to complete the laboratory work, initiate the synthesis of data, and develop mathematical models of the tundra ecosystem. Research emphasis will be directed to arctic lake and river regional systems and to marine biological dynamics in conjunction with near-shore marine ecological factors relevant to nutrition and environmental pollution.

Economic and Social Sciences

The principal research effort is the Man-in-the-Arctic project, the current phase of which consists of six study projects in economics, natural resource management, and transportation. The integrated results of these projects will provide the basis of four research reports: Issues in Alaskan Development; Analysis of Development Strategies in Alaska; Regional Development Strategies; and the Kobuk Transportation Corridor Report.

The objective of this long-range research effort is to develop a basic understanding of the forces of change in Alaska and to use this understanding to assist in the solution of critical problems of northern social and economic development. The economic and social studies being investigated are, to a significant extent, associated with Alaskan resource development.

Information Services

The information services program coordinates governmental and nongovernmental information services reporting on arctic research and engineering programs, disseminates this information to a wide audience of scientists, science managers, and government officials, and provides information support for the Interagency Arctic Research Coordinating Committee. The broad dissemination of such information assists in the development of interagency and international cooperation, and in the efficient use of research and logistic resources.

The program's objectives are (1) to disseminate information on arctic research and engineering programs through the quarterly *Arctic Bulletin* and other means; (2) to collect, catalog and store arctic natural-history specimens at a centralized facility for distribution to scientists; and (3) to develop a computerized bibliography on arctic research.

UNITED STATES ANTARCTIC RESEARCH PROGRAM..... $25,800,000

The research activities of the U.S. Antarctic Research Program generally fall under one of four categories: (1) investigations of the physical and biological characteristics of the continent and its surrounding seas; (2) studies directed toward understanding the role of Antarctica in global climate variations and their prediction; (3) basic scientific investigations such as in upper atmosphere physics, tectonics, terrestrial biology, and paleontology, that are meaningful in a worldwide context only when Antarctic data are included: (4) evaluation of the renewable and non-renewable resources in the Antarctic area.

As the principal instrument of United States national interest and policy in Antarctica the antarctic program is conducted within the context of the Antarctic Treaty and in support of national objectives stated in a Presidential announcement on October 13, 1970; namely, to maintain the Antarctic Treaty, to ensure that the continent is used for peaceful purposes and does not become an object of international discord, to foster scientific research, to protect the environment, and to ensure the wise and equitable use of antarctic resources. Funding and management responsibilities for the U.S. Antarctic Research Program are set forth in Office of Management and Budget Circular A–51, which assigns to the National Science Foundation the responsibility

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for developing, funding, and implementing an integrated U.S. program.

The U.S. Antarctic Research Program differs from those of other countries by its heavy reliance on ski-equipped transport aircraft (LC–130 Hercules). The U.S. program has been developed around this unique capability, which permits the conduct of substantial activities far inland from the coast. Since 1957, the U.S. has maintained a research station at the South Pole, the apex of territorial claims by seven other nations. During FY 1975, construction will be completed of a new South Pole Station, which is expected to support a variety of research investigations over the next decade. Since 1957, the U.S. has been maintaining at least one other inland station on the Antarctic continent. At present, the inland Siple Station is a key station in a global network investigating the influence of the sun on the terrestrial environment. In addition, the program includes two coastal stations and two research ships. Palmer Station and the R/V *Hero* support a program of biological and geological research in the politically contentious Antarctic Peninsula area. McMurdo Station, on the Antarctic coast south of New Zealand, is the logistic hub for supporting inland operations as well as a variety of summer and year-round research programs. During the austral summer, temporary field sites for research are established throughout Antarctica by aircraft. The research ship *Eltanin*, which was withdrawn from service during FY 1973 for budgetary reasons, will resume service during FY 1974 under joint sponsorship of the U.S. and Argentine antarctic programs.

University scientists, as well as scientific personnel from Federal laboratories and industry, participate in the research programs. Seventy-five scientists and 140 graduate students were supported during FY 1974. Many investigations, often under a single university research grant, involve small groups of scientists and graduate students. Several large-scale multidisciplinary research efforts are conducted with international and multi-institutional involvement. Examples are the Dry Valley Drilling Project, the Ross Ice Shelf Project, and the International Antarctic Glaciological Project.

Logistic support for the U.S. Antarctic Research Program is provided by the Departments of Defense (Navy) and Transportation (Coast Guard), augmented by civilian contractors. DOD support costs are funded by the Foundation.

Upper Atmospheric Sciences

The Antarctic continent offers a stable platform for observing the earth's environment of electromagnetic fields and energetic particles at very high latitudes. The ground-based and balloon-launched instruments at Siple Station are part of a global-scale U.S. program to study solar-terrestrial interactions. Observations are also made at South Pole and McMurdo Stations, and, as appropriate, at stations of other nations.

Very low frequency signals transmitted from Siple Station are used to trigger pulsations in the earth's ionosphere. Observations of the effects are correlated in space and time with measurements by earth satellites and at a magnetically conjugate station at Roberval, Canada. Controlled experiments are performed to improve the understanding of phenomena such as solar-induced magnetic storms and auroral particle precipitation.

Naturally occurring disturbances in the electromagnetic environment affect global navigation systems, communications, and possibly weather and climate. Also, the induction of ground currents by magnetic storms in the vicinity of large electric-power distribution networks may cause power surges with resultant outages. The objective of the program is to improve our knowledge of the sun's influence on the earth's electromagnetic environment so that these effects can be understood, predicted, and coped with.

Meteorology

The Antarctic continent and the surrounding oceans strongly influence world weather and climate. The intense year-round cooling influence of Antarctica, and the approximate circular symmetry of the atmospheric and oceanic flow around the earth's axis of rotation, produce the strongest flow patterns in the fluid system of the earth. This flow has strong perturbations imposed on it by the large seasonal fluctuations in the extent of the sea ice cover, which doubles the size of the antarctic ice surface during winter.

The main objective of the meteorology program is to synthesize observed phenomena into a quantitative understanding of the south polar heat sink. This understanding is a necessary prerequisite to the understanding of global weather and climate processes. The structure and dynamics of the planetary boundary layer on the polar plateau are beginning to be understood. Investigation of the effect of seasonal variations of heat balance and ice extent on large-scale dynamic processes has begun.

Synoptic observations at all U.S. stations support the World Weather Watch (WWW) of the World Meteorological Organization. At the South Pole, a comprehensive study of boundary-layer processes and low-level tropospheric circulation is under way. Monitoring of pollutants (aerosols, trace metals and gases, both man-made and natural) provides baseline data on global contamination.

Ocean Sciences

The ocean sciences program encompasses physical oceanography and marine geology and geophysics. The ocean area around Antarctica (often referred to as the Southern Ocean) exerts major influences on the world's ocean system, exchanging water at various levels with all adjacent oceans. In addition, this ocean area contains an abundance of potentially exploitable resources including probable petroleum deposits and reserves of manganese, copper, nickel and cobalt in the form of manganese nodules.

The program focuses on the study of sea ice, heat and salt budgets, bottom water formation, composition and movement, and circumpolar currents. The objective of the physical oceanography program is to develop an understanding of the composition and flow of antarctic currents and bottom water, to clarify their interactions with the world's oceans, and to determine the nature and extent of air-sea-ice interactions.

The objective of the marine geology and geophysics programs is to increase knowledge of global plate tectonics and sea-floor spreading,

to provide information on past climatic changes, and to assess the economic potential of the antarctic ocean regions.

Earth Sciences

The earth sciences program emphasize investigation of the geology and geophysics of the antarctic continent and the subantarctic islands.

The program objectives are: (1) to understand the relationship of the geology and geodynamics of the antarctic region to the geology and geodynamics of the world; (2) to determine the distribution, quantity, and accessibility of nonrenewable resources; (3) and to establish the paleoclimatic history of the antarctic region.

The major research projects include a drilling program in the dry valleys (Dry Valley Drilling Project), the Scotia Arc-Antarctic Peninsula Tectonics project utilizing the R/V *Hero*, regional geological investigations, and the Dufek Massif Drilling Project, for which a reconnaissance survey was made in FY 1974. Funds are also provided for mapping activities by the U.S. Geological Survey.

The analysis of deep sea cores obtained from *Eltanin* cruises in the continental shelf area contributes to the energy program by providing information on the fuel resources potential of these regions.

Glaciology and Remote Sensing

The continental and oceanic ice cover has a direct influence on world weather and climate. Changes in the extent of sea ice relate to changes in oceanic and atmospheric circulation. Changes in continental ice volume relate to past and future changes in sea level and world climate. In addition, stored within the ice is an unequaled record of prior atmospheric conditions. Isotopic analysis of ice cores provides a record of temperature conditions extending back hundreds of thousands of years, enabling detailed reconstruction of past climatic fluctuations. Studies of entrapped dust and gases and other ice-core characteristics provided information on possible causes and effects of climatic change.

The objectives of the program are to determine the dynamics of the antarctic ice cover, its history of change, and its interaction with the global environment.

The major research projects are the International Antarctic Glaciological Project (IAGP) and the Ross Ice Shelf Project (RISP). The IAGP is a ten-year long study of the ice cap regime in East Antarctica. The RISP is an interdisciplinary investigation which, in addition to glaciology, includes biology, oceanography and geology. Field programs include measurements such as ice movement, temperature, thickness, accumulation and internal properties. Ice-core drilling and airborne remote sensing of surface and subsurface features of the ice cover are major elements of the program.

Biological and Medical Sciences

Biological and medical research in the Antarctic encompasses a variety of scientific investigations which, together, provide a broad, balanced approach to antarctic ecological and environmental problems, including human adaptation. Current areas of research include: the structure and function of terrestrial and marine ecosystems; population dynamics and behavior of marine mammals and sea birds; adaptation of the biota to low temperature environments; and human

adaptation and response to isolation under severe Antarctic conditions.

The objective of the biology program is to obtain data required for establishing conservation measures, for the evaluation and management of commercial whaling and sealing industries, and for estimating the economic potential of the living marine resources (foreign sources estimate a maximum sustainable yield as high as 50 million metric tons annually for some species). Continuous attention is also devoted to the monitoring of pollution to determine stresses induced into antarctic life systems and organisms. The medical program is aimed at physical and psychiatric observations on the adjustment of expeditionary personnel during antarctic service.

Information Services

The information services provide for the dissemination of data and specimens obtained through antarctic research and for the collection and distribution of information required to meet U.S. obligations under the provisions of the Antarctic Treaty.

Specific objectives of the program are: (1) to provide support for the sorting, cataloging, preservation and storage of antarctic specimens, and for their distribution to qualified scientists; (2) to maintain a bibliography of antarctic research; (3) to arrange for the translation into English of selected foreign antarctic scientific literature; and (4) to prepare and publish a bimonthly journal describing antarctic program activities.

The services provided by this program ensure that the information obtained through research activities by all nations is given the broadest possible dissemination, both nationally and internationally.

Research Ship Operations

This program provides for the full cost of operation of one research ship (*Hero*) and partial support of another (*Eltanin*) used in the conduct of research in Antarctic Ocean areas.

The objective is to provide the seagoing platforms required to support U.S. marine science efforts in the antarctic region. The research ship *Hero* was especially constructed for marine biological work in the Antarctic Peninsula area. *Hero* also provides logistic support to Palmer Station and to field parties on the Antarctic Peninsula. The USNS *Eltanin* is specially configured for polar operations. The operation of the *Eltanin* was suspended on January 6, 1973, owning to budgetary constraints. However, a cooperative arrangement with Argentina has been negotiated that will allow the ship to resume operations under joint sponsorship.

Contract Support Operations

Civilian contract support of the U.S. effort in the Antarctic contributes to the achievement of effective operation of scientific facilities, and provides flexibility in the support services. This program permits the application of new techniques and administrative arrangements designed to enhance the effectiveness of program operations and management. Contract support operations will include specialized support of the U.S. scientific programs on the antarctic continent and all-civilian operation of Siple, South Pole, and Palmer Stations.

The objective of the contract support program is to provide specialized technical and logistic support for the U.S. Antarctic Program in the operation of scientific laboratories and stations. In addition, existing naval support services will be replaced with commercial services in those cases where improved cost-effectiveness and management will result.

DOD Support Operations

The Antarctic is an isolated continent which requires two major supply lines of several thousand miles each for support of the U.S. program. The United States could neither conduct a scientific research effort nor maintain a viable presence in the Antarctic without the logistic support provided by the Departments of Defense and Transportation.

The U.S. Navy has the primary logistic support role in the United States Antarctic program. The headquarters and continental U.S. staging area for most of the antarctic support operations are in Rhode Island, where the Naval Support Force, Antarctica personnel are trained, equipment and supplies are procured and shipped, and preparations for antarctic operations are made. VXE–6, the Navy antarctic flying squadron, which is an element of the Naval Support Force, Antarctica, during the operational season, is based at Point Mugu, California. A small advance staging center is located at Christchurch, New Zealand. Major activity in New Zealand is confined to the six-month operational season.

By mid-FY 1974, the aircraft inventory will include five ski-equipped LC–130 aircraft and six UH1N turbine helicopters. The fixed-wing aircraft provide the only ski-equipped heavy airlift capability possessed by any nation in the Antarctic, and are thus essential to the maintenance of the U.S. presence and conduct of U.S. scientific efforts on the Antarctic continent. The major science and support efforts in the Antarctic take place during the austral summer season, from early October until the end of February.

Under OMB Circular A–51, the National Science Foundation is responsible for funding the logistic support services furnished to the U.S. Antarctic Research Program by the Department of Defense. The Secretary of Defense has designated the Secretary of the Navy as the DOD Executive Agent for the discharge of Defense support responsibilities.

OCEANOGRAPHIC FACILITIES AND SUPPORT $15,000,000

Ships and other specialized facilities are required for academic oceanographic research activities not only in deep ocean areas but also in continental-shelf, coastal and estuarine regions and in the Great Lakes. These facilities contribute to the Nation's marine program by sustaining an important research and training capability in the Nation's universities. The program thus facilitates the development of basic knowledge concerning the marine environment by providing support for the sea-going and shore facilities required in the pursuit of marine research programs, primarily those supported by the Foundation but also some supported by other Federal agencies and State and local sources.

The continuing objectives of this program are to:

Maintain and improve a cooperative system of oceanographic facilities and operational capabilities at key locations in the the academic community to help sustain a strong oceanographic research program.

Promote shared use of facilities through the academic community organization entitled "University National Oceanographic Laboratory System (UNOLS)."

Promote effective management of oceanographic facilities through continuing improvement of the match of system facilities to current research program requirements.

Facilities supported by this program include open-ocean ships ranging in size from about 100 ft. to 246 ft.; coastal, estuarine and Great Lakes vessels, generally less than 100 ft. in length; other special platforms for data collecting in the field; docking and shore facilities for maintaining and servicing these vessels; major shared-use equipment; and laboratories for data analysis ashore.

Foundation support for the marine sciences is currently distributed among 60 U.S. institutions, of which 16 operate. Federally supported ships and related facilities. Shared use of this set of facilities, collectively identified as the academic fleet, is essential to the overall success of funded research activities. The community organization UNOLS works closely with this program to foster and coordinate shared use of the facilities.

The Foundation's share of the facilities and operations support for academic oceanography was 68% of the total Federal support in FY 1973, and will increase to about 76% in FY 1974 and FY 1975. In large measure, the increase results from decreased support from other Federal agencies.

Operations

This program activity provides support for the operation and maintenance of ships and boats, aircraft and submersibles; and for technician pools and community coordinating activities. The major component is operations support for ships.

The objectives of this program activity are to:

Support and maintain the operational capability of the facilities needed for academic oceanographic research.

Promote better management and more effective utilization of oceanographic facilities.

Promote liaison with the academic community and coordination of support activities among Federal agencies.

This program is the primary source of support for facilities essential to the oceanographic and marine-related research and training activities supported by the Foundation at academic and private research institutions. It contributes nearly 75% of the total operating budget for the major academic oceanographic facilities necessary for carrying out the Nation's overall program in the marine sciences.

Shipboard Equipment and Other Shared Facilities

The increasing sophistication of marine research programs and the facilities used to carry them out requires systematic replacement of worn-out, obsolete and obsolescent equipment aboard ship; continued

improvement of shore facilities to meet higher performance requirements; and development of staging facilities at strategic locations to promote better facilities utilization. Changing regulations pertaining to environmental protection, communications and safety also impose requirements for new or improved ship equipment. Program support is provided for such replacement items as radar and other navigational equipment; replacement or initial installation of sewage and bilge holding or treatment facilities, shipboard computers, seismic profiling systems, and water and bottom-sampling gear; and construction or renovation of shore facilities.

The specific objectives of this program activity are to:

Upgrade ship equipment.

Support the acquisition of major research equipment items for shared multiproject utilization.

Support the construction of shore facilities required for staging cruise operations.

SPECIAL RESEARCH PROGRAMS

SCIENCE AND TECHNOLOGY POLICY RESEARCH---------- $1,500,000

Under Reorganization Plan No. 1 of 1973, the Director of the National Science Foundation has been designated as the President's Science Adviser and as Chairman of the Federal Council for Science and Technology (FCST). In addition, responsibilities of the Director and Deputy Director of the recently abolished Office of Science and Technology (OST) have been transferred to him. In his new role, the Director is responsible to advise and assist the President, and agencies in the Executive Office of the President on matters involving science policy and to act as the President's representative in various international scientific and technological activities.

The Science and Technology Policy Research Program exists to provide the analytical basis for policy formulation in support of the Director's roles as President's Science Adviser and Chairman, FCST. The research program, where possible, will build upon the existing NSF grant and contract program as well as the existing staff expertise of NSF. However, the unique policy requirements of STPO will require additional contract support to supplement the existing in-house NSF program.

ENERGY R. & D. POLICY RESEARCH---------- $4,500,000

On August 3, 1973, the Office of Energy R. & D. Policy (OEP) was established to provide to the Director of NSF, in support of his role as Science Adviser under the President's Reorganization Plan No. 1 of 1973, an independent source of advice and analysis of energy R. & D. and other energy-related programs for use by the Executive Office of the President (EOP).

The OEP will assemble and mobilize a wide range of information and advice in energy-related matters, furnishing the Director with a capability to respond to requests for policy analysis of energy issues. Specifically OEP will:

Provide analysis of specific issues and selected programs related to energy R. & D., including energy conservation, economic, sociological, environmental and other areas of soft research.

Develop, support and supply EOP with a framework with which to evaluate systematically, energy R. & D. programs. Develop appropriate criteria for assessing the merits of individual technological approaches.

Provide independent assessment of environmental health, and safety standards and identify necessary additional research to improve standard setting.

Indentify and recommend critical new research needs in energy R. & D. to EOP.

Identify and evaluate significant current research findings that could affect energy R. & D. or energy programs or policies.

Determine ways in which universities and other research organizations can make their most effective contribution to energy R. & D. from a research and manpower standpoint (e.g., materials, metallurgy as well as basic chemical and physical processes).

Maintain awareness of current plans and viewpoints of consumers, of industry and associations on matters related to energy R. & D.

Provide assistance to EOP in establishing workshops, seminars, etc., and in supporting the President's Energy R. & D. Advisory Council.

Coordinate with the Federal Energy Office in the area of energy R. & D.

NATIONAL R. & D. ASSESSMENT PROGRAM---------- $3,000,000

The National R. & D. Assessment Program provides an analytical capability, consonant with the expressed needs of the Executive Office of the President, the Congress, and the National Science Foundation. The overall purpose is to supply objective analysis and define options available for enhancing the contribution of science and technology to the Nation. Through this program the National Science Foundation analyzes (1) patterns of R. & D./technological innovation, (2) the incentives and decisions that underlie these patterns, and (3) the implications of alternative options on future patterns of R. & D. and technological innovation.

The program is designed to achieve a fuller understanding of:

Relationships between Government policy options and R. & D./technological innovation.

Socio-economic effects of R. & D./technological innovation.

Processes of technological innovation.

The program, in providing an analytical capability responsive to the needs of public policy decision-makers, focuses on:

Identification of issues.

Literature management and information services.

State-of-the-art summaries of what is known about specific issues.

Identification of, and research on, major gaps in understanding.

Analysis of the range of policy options including their likely positive and negative consequences.

The program is guided by the needs of Government policy-makers for information and analyses which will aid decision-making affecting R. & D. and technological innovation. Studies of Government policy

options, combined with a fuller understanding of the processes of technological innovation and of the benefits and costs to society from such innovation, will attempt to provide a framework of knowledge within which decision-makers may consider various policy options and their likely consequences.

Therefore, the results of these kinds of research projects have to be made available to potential users in a timely and useful fashion. As soon as reported results are available the staff brings the results to the attention of interested parties such as Federal and other government policymakers, congressional staffs, staff of other agencies, industrial groups, and other researchers by:

Distributing copies of executive summaries and detailed technical reports to individuals who have indicated a major interest in the specific subject dealt with.

Assuring that all final reports are made publicly available through NTIS.

Encouraging researchers to publish findings and methodology in professional literature.

Arranging for colloquia in which research results and their implications will be discussed among researchers and decision-makers.

Periodically synthesizing, in writing, these results in a language that will bridge the various interested parties.

EXPERIMENTAL R. & D. INCENTIVES PROGRAM---------- $2,200,000

The objective of the Experimental R. & D. Incentives Program is to identify and test incentives which the Federal government might use to accelerate the application of R. & D. results. The program supports experiments which test various techniques, mechanisms and procedures for stimulating technical innovation in both the public and private sectors. Learning what incentives are most effective in different settings can result in more effective approaches to the implementation of Federal programs dealing with the increased application of science and technology in the civil sector.

Through the Experimental R. & D. Incentives program mechanisms are identified that can improve the effectiveness of the innovation process which in turn can have a beneficial impact on:

The economy; through improved products and productivity—and thereby through increased international competitiveness,

Employment; through the creation of new job opportunities, and

The quality of life; through improved goods and services and increased buying power therefor.

Such innovation can be stimulated by:

Increasing the R. & D. effort, and

Reducing the barriers to the application of the resulting new science and technology.

These and other facets of the climate for innovation are strongly affected by Federal policy. However, the innovation process, and the interrelated effects of Federal policy, are so vaguely defined that the actual effect of any given incentive can best be determined by field tests of proposed actions.

The R. & D. Incentives Program provides operational experience with various incentives which the Federal Government might use to increase the application of science and technology in the civil sector.

3. NATIONAL RESEARCH CENTERS----------$52,500,000

Authorization, fiscal year 1975

National Astronomy and Ionosphere Center	$3,300,000
Kitt Peak National Observatory	7,800,000
Cerro Tololo Inter-American Observatory	3,000,000
National Radio Astronomy Observatory	20,500,000
National Center for Atmospheric Research	17,900,000
Total	52,500,000

Five National Research Centers are supported by the National Science Foundation to meet national needs for advanced research in areas of science which require specialized instrumentation and equipment beyond the financial and management capabilities of individual institutions. These facilities are available for use by all qualified scientists. The centers are managed and operated by nonprofit corporations or universities under contract to the Foundation.

The centers maintain scientific staffs to provide the necessary expertise to support the research programs of visiting scientists, to develop advanced instrumentation, and to participate in the conduct of research programs.

The following table lists the centers supported, the types of research conducted, the centers' locations, and the cognizant contractors.

National research center	Type of research	Location of major facilities	Contractor
National Astronomy and Ionosphere Center (NAIC).	Radio and radar astronomy and ionospheric physics.	Arecibo, P.R.	Cornell University (CU).
Kitt Peak National Observatory (KPNO).	Stellar, solar, and planetary optical astronomy.	Kitt Peak, Ariz.	Association of Universities for Research in Astronomy, Inc. (AURA).
Cerro Tololo Inter-American Observatory (CTIO).	Stellar and planetary optical astronomy.	Cerro Tololo, Chile	(AURA)
National Radio Astronomy Observatory (NRAO).	Radio astronomy	Green Bank, W. Va., and Kitt Peak, Ariz.	Associated Universities Inc. (AUI).
National Center for Atmospheric Research (NCAR).	Atmospheric sciences	Boulder, Colo.	University Corporation for Atmospheric Research (UCAR).

NATIONAL ASTRONOMY AND IONOSPHERE CENTER---------- $3,300,000

The objective of the National Astronomy and Ionosphere Center at Arecibo, Puerto Rico, is to provide the scientific community with a unique radio/radar telescope for research in astronomy and ionospheric physics. The telescope has a fixed, 1000-foot reflector that is used both for transmitting and receiving radar signals and for observing the natural radio emissions of distant celestial bodies. The 19.8-acre collecting area gives the telescope exceptional sensitivity. Three major programs are conducted: radio observations of celestial radio sources, radar observations of the moon and the planets, and radar studies of the earth's ionosphere.

Scientific Research Support

Scientific research support is programmed at $3,300,000. Of this amount, $3,040,000 is for research operations, administration, and maintenance. The remaining $260,000 is for observing equipment required for the upgraded telescope facility and includes test equipment, receivers, and digital devices.

Radio Astronomy

The objectives of this program are (a) to continue the search for new radio sources in the celestial sphere and measure their distribution, frequency spectrum, polarization, and time variability; (b) to identify the constituents of gas concentrations in space and to measure their distribution, motion, temperature and density; and (c) to continue the pulsar surveillance program.

The increased accuracy of the upgraded reflector surface together with modifications to the suspended portion of the antenna have provided a capability for radio astronomy operations to frequencies as high as 7.2 GHz (4.2 cm wavelength).

Radar Astronomy

The radar astronomy program makes use of the Arecibo telescope to study objects such as the moon and inner planets by analyzing radar echoes reflected off them. Measurements of the absolute delay of the radar echo and the Doppler shift in frequency give accurate information about the orbits of these bodies. Through detailed studies of the characteristics of the echo at various time delays and Doppler shifts, the surface features and rate of rotation of the body can be determined.

Ionospheric Physics

The ionospheric physics program is concerned with the complicated photochemical and dynamical processes governing the behavior of the ionized and neutral constituents of the upper atmosphere. Studies are conducted of photoionization; atom-ion interchanges and dissociative recombination; optical emission (airglow); thermal coupling between electrons and ions; ambipolar diffusion of ions and diffusion of neutral particles; motions induced by electric fields, neutral winds, tides, and gravity waves; energy transport between ionosphere and protonosphere; and plasma instabilities.

KITT PEAK NATIONAL OBSERVATORY (KPNO)---------- $7,800,000

The objective of the Kitt Peak National Observatory (KPNO) is to provide the U.S. scientific community with a major facility for research in stellar, solar, and planetary astronomy. The facility consists primarily of ground-based telescopes and the auxiliary equipment necessary to observe astronomical objects in the optical and infrared regions of the electromagnetic spectrum. At least 60 percent of the observing time on the telescopes is made available to visiting astronomers.

The major observing facilities are located at an elevation of 6,800 feet on Kitt Peak, a mountain 40 miles southwest of Tucson, Arizona. Since 1957, nine telescopes have been erected on Kitt Peak: the new 4-meter telescope, a 2.1-meter general purpose reflector, a 1.3-meter cassegrain reflector for photometric and infrared studies, two 92-

centimeter reflectors for direct photography and spectroscopic observations, two 41-centimeter instruments for photoelectric photometry, the 1.5-meter McMath Solar Telescope that is used for both solar and planetary observations, and a recently completed Solar Vacuum Telescope and Magnetograph for mapping magnetic fields and the motions of gases on the sun. The new 4-meter telescope was dedicated in June 1973 and will become fully operational as an instrument available to visitors in FY 1974.

In addition to the telescopes, the Kitt Peak installation includes dormitory, dining, technical and administrative facilities for operating and maintaining the equipment and for serving the telescope users. The observatory headquarters, located in Tucson, near the University of Arizona campus, consist of offices, laboratories, shops, a library, and computer facilities for the support of visitors, resident KPNO staff, and the administrative activities of the observatory.

Stellar Astronomy

The stellar astronomy program includes measurements of the brightnesses, colors, motions, and spectral characteristics of stars within our own galaxy. These measurements permit determination of temperatures, masses, and structures of the outermost layers of the stars. This information is essential to formulating and testing theories of the origin and evolution of stellar systems and the galaxy, and the conditions necessary for the formation of planetary systems.

Solar Astronomy

The solar astronomy program includes studies of the physical characteristics of the outer layers of the solar atmosphere, including temperatures, pressures, gas motions, and magnetic fields. Among the specific thrusts are efforts to explore the coupling among gas motions, magnetic fields, and the strong radiations that give rise to solar flares and other phenomena that affect the interplanetary environment.

Planetary Astronomy

The planetary astronomy program includes theoretical and observational studies of the structure and composition of the atmospheres of Venus, Mars and several larger planets, such as Jupiter and Saturn, whose orbits lie beyond that of Mars. Knowledge of the pressures, temperatures, and chemical compositions of the atmospheres of these bodies is essential to an undertanding of the origin and evolution of the solar system. Other important projects are concerned with the properties of terrestrial airglow emissions and the physics of the earth's ionosphere.

Research Support Services

The research support services program includes the engineering and technical services required to support the KPNO and CTIO 4-meter telescopes, KPNO scientific programs, and general observatory needs. The activities cover support and operation of the optical, electronics, and machine shops, and the scientific computer laboratory with its peripheral equipment, programmer services, and supplies.

Administrative, Operations, and Maintenance Services

The administrative, operations, and maintenance services program includes such activities at both Kitt Peak and the headquarters in

Tucson. The program includes the costs of observatory management and business functions; operation of the Director's office, and the personnel, accounting, budgeting and contracts offices; shipping and receiving; legal services; travel arrangements; utilities and communications; vehicle maintenance; computer equipment lease and maintenance agreements; photographic, printing, and reproduction services; the library; and related services and supplies.

Equipment

The equipment program at KPNO provides funds for telescope instrumentation, computer hardware, and research and general observatory equipment. The telescope instrumentation projects provide the necessary auxiliary instrumentation for, and modifications to, existing telescopes on Kitt Peak, and also the hardware required for the design and development of new advanced observing devices.

Management Fee

The management fee consists of funds paid to AURA by NSF, under terms specified in the contract, to cover corporate expenses incurred in the operation and management of KPNO.

Construction of Buildings and Research Facilities

This program provides for the construction and erection of telescopes and research facilities, and the construction of facilities for administrative, operations, and maintenance support of visitors and staff activities on Kitt Peak and at the headquarters complex in Tucson. The program includes site improvement projects and the upgrading of roads and utilities. In FY 1974, $24,000 was budgeted for road improvements and expansion of the water catchment system on Kitt Peak.

CERRO TOLOLO INTER-AMERICAN OBSERVATORY (CTIO)--$3,000,000

The Cerro Tololo Inter-American Observatory (CTIO) was established in the Republic of Chile, South America, for the purpose of making available a visitor-oriented astronomical research facility in the Southern Hemisphere to the U.S. scientific community. The facility includes the following telescopes: a 1.5-meter general purpose reflector, and a 92-centimeter, a 61-centimeter and two 41-centimeter cassegrain reflectors. In addition, there is on loan from the University of Michigan a 61-centimeter-aperture Schmidt telescope that has been used continuously since 1967. In late FY 1974 the 1.0-meter reflector of the Yale University Observatory will be installed on Cerro Tololo to share the observing burden of the 1.5-meter telescope. The new 4-meter reflector, identical to the recently dedicated 4-meter Mayall Telescope on Kitt Peak, Arizona, will become fully operational in FY 1975. This large telescope will enable CTIO to carry forward new investigations of nebulae, quasars, pulsars and remote extragalactic objects.

Stellar and Planetary Astronomy

The stellar and planetary astronomy program consists of research activities associated with observations of astronomical objects in the southern skies. Many of these objects, including certain nearby star clusters, peculiar galaxies, the Southern Milky Way, the Magellanic Clouds, and the region of the South Galactic Pole, are of fnudamental importance to our understanding of the universe and can be observed only from the Southern Hemisphere. During the long fall and winter nights, the Southern Milky Way and, in particular, the center of the galaxy, pass overhead and are well positioned for observation. At certain times of the year the planets pass nearly overhead and are in an ideal position for study with a minimum of atmospheric interference.

Observing time on the CTIO telescopes is allocated so as to provide visitors with at least 60 percent of the time on each instrument. As part of the stellar and planetary astronomy program, the observatory provides visitors with travel support as well as the night assistants and supplies necessary to carry out successful observing programs.

Operations and Maintenance

This program consists of the operations and maintenance services for both the headquarters complex in La Serena and the observing facilities on Cerro Tololo. The program includes buildings and grounds maintenance, dining room services, and vehicle maintenance; engineering, electronics, and other shop services; computer equipment operations, lease, and maintenance costs; and related supplies, travel, and services.

Administrative Services

Administrative services encompass financial and administrative support activities such as accounting, budgeting, contracts, shipping and receiving, personnel, legal, and travel arrangements, general photographic services, library services, printing and duplication, equipment rental, utilities and communications and related supplies.

Equipment

The equipment program provides auxiliary instrumentation for telescopes, scientific research equipment, computer hardware, and general observatory equipment such as furnishings, vehicles and machine tools.

Management Fee

The management fee is a fixed amount paid to AURA, under terms specified in the contract between AURA and the NSF, to cover corporate expenses incurred in the operation and management of CTIO.

Construction of Buildings and Research Facilities

This program provides for the construction of buildings for telescopes and research facilities, and of facilities for administrative, operations and maintenance support of visitors and staff on Cerro Tololo and at the headquarters in La Serena. The program includes site improvement projects and the upgrading of roads and utilities. In FY 1973, construction was begun on modifications to the technicians' dormitory on Cerro Tololo and on the vehicle shop expansion in La Serena. Erection of the prefabricated houses budgeted for in FY 1973 will begin in early FY 1974. In FY 1974 CTIO will initiate construction of an astronomers' dormitory annex on Cerro Tololo and an instrument and maintenance shop and additional staff housing in La Serena.

NATIONAL RADIO ASTRONOMY OBSERVATORY---------- $20,500,000

The National Radio Astronomy Observatory (NRAO) is a widely dispersed establishment of facilities for research in radio astronomy. The central offices, laboratories, library, and computing center are located in Charlottesville, Virginia, for the most part on the grounds of the University of Virginia. The principal observing station, with a laboratory building and residence hall, is in a valley near Green Bank, West Virginia, remote from sources of electromagnetic noise. Three major radio telescope systems are operated at this location: a 300-foot meridian transit telescope; a 140-foot fully steerable telescope; and a radio interferometer consisting of three 85-foot telescopes with a portable 45-foot telescope for remote operations. A 36-foot millimeter-wave telescope requiring a dry atmosphere for minimum absorption of radio waves is located on Kitt Peak, near Tucson, Arizona. A major new radio telescope designated the Very Large Array (VLA) is under construction on the Plains of San Augustin near Socorro, New Mexico.

The objective of NRAO is to provide advanced facilities for the use of the scientific community in the pursuit of research in radio astronomy.

Scientific Research Support

The NRAO facilities are available to any qualified scientist or graduate student with an approved research project to be conducted, independently or in cooperation with NRAO staff members. Telescope observing time is allocated on the basis of the scientific merits of the proposed research and the availability of the telescopes. Visitors are assigned at least 60 percent of the available observing time and NRAO staff the remainder. During FY 1973, 210 visiting scientists, including 64 students, used the NRAO telescopes. They came from 44 U.S. and 12 foreign institutions.

Construction of Research Facilities

The construction of the Very Large Array (VLA) will continue in FY 1975 with the objective of providing radio astronomers with an advanced instrument capable of overcoming observational barriers in radio astronomy. Major construction elements in progress are the antenna system, antenna transporters, site development, rail network, electronic systems, and computer system.

Management Fee

NRAO is operated by Associated Universities, Inc. (AUI) under a cost-reimbursable contract. AUI is paid a management fee to defray corporate expenses incurred by performance of the contract but not directly related to work under the contract.

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH-------- $17,900,000

The National Center for Atmospheric Research (NCAR) has two primary objectives:

To plan and conduct, in cooperation with universities and other scientific organizations, atmospheric research programs requiring large scale coordinated efforts and facilities beyond the capabilities of single university departments.

To provide facilities and logistic support to the atmospheric sciences programs of universities.

NCAR's principal scientific programs are:

Participation in the Global Atmospheric Research Program (GARP), including the development of mathematical models of the global atmosphere required for extending weather prediction capability to periods of up to two weeks, and for improving the understanding of climate; participation in GARP field experiments such as the GARP Atlantic Tropical Experiment (GATE), scheduled for the summer of 1974 to study atmospheric characteristics in the tropics; and development of observational and data-handling techniques required for GARP experiments scheduled later in the decade.

Investigations of the physics of clouds and precipitation. This research provides the scientific basis for the National Hail Research Experiment (NHRE), a five-year (1972–76) experiment sponsored by the Foundation's program of Research Applied to National Needs to increase our knowledge of hailstorms, and to test the feasibility of suppressing the formation of damaging hail.

Study of the sun's atmosphere, the solar wind, and the impact of solar events on the earth's atmosphere.

Investigation of (1) global air quality, (2) factors affecting the climate, and (3) chemistry and dynamics of the upper atmosphere.

Instrumentation and logistic support to atmospheric scientists is provided by:

The Research Aviation Facility, located at the Jefferson County Airport, which operates and maintains aircraft and instrumentation required for airborne experiments.

The Field Observing Facility, located at Marshall, Colorado, which provides radars and other specialized field research instrumentation.

The Computing Facility, located in the main NCAR laboratory at Boulder, which provides computers, software and programming support to scientists.

The National Scientific Balloon Facility (NSBF) at Palestine, Texas, which provides support for research requiring the use of high-altitude balloons.

Investigations of the Earth's Atmosphere

The objectives of this program are (a) to improve the accuracy of weather predictions on time scales from several hours to several weeks, (b) to enhance the ability to modify the weather to prevent damage caused by severe storms, (c) to enable long-term climatic predictions, and (d) to develop a better understanding of natural and induced changes in the atmospheric environment.

Solar Physics and Solar-Terrestrial Effects

The objective of this program is to define the relationship among the solar atmosphere, the interplanetary medium, and the upper atmosphere of the earth. The emphasis of the program is on the study of the lower solar atmosphere, the solar corona, and the interplanetary solar wind, and on the processes that control the output of solar wind plasma, ultraviolet radiation, and energetic particles.

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Facility Operation and Development

The NCAR Research Aviation Facility provides the atmospheric scientific community with airborne platforms and allied services of systems and instrumentation development, engineering, testing, and evaluation that are required for observing, measuring, and recording atmospheric conditions.

Postdoctoral Education and Special Studies

The principal objective of this program is to bring university scientists in contact with atmospheric science and to facilitate the development of joint NCAR-university research programs. The program consists of approximately 20 one-year postdoctoral appointments under which scientists from various disciplines develop research projects in the context of NCAR research activities. Also included in this activity are educational and research seminars and a short-term appointment program for scientists visiting NCAR for periods shorter than four months.

Administrative and Research Support Services

This activity provides for all management and research support services, including the salaries of administrative personnel; rent; plant and equipment maintenance; communications; utilities; and information services.

Management Fee

The management and operation of NCAR is accomplished by the University Corporation for Atmospheric Research (UCAR) under the terms of a contract between UCAR and the Foundation. A management fee of $340,000 is paid annually to UCAR.

NATIONAL SCIENTIFIC BALLOON FACILITY ($1,070,000)

The National Scientific Balloon Facility (NSBF) is managed and operated under contract by the University Corporation for Atmospheric Research (UCAR) as part of the National Center for Atmospheric Research. Funding for this facility is included in the total funding for NCAR.

The objective of the National Scientific Balloon Facility is to provide ballooning support to scientifists requiring observations from high altitudes in such fields of science as aeronomy, infrared and optical astronomy, and high energy astrophysics. The facility is located at Palestine, Texas. The present staff consists of 43 full-time scientists, engineers, technicians, and administrative personnel.

4. SCIENCE INFORMATION ACTIVITIES $8,500,000

Authorization, fiscal year 1975

Research	**$3,500,000**
National Information Systems	2,300,000
User Support	**2,200,000**
Foreign Science	**300,000**
Total	8,300,000

The Science Information Activities program is administered by the National Science Foundation under the provisions of the National Science Foundation Act of 1950, as amended, and Title IX of the National Defense Education Act of 1958. The purpose of this program is to promote the dissemination of scientific information and to help scientists and others obtain and use the results of worldwide scientific research. This goal is pursued by supporting activities whose results can be applied to improve and extend science information services provided by Government agencies, scientific societies, colleges and universities, and private organizations. Support is limited to projects of national significance that cannot be successfully conducted by private organizations without Federal support.

General objectives of the program are:

Development and dissemination of knowledge and new techniques essential for continuous improvements in science information services, including their assessment by cost/benefit criteria.

Achievement of intersystem compatibility and increased efficiency among major science information systems.

Development of improved means for retrieving quantitative and factual data.

Development and demonstration of more effective ways of helping scientists and others use information made available through present systems.

Expansion of international exchange of new scientific knowledge and improvement in access to foreign science results by U.S. scientists.

These objectives result from an analysis of past priorities and results of the Science Information Activities program and from user requirements expected to arise later in this decade. New programmatic and organizational structures have been established within the Office of Science Information Service (OSIS) in line with the revised objectives. Coordination of science information activities in this country and relationships with international science information organizations also are being guided by these objectives.

RESEARCH $3,500,000

The research program contributes new tested knowledge for use by organizations in improving their present science information programs and for developing new services. This progam is the only major source of support in the United States for research on science information problems. Specific research objectives are to support experimental applications of technology for long-range improvements of science information systems; to seek cost-effective ways of advancing networking and interconnections among systems; to develop innovative science information services required to meet users' needs in future years; to provide a theoretical framework that will contribute to more systematic applications and improved services; and to provide data on the costs and benefits and trends in science information supply and demand relationships. Research results also provide bases for orderly development of the National Information Systems and User Support Programs.

NATIONAL INFORMATION SYSTEMS $2,300,000

This program seeks to improve the operation of existing systems for gaining access to the literature of science and technology and for locating and retrieving specific quantitative data obtained in research.

Objectives of its literature-oriented activities are to promote interconnections, increase operational efficiency, and reduce the overlap among Federal and private systems in their coverage of the world's literature. With completion of automation of major abstracting and indexing services, emphasis has shifted to reduction of gaps and overlaps among major science information systems and to creation of efficient ways of exchanging information among them.

Introduction of improved methods for identifying and retrieving specific data, such as "tagging" them at the time of publication, is a principal objective of the program's data-oriented activities. Another objective is to foster management policies and procedures for improved and more economical access to data.

USER SUPPORT $2,200,000

By concentrating on the needs of interests of users, in contrast to those of the originators or distributors of information, the User Support program seeks ways to increase the application of available knowledge and to reduce the cost of delivering it to users. Two broad approaches are being used: (1) identification of new user groups for existing services; and (2) testing the purchasing appeal of new or modified services for both new and existing user groups. An expanded user-paying base for services is expected to increase revenues for services and allow the services to further test potentially more useful ways of providing information with their own funds.

The program includes four types of sequentially related activities. First are studies to establish a planning base for improved management of Federal and private science information services and to guide future development of the User Support Program. Activities include: data collection to determine information user needs, interests, and preferences; studies and critical reviews of knowledge on how purchase decisions are made with respect to information services; and studies of technical and economic barriers to adoption of improvements in science information services. Second, design and development studies are undertaken to translate research results into usable approaches for overcoming barriers to more efficient and effective use of scientific and technical information services. Examples of activity are studies and demonstrations of the economic feasibility of ways of improving local access to literature identified through national bibliographic information retrieval systems and methods of extending computer-based information retrieval services to occasional users. Design and development studies may lead to innovative new programs sponsored by industry, non-profit, Federal science information services, or user groups, as well as to proposals for further demonstrations and experiments supported by NSF. Third, experiments and demonstrations are carried out to evaluate promising innovations in user services which cannot be implemented until technical or economic uncertainties are reduced or eliminated. Included are experiments and demonstrations of user-controlled publications and new information services for users in industry. Finally, the program supports applications efforts designed to stimulate the adoption and use of innovations in services to users, especially those developed with NSF support.

FOREIGN SCIENCE $300,000

The objective of this program is to increase access to foreign science information among U.S. scientists by supporting U.S. participation in cooperative international science information programs and by serving as the focal point for such activities by U.S. government and private groups.

In FY 1974, the program supported U.S. participation in UNESCO's UNISIST program, the Federation of International Documentation, and the Abstracting Board and the Committee on Data for Science and Technology of the International Council of Scientific Unions. Also supported were cooperative science information activities with U.S.S.R. information centers and distribution of translations of foreign reports in the United States.

5. INTERNATIONAL COOPERATIVE SCIENCE ACTIVITIES $8,000,000

Authorization, fiscal year 1975

Cooperative Science Programs	$5,600,000
Scientific Organizations and Resources Programs	1,700,000
International Travel	500,000
Support for Special Foreign Currency Projects	200,000
Total	8,000,000

The Foundation's international cooperative science programs support U.S. scientists who (1) participate in research and exchange activities with scientists of other nations; (2) plan, organize, and participate in the activities of international scientific unions and organizations; (3) attend and present reports on their scientific research at international meetings; and (4) visit and conduct research in foreign laboratories.

The primary goal of the program is to foster international cooperation in basic and applied research. Specific objectives are to (1) produce new knowledge and encourage its application to human needs; (2) strengthen international cooperative programs through support of leading U.S. institutions and scientists; (3) support maximum interchange of information between U.S. scientists and their foreign colleagues; and (4) contribute to the advancement of U.S. foreign policy interests. This program includes support for increased participation by United States scientists in international cooperative science activities related to the solution of energy problems in the United States.

COOPERATIVE SCIENCE PROGRAM $5,600,000

The objectives of these cooperative activities are to produce new knowledge, exchange information, provide U.S. scientists with opportunities to work on unique problems, and reduce the costs to the United States of attacking global scientific problems. These programs all serve our national policy of strengthening international cooperation through scientific research.

This program includes cooperative research projects, seminars, and exchange of scientists with 18 countries. The Foundation serves as Executive Agency for bilateral research and exchange programs with Argentina, Australia, Brazil, the Republic of China, France, Hungary, India, Italy, Japan, Mexico, Romania, and Spain, and supports

U.S. scientists in their efforts to develop scientific programs with the U.S.S.R. The National Academy of Sciences' exchange programs with the Academies of Sciences of the U.S.S.R., Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and Yugoslavia are also funded by the Foundation. The exchange of scientists program initiated between the National Academy of Sciences and the Science and Technology Association of the People's Republic of China is also included in this program. The Foundation provides partial funding to support U.S. and P.R.C. scientific delegations. The U.S.-Spain Cooperative Science Program is supported with funds transferred to the Foundation by the Department of State.

This program also provides support for the planning and development of cooperative activities with other countries in the energy R. & D. field. These efforts include visits by individuals and task forces to foreign laboratories; international conferences and seminars involving technical experts; and technological surveys, studies and related services.

SCIENTIFIC ORGANIZATIONS AND RESOURCES PROGRAM---- $1,700,000

International nongovernmental scientific organizations advance science by facilitating communications among the world's scientists. Important mechanisms for developing communications include the organization of meetings; establishment of standards; planning and coordinating and, in some cases, providing facilities for carrying out international research programs; and the rendering of scientific advice, on request, to intergovernmental organizations. This program provides funds to support U.S. participation in international organizations, chief among which is the International Council of Scientific Unions (ICSU), together with its 17 member unions. A large share of the funds goes to the National Academy of Sciences (NAS) which, through various U.S. National committees, is the U.S. adhering member to ICSU and all but one of its affiliated unions. The program also supports the membership of the NAS in the International Institute for Applied Systems Analysis (IIASA), a multinational nongovernmental institution supported by 13 industrialized nations to study problems of modern societies. The Institute applies systems analysis, computer technology, and modern management techniques to the solution of societal problems.

The objectives of this program are to ensure that:

U.S. scientific interests are represented and defended in international organizations,

U.S. scientists participate and maintain a leadership role in these organizations,

The U.S. scientific community is informed of the results of the organizations' activities, and receives maximum benefit from U.S. participation,

The Federal Government has available to it useful studies relevant to important international scientific and technological organizations and issues.

U.S. scientists and institutions are adequately informed on progress made in other countries toward an alleviation of the worldwide energy problem.

INTERNATIONAL TRAVEL PROGRAM---------- $500,000

This program provides funds to enable U.S. scientists to attend international conferences, visit foreign laboratories to conduct research, participate in international cooperative programs, and exchange information.

The objectives of the program are to obtain information that will advance research efforts in the United States, enable U.S. scientists to discuss their research efforts in international scientific gatherings, and advance the education, leadership and experience of individual U.S. scientists.

SUPPORT FOR SPECIAL FOREIGN CURRENCY PROJECTS------ $200,000

This program provides dollar supplement grants to U.S. institutions involved in cooperative projects in special foreign currency countries. Examples of costs incurred by U.S. institutions that cannot be paid with U.S.-owned excess currency are (1) cost of reducing data collected overseas; (2) purchase of small, but essential, expendable scientific instruments and equipment; (3) international travel to excess currency countries whose governments do not permit the use of their funds for travel; and (4) costs incurred in the administration of foreign currency grants and contracts.

6. RESEARCH APPLIED TO NATIONAL NEEDS---------- $139,100,000

Authorization, fiscal year 1975[1]

Energy Research and Technology	88,700,000
Environmental Systems and Resources	21,200,000
Advanced Technology Applications	13,400,000
Social Systems and Human Resources	12,100,000
Exploratory Research and Problem Assessment	3,700,000
Total	$139,100,000

[1] Amounts indicated for individual categories reflect relative percentage cuts based on the overall reduction of $9.8 million. These are not binding on NSF which may make such adjustments as it deems appropriate.

The Foundation's program of Research Applied to National Needs (RANN) is designed to focus U.S. scientific and technical resources on selected problems of national importance, with the objective of contributing to their practical solution. An important purpose of RANN in this process is to shorten the lead time between the discoveries of science and their application in meeting the Nation's needs. Thus RANN provides a key bridge between the Foundation's basic research and education programs and the development and operating programs of the Federal mission agencies and other important elements of the user community, including State and local governments and private industry.

The principal emphasis of the RANN program currently is placed upon three major problem areas. These are Energy, the Environment, and Productivity. These problems are complex and interrelated. They involve all aspects of our society and require focused interdisciplinary research efforts to provide the knowledge base required for their solution. Indeed, the interdependence of such major national problems as energy production, environmental quality, and increased productivity requires the application of the full interdisciplinary capability of the best scientific and technical skills of the nation if sound overall

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solutions are to be found. RANN provides a unique Federal capability for identifying, developing, and supporting research on problems requiring the interdisciplinary research approach. This capability is being, and will be brought to bear on the major problems of Energy, the Environment and Productivity, as summarized below. Following this summary, there is a brief description of the important activities in the areas of Technology Assessment and New Initiatives, Program Management and Research Utilization, and Program Planning and Evaluation.

ENERGY RESEARCH AND TECHNOLOGY---------- $88,700,000

The Nation has the urgent need to achieve energy self-sufficiency. There is a wide range of potential technology combinations that will help achieve this goal. It is necessary in selecting combinations to provide a measure of insurance against technical and cost uncertainties. For this reason, an extensive mix of technologies has been selected for acceleration. The NSF Energy Research and Technology program contains the following complementary approaches to the Nation's goal of energy self-sufficiency:

Solar Energy.—A comprehensive research effort has been established to provide the full technology base for widespread utilization of the sun's energy in a manner that is non-polluting and is socially as well as economically acceptable. With growing momentum since FY 1971, the Foundation has supported solar energy research to provide a solar alternative for the Nation's energy future. Although the full impact of solar research will not be visible in the short range, the economic viability of several important applications (e.g., heating and cooling of buildings, wind energy conversion, and bioconversion to fuels) can be proven in the next five years. By the year 2000 it is reasonable to expect that terrestrial applications of solar energy could contribute from 15 percent to 30 percent of the Nation's total energy requirement.

Geothermal Energy.—In concert with the Atomic Energy Commission and the Department of Interior, a coordinated effort will be mounted to harness the earth's heat as a major, alternative energy resource. An aggressive research effort is designed to develop the full technology base to stimulate the installation by private industry of tens of thousands of megawatts generating capacity by the middle of the next decade. This would save on the order of 1,000,000 barrels of oil daily. Achievement of geothermal energy production goals for the generation of electricity by the turn of the century would save from 3,000,000 to 6,000,000 barrels of oil daily and could simultaneously conserve energy by utilizing geothermal heat for non-electric purposes, such as space heating and air conditioning.

Energy Conversion and Storage.—Research in this program area has many important facets. It is focused on determining the feasibility of developing new and improved energy storage technologies including superconducting magnetic storage and sodium sulfur batteries. To increase the efficiency of electric generating plants, investigations will focus on magnetohydrodynamics electrical generation, topping and bottoming cycles and combined cycles.

Energy Systems.—Studies to acquire, through systems analysis, a knowledge base for assessing alternative energy system and public policy options to provide the most effective use of energy resources.

Advanced Automotive Propulsion.—Research to increase engine fuel economy and cycle efficiency and reduce pollutant emissions, with particular attention given to non-equilibrium combustion phenomena.

Energy Resources.—Research to develop methods for effectively utilizing conventional energy resources (e.g., coal) and for environmentally managing new resources (e.g., shale deposits) and to investigate secondary and tertiary petroleum extraction methods.

Energy and Fuel Transportation.—Research to improve the transportation of all forms of energy from production source to consumption site through investigations involving techniques of control and reliability, as well as through research on superconducting and electrically insulating materials. Research will also be carried out on the transportation of fuels, such as hydrogen and methanol.

The NSF Energy Research and Technology program is described in detail in the following sections.

Solar Energy

The inexorable depletion of the fossil fuel reserves on which modern civilization depends and the environmental impacts associated with their use make crucial the development of alternative energy sources. The objective of the national Solar Energy Research Program is to develop, at the earliest feasible time, the full technology base for those applications of solar energy that can be made economically competitive and environmentally acceptable as alternative energy sources. An intensive study by leading industry, university, and government experts has identified the highest priority opportunities for the exploitation of solar energy. Solar energy can be used to generate electric power, to heat and cool buildings and to produce renewable supplies of clean hydrocarbon fuels. Six phased research subprograms covering these three areas of application are presently underway. It is important to recognize that each of the subprograms can make a substantial contribution to the realization of the full potential of solar energy. These subprograms which are described in detail in subsequent sections are:

(1) Heating and Cooling of Buildings.
(2) Solar Thermal Conversion.
(3) Wind Energy Conversion.
(4) Bioconversion to Fuels.
(5) Ocean Thermal Energy Conversion.
(6) Photovoltaic Energy Conversion.

Heating and Cooling of Buildings

Approximately twenty-five percent of the energy consumed in the United States is used for heating, cooling and supplying the hot water needs of buildings. The overall objective of this program is to establish the full technology base for the widespread availability and utilization of solar energy systems to help meet the heating and cooling needs of all types of buildings in all of the climatic regions of the United States to the degree that such applications can be made economically viable and socially and environmentally acceptable. To accomplish this objective, a balanced program of advanced research, as well as a series of subsystems tests and system proof-of-concept experiments will be carried out.

Solar Thermal Conversion

The objectives of the NSF Solar Thermal Conversion program are to prove the technical and economic feasibility of solar thermal conversion systems, and to provide the full technology base by the mid 1980s for load following electric energy generation applications and electrical and thermal service applications for various types of communities including Federal installations. To accomplish these objectives, major efforts will be aimed at:

Design, fabrication, integration, and one-year test of a 10 MWe central receiver experiment with the output from this plant integrated into a private utility power grid.

Complete design, fabrication, integration, and one-year test of a 200 KWe, 2 Mwth solar total energy system providing electrical and thermal service to a new civilian community or Federal base installation.

An Advanced Research and Technology subprogram that will include research on alternative concentrator-collectors, thermal transfer and storage subsystems; and deployment of instrumentation to monitor the direct solar and circumsolar radiation in the southwest United States. Also included is research on selective absorber and reflector coatings, second generation system application analysis, and fabrication of very high temperature (1500 degrees F) experimental receiver/storage components.

Wind Energy Conversion

The key deterrent to expanded use of large wind power systems in the U.S. in this century has been the relatively high cost of these systems. Several systems of 100 KW to 1.25 MW were built in the 1930s through the 1950s, and while proving technical feasibility, they were ultimately uneconomical in the marketplace of that era. Small, farm-type systems also became uneconomical after rural electrification provided cheap and reliable power. The technological developments of the past twenty years in such fields as materials, helicopter technology, automatic controls, and computer modeling have not been systematically applied to wind systems because of the availability of inexpensive power from other sources and problems associated with the short-term variability in the wind. In this era of energy shortage, however, advanced wind power systems, which will take advantage of these new developments have the potential of providing for domestic use significant amounts of non-depletable, non-polluting energy.

The objective of this research program is to expedite the development of the technology for economically viable wind energy conversion systems suitable for large-scale utilization.

The program provides for advanced research and technology to reduce cost (and cost uncertainty) per unit performance, and for a phased set of experiments through systems proof-of-concept to establish the full technology base for widespread utilization of cost-effective wind energy conversion systems.

Bioconversion to Fuels

Bioconversion to Fuels system offers the potential of converting replenishable supplies to clean hydrocarbon fuels (biomass) to energy in various forms. Estimates indicate that significant amounts of the

Nation's current gas and oil requirements could be provided by means of these systems. However, the extent to which these projections can be fulfilled will depend upon the amount of space available for biomass production and the economy of energy farming practices and of systems to convert organic material to useful fuels. Major problems to be solved include increasing biomass growth rates and yields, devising economical means of biomass harvesting and processing, and improving the efficiencies and reducing the cost of various conversion processes.

This research program is aimed at developing the technology for biomass conversion plants of up to 1000 tons/day capacity as well as high-yield energy crop producing facilities by the middle of the next decade. Major sources of waste organic matter such as agricultural and logging residues and urban solid wastes will be examined as feedstocks for energy conversion processes. Proof-of-concept conversion experiments will be carried out to verify the technologies for these processes. In addition, the goal has been established to show the technical feasibility of the production of hydrogen by photosynthetic and biochemical methods in the same time period.

Ocean Thermal Energy Conversion

The basic objective of the Ocean Thermal Energy Conversion program is to establish the technical and economic viability of large-scale ocean experiments capable of converting ocean heat into significant quantities of electrical energy. Associated with such experiments are the additional options of producing protein, plant-life, minerals, and fresh water.

Research carried out under this program will permit us to move from the current feasibility and conceptual design studies into the design of a proof-of-concept experiment which could be on line in the early 1980s. This will be accomplished by:

Emphasizing advanced research leading to design and fabrication of system components that represent reasonable advances in existing technology.

Establishing requirements for the design and construction of suitable test facilities (both shore-based and sea-based) and undertaking the testing of candidate components and subsystems.

Conducting system optimization studies and subsystem experiments on energy delivery systems for transmitting the output of ocean thermal plants to energy consumers.

Conducting environmental assessment studies, especially with regard to possible impacts of thermal redistribution.

Commencing the design of a 10 Mwe-near shore proof-of-concept experiment.

Photovoltaic Energy Conversion

The general objective of research efforts on Photovoltaic Energy Conversion is to develop the full technology base for low-cost, long-lived, reliable photovoltaic systems suitable for a variety of terrestrial applications including the generation of electricity for buildings and central power systems. Research efforts will continue to focus on achieving the following specific objectives:

Complete research on, and undertake proof-of-concept experi-

ments which give promise of reducing by a factor of ten solar array production costs (presently about $50 per peak watt) and to establish the technology by the latter half of this decade.

Conduct a focused research effort on advanced fabrication technologies for photovoltaic devices that show a potential for a factor of one hundred or greater reduction in production costs; and conduct proof-of-concept experiments of this advanced technology in the first half of the next decade.

Conduct systems and applications studies to identify suitable proof-of-concept experiments of cost-effective photovoltaic energy conversion systems.

State-of-the-art silicon cells have received significant research support in the past and show strong promise for cost reduction. Development of the technology for single-crystal ribbon and polycrystalline thin-film silicon solar cells, and thin-film devices from a variety of other promising semiconductor materials, such as CdS and Ga As, will also require research. The most promising photovoltaic devices will be carried into the proof-of-concept experiment phase.

To achieve the general and specific research objectives of the NSF Photovoltaic Energy Conversion program, the expertise developed in earlier and on-going research must be utilized. This is being undertaken through close collaboration with numerous government laboratories, such as the NASA-Lewis Research Center, the Jet Propulsion Laboratory and Goddard Space Flight Center. A number of private industries are currently participating in the program and it is expected that more will be included in FY 1975.

Geothermal Energy

After 70 years of growth, geothermal energy has just recently become a small but viable contributor to U.S. energy supplies. However, its development must be greatly accelerated if it is to meet urgent domestic needs on a significant scale.

Geothermal energy utilization began on an industrial scale in Italy in 1904 when electricity was first produced at the Larderello field south of Florence. Today, approximately 400 MWe is being generated in Italy and slightly more than 1000 MWe in the world, including 400 MWe at the Geysers in the U.S. Geothermal energy has been extensively used for municipal heating in Iceland since the 1930's and to a very much smaller extent in the United States.

Many who have studied the total U.S. geothermal resource have compared its potential favorably with that of present U.S. oil and gas reserves. The theoretical energy recovery in cooling a cubic mile of granite from 300 to 100 degrees C is sufficient to supply all the U.S. requirements for one week. All of the readily exploitable geothermal resources are located in the less populated western third of the U.S., but development could have considerable impact on providing the power requirements of large load centers. For instance, the Imperial Valley in California has been estimated to be capable of sustaining a generating capacity of as much as 100,000 MWe for 50 years. The principal problems which appear to be inhibiting the growth of geothermal energy utilization in the U.S. are: (1) a lack of confidence on the part of energy industries in geothermal reservoirs as a reliable, long-term supply of energy; (2) institutional, legal, and environmental problems associated with the development of such reservoirs; and (3) unsolved technical problems and economic uncertainties concerning the utilization of geothermal energy in an environmentally acceptable matter. The purpose of the NSF program is to accelerate solutions to these problems.

The long range goal of the NSF Geothermal Energy research program is to provide the full technology base for the cost effective commercial production of tens of thousands of MW of electrical power from domestic resources by the middle of the next decade. This could save on the order of 1,000,000 barrels of oil per day. The corresponding geothermal energy production capabilities should exceed 100,000 MWe as we move into the next century, with equivalent daily oil savings of from 3,000,000 to 6,000,000 barrels. Important contributions to conservation goals can also be achieved by utilizing geothermal heat and associated fluids for non-electric purposes, such as space heating and air conditioning, production of minerals, and desalination of brines.

Program objectives leading to this goal are: (1) research to provide necessary technological advances to improve significantly the economics of geothermal power production, (2) establishment of small experimental systems and testing facilities to allow research and experiments that cover the spectrum of potential geothermal resources, (3) research to expand our knowledge of recoverable reserves of geothermal energy, and (4) analysis to provide carefully researched policy options needed to resolve growth-inhibiting environmental, legal, and institutional problems.

Agencies participating in the Federal Geothermal Energy effort include the Atomic Energy Commission, the U.S. Geological Survey and the Bureau of Reclamation, as well as NSF. The efforts of these agencies follow a closely coordinated, integrated program to provide maximum exploitation of this valuable resource. Other agencies will participate in the program as special program requirements dictate.

The NSF geothermal research is composed of the following program elements: (1) Resource Exploration and Assessment; (2) Environmental, Legal, and Institutional Research; (3) Resource Utilization Projects and (4) Advanced Research and Technology. The specific objectives of each program element are summarized below.

RESOURCE EXPLORATION AND ASSESSMENT

Improve geophysical, geochemical, geological and hydrological techniques necessary for locating and evaluating geothermal resources.

Develop better methods for predicting the power potential and longevity of geothermal reservoirs.

Provide research support to the U.S.G.S. national survey program with regional assessments of geothermal resource potential.

ENVIRONMENTAL, LEGAL AND INSTITUTIONAL RESEARCH

Evaluate waste disposal control technology and surface and subsurface environmental effects of geothermal development.

Improve the national capability to prepare environmental impact statements for key government geothermal projects.

Identify social, legal, and economic problems associated with geothermal development, both locally and regionally, for policy development, and evaluate the socio-economic framework of commercial utilization of geothermal resources.

RESOURCE UTILIZATION PROJECTS

Prove the technology for economic production of electric power from geothermal systems while meeting environmental standards.

Provide improved operational understanding of geothermal reservoir engineering and management and potential of different classes of geothermal reservoirs.

Provide improved understanding of geothermal power plant design and operating characteristics.

Provide experimental test beds for use by industrial, university and Federal laboratories in component testing and evaluation.

Involve industry engineers, analysts, technicians, and managers in field and power plant development to expedite early industrial exploitation of advanced geothermal technology.

Develop a cadre of trained and experienced geothermal engineers and technicians.

ADVANCED RESEARCH AND TECHNOLOGY

Resolve major technical problems inhibiting the fullest practical commercial utilization of U.S. geothermal resources, including problems in: drilling in hostile geothermal environments; well logging techniques and instrumentation; behavior of reservoirs under production conditions; extraction of geothermal fluids from the subsurface; efficient conversion of heat in geothermal fluids to electric power; and monitoring environmental effects due to geothermal production.

Energy Conversion and Storage

The objective of the Energy Conversion and Storage Program is to develop methods for storing energy and for converting it into its most useful forms. On the storage side, research on advanced battery technology, useful in both automotive propulsion and electric utility application, is supported. Feasibility of storage in superconducting magnets is also studied. On the conversion side, investigations of magneto-hydrodynamics (MHD) are supported to increase efficiency of electric generating plants.

Present energy requirements are being fulfilled primarily through combustion of fossil fuels. Projections that show the substitution of alternative resources, such as nuclear, still require a significant fraction of our energy requirements to be provided by combustion through the year 2000. The National Science Foundation will place primary emphasis on focused research to increase the efficiency of current systems by going to higher temperatures, adding topping and bottoming cycles, and by use of combined cycles. The detailed understanding of combustion processes will be pursued, since this can have a major impact on our ability to maximize energy release and burn fuels which are not now generally acceptable from an environmental impact point of view. This research will complement programs under the OCR and AEC and will be coordinated with their efforts. The adverse effects of

temperature on the environment have been recognized and solutions to the problem continue to be an integral portion of the heat transfer and fluid mechanics work in waste heat management studies.

Energy Systems

The Energy Systems program element is an interdisciplinary undertaking in which all aspects of energy (technology, environmental, economic, societal, regulatory, and legal) are assessed and analyzed. The purpose is to improve systematically our knowledge of alternative energy systems and public policy options which will provide the most effective uses of energy to meet our national needs. The NSF/RANN Energy Systems program is an integral part of the Federal energy program and is coordinated with and supportive of the long-range needs of the Federal Energy Office, AEC, EPA, FPC, DOI and other Federal, State, and local agencies of government.

Principal research objectives are to:

Develop comparative analyses of the potential of current and advanced energy resources (e.g., gasified coal, oil shale, tar sands, solar, geothermal, etc.), to analyze the most promising longer-range research opportunities, and to offer alternative research and utilization priorities.

Identify areas of energy consumption and devise conservation technologies and strategies.

Select energy systems to optimize use of energy resources.

Create the methodological base for the analysis of public policy options to provide inputs to Federal, State, and local decision makers.

Energy Resources

At present, an energy problem exists because of the expanding demand for and depletion of domestic supplies of fuel. For example, projections show that the annual consumption of oil will be 8.1 billion barrels per year by 1980. The U.S. production capacity can not increase to meet the increased demands with present technology and secondary recovery methods. A significant portion of our oil reserves can not now be economically recovered. However, it appears that the problem could be alleviated by use of tertiary oil recovery techniques in existing fields or by development of an economic oil shale process. On the other hand, coal is readily available in the eastern and western portions of the U.S. and represents a resource from which large, clean, economical supplies of gas and oil may be obtained. The NSF Energy Resources program element supports research projects in advanced coal technology which emphasize the fundamental and innovative aspects of coal conversion technology consistent with our environmental safety, water availability, and land use requirements. An effort will also be initiated in FY 1975 to perform focused research on more efficient and innovative methods of oil recovery from existing fields as well as from oil shale reserves.

Because of the obvious interest in and immediate potential for coal utilization, NSF program activities will be closely coordinated with Department of Interior and other Federal agencies and private industry.

Advanced Automotive Propulsion

In 1969, it was recognized that achievement of ambient air quality goals in the U.S. would require a major reduction, of emissions of air pollutants from automobiles. Since the internal combustion engine operates at a low overall energy conversion efficiency and gasoline is in increasingly short supply, there is a need for advanced research to provide the basis for improving overall automative power plant performance through understanding of the physics and chemistry of the principal phases of combustion. Although extensive engine development work is underway in manufacturing firms and other Federal agencies, too little attention has been given to providing the underlying research base for improvements in operating efficiency and reduction of noxious emissions.

NSF initiated such a program in the latter half of FY 1974, with the objective of acquiring an understanding of basic fuel combustion and energy conversion processes as they relate to the design of engines with greater efficiencies (while maintaining low air-polluting emissions), thus lowering demand for gasoline. A successful effort could raise heat engine energy conversion efficiency—which now ranges from 20 percent (10 percent–15 percent installed) to 30 percent—to a level as high as 45 percent by 1980, with a proportionate potential increase in vehicle fuel economy. Basic knowledge is also needed in the areas of alternative fuel properties and materials to achieve fuel economies in practical engines while retaining desirable characteristics such as low emissions, starting, and drivability.

This program is being implemented primarily in the university community. It provides an opportunity to utilize to the fullest extent the body of scientific expertise (thermo-chemistry, combustion and detonation, materials research, etc.) that has been developed over the years in support of the Nation's aerospace efforts and focuses this capability on advanced automotive combustion and propulsion research. This effort is closely coordinated with research supported by other government agencies (U.S. Environmental Protection Agency and Department of Transportation) and industry.

Energy and Fuel Transportation

The objective of the energy and fuel transportation program is to improve transport of energy in all forms from production sources to consumption sites. This research includes methods of planning transmission and distribution systems, techniques of control of distribution and generation to optimize system utilization, and techniques for reliability and security determination. Innovative research on power transmission technology involves: superconducting and electrically insulating materials, new uses of circuit breakers, and research on electrical breakdown. Transportation of fuels by pipeline and by bulk shipment in novel forms such as hydrogen and methanol also are investigated.

This program is closely coordinated with the Department of Interior, the AEC, and the Electric Power Research Institute.

ENVIRONMENTAL SYSTEMS AND RESOURCES---------- $21,200,000

The Foundation's program of Environmental Systems and Resources supports research focused on environmental problems and has the following objectives:

To assess the effects on the environment of energy production and use;

To identify, analyze, and encourage the development of alternative solutions to important regional environmental problems;

To modify severe and destructive weather for man's benefit; and

To measure amounts and assess effects of trace contaminants in the environment in order to establish a basis for their control.

Environmental Effects of Energy

The objective of this program is to develop the scientific knowledge base needed to help in efforts to reduce conflicts between increased energy production and environmental quality. Alternative means will be sought to reduce the environmental impacts of energy extraction, generation, and consumption. Emphasis is placed on environmental effects susceptible to new control technology, as well as on indirect environmental consequences of energy extraction, transportation, and use.

Specific objectives of this program are to:

Analyze environmental contaminants and land use consequences of energy resource extraction.

Evaluate environmental effects and develop criteria for siting to minimize effects of fuel processing, central power stations, and other conversion facilities.

Analyze the environmental effects of alternative uses of energy for transportation and industrial productivity.

This program is based on RANN environmental research initiated in FY 1973 in Trace Contaminants Program, the Weather Modification Program, and the Regional Environmental Systems Program which is directly applicable to environmental effects of energy generation. This on-going research amounts to $1.0 million in FY 1974 in direct support of the program objectives and contributory to the national energy program. Additional research on environmental management supported in other RANN programs is relevant to energy use and provides further support to achieve the objectives of the Environment Effects of Energy Program. The research planned for FY 1975 has been closely coordinated within the agency and with the AEC, DOI, and EPA. Continuing coordination will be carried out to achieve national energy goals.

Environmental research on the effects of extraction, processing, and consumption of energy will target primarily on impacts of coal and oil shale extraction, coal conversion to gas or liquid fuel, oil and gas transport and refining in coastal areas, and industrial processes and transportation changes as they may effect land use. These investigations will emphasize pollutant pathways, effects, and controls, as well as ecosystem management options for minimizing ecological effects.

The central focus of this program is on providing the knowledge needed for the implementation of the Federal Energy Program with minimal environmental consequences and the effective dissemination to Federal, State, and local agencies, industry, and the public.

Regional Environmental Systems

Research on Regional Environmental Systems is designed to enhance man's ability to deal effectively with regional environmental

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problems. The program is focused on specific regional environments within the context of overall societal goals. Research in this program element is user-oriented and is designed to produce information of value to the planning and management of regions or natural resources, including energy, with maximum benefit and minimal environmental disruption. Accordingly, there is a substantial and continuing coordination effort and information exchange between investigators and Federal agencies, State and local governments, and industry.

The objectives of this program element are to:

Define specific environmental problems, including those unique to a geographic region (coastal zones), those arising from resource development (land use), and problems arising from competing human activities;

Inventory policy and management alternatives that can serve as mechanisms to implement possible solutions;

Identify resources impacted and ecosystems affected by degrading change so as to predict consequences of alternative strategies to correct environmental problems;

Evaluate economic and legal consequences of management mechanisms for solving environmental problems;

Synthesize alternatives from environmental, economic, and social information; and

Evaluate alternatives in terms of retaining environmental quality, economic productivity, strong interregional relationships, and equitable distribution of costs and benefits.

Major research efforts encompass studies on the environmental aspects of the following three program activities:

Land Use Allocation.—Objectives are to develop methods for assessing environmental consequences of regional and local land use decisions and land use consequences of environmental management strategies; to develop and evaluate selected technologies for land use planning; and to evaluate institutional mechanisms for controlling land use and managing growth.

Coastal Zone Management.—Goals are to provide alternatives to avoid undesirable effects of waste discharges, dumping, and dredging estuaries; to devise improved management strategies for ecologically important coastal wetlands; and to provide the basis for wise planning for human intrusion into coastal zones.

Urban/Rural Environmental Management.—Objectives are to analyze the urbanization process as it creates environmental changes; to evaluate the planning for, and consequences of, development activities such as residential and industrial siting, transport nets, utility routes, and open space preservation; to devise and evaluate alternatives for disposal of urban, industrial and agricultural wastes with least insult to urban/rural ecology.

Weather Modification

The major goal of the Foundation's Weather Modification Program is, through research, to prove the concept of weather modification knowledge as a tool to address societal needs. Of particular concern is the alleviation of damage due to certain weather hazards such as hail, drought, lightning, and highway fog. Of associated concern is the impact of inadvertent weather modification brought about by pollution

and energy use in metropolitan and megapolitan areas, by agricultural and strip mining areas, and by large power generation facilities. The NSF/RANN role in weather modification is coordinated with the programs of other Federal agencies through the Interdepartmental Committee for Atmospheric Sciences.

The major objectives of the Weather Modification program element are:

To more fully evaluate the impact of weather on man, especially in a technology-oriented, highly industrialized society such as that of the U.S., and to develop the full scientific base necessary for successful weather modification applications.

To develop the operational predictive models and statistical methods and measurement systems which are essential to accurate, short-time evaluation of weather modification events, both advertent and inadvertent.

To develop the tools and techniques for performing weather modification research through proof-of-concept experiments.

To carry out selected, comprehensive, goal-oriented weather modification research projects, such as the National Hail Research Experiment (NHRE) and the Metropolitan Meteorological Experiment (METROMEX).

The major objectives of the two comprehensive projects are:

NHRE: To prove the concept of cloud seeding as a method suppressing the damage due to hail at a cost that is small compared to the damage alleviated.

METROMEX: To delineate the extent to which and the mechanisms whereby a metropolitan area changes its regional weather.

Environmental Aspects of Trace Contaminants

The Trace Contaminants program element is concerned with the environmental consequences arising from mining, manufacturing, use, and disposal of selected metallic and synthetic organic compounds.

The program is principally committed to determining the *levels* of potentially or overtly toxic trace substances in the environment; assessing the *effects* of these levels on man, animal, and plant communities; and relating these findings to methods of *control.* A close communications relationship exists between investigators, producers of industrial wastes, and officials in the Council on Environmental Quality, National Institute of Environmental Health Sciences, and the Environmental Protection Agency.

The objectives of this program element are to:

Identify and quantify contaminants resulting from agricultural and mining operations, and the manufacture, use and disposal of products and byproducts;

Develop new, and improve existing techniques in analytical chemistry specifically applicable to the above objective;

Describe through modeling and field validation, contaminant transport pathways accounting for change in the quantity, chemical structure, and toxicity of compounds caused by passage of time, differing physical conditions, and the degrading of modifying actions of bacteria and other biological influences;

Assess the potential for damage to ecosystem communities, pop-

ulations, and biological species (including man) along the contaminant flow paths;

Identify and analyze legal and economic incentives (or disincentives) which contribute to environmental pollution by chemical contaminants; and

Design and develop through research novel approaches to decontamination technology, and identify the costs and benefits of alternative abatement strategies.

ADVANCED TECHNOLOGY APPLICATIONS.....$13,400,000

The major objectives of the Advanced Technology Applications Programs are to accomplish the following through aggressive highly focused research.

Develop earthquake engineering technology to make it possible to design and construct buildings and other structures that can better withstand the forces of earthquakes with reasonable economic costs.

Develop advanced industrial processing technology, to increase industrial productivity, including enzyme technology and other concepts such as new industrial automation techniques.

Increase the speed and cost-effectiveness of underground excavation processes.

Advance the technology for new instruments to diagnose and treat diseases, to improve accuracy and efficient measurement of processes, and to enhance production of goods and services.

Improve understanding of the socio-economic consequences of policy decisions on land use and other issues in relation to disasters and natural hazards to aid in emergency planning and technology applications to these problem areas.

Transfer technology to the appropriate user community.

Disaster and Natural Hazard

The purpose of this program element is to support research to advance the technology to reduce the losses caused by hazards and disasters such as earthquakes, fires, and other large-scale phenomena. These hazards cause direct loss of billions of dollars of property and thousands of lives each year, and untold losses caused by the disruption of normal community functions.

This research is focused on such issues as techniques for building earthquake resistant structures and learning how strong earthquake ground motions act upon all types of structures and their contents. These efforts range from studies on small structures such as elevators and retaining walls to dams, high rise buildings, and entire utility service systems.

The fire research efforts focus on understanding the process of combustion for various materials; the fire spread mechanisms; and the methods for extinguishing fires. Attention is also given to the modeling of fire propagation, the effectiveness of fire-fighting systems, and the deleterious effects of smoke. Research to improve the detection and suppression of fires is also supported. The NSF effort complements the role of NBS through a closely-coupled cooperative arrangement. The NSF effort provides the university research base that is needed in many areas important to the NBS and the fire protection community.

As this research base is advanced and new technology developed, it will be necessary to devise improved methods for making the fire protection community aware of the progress and to encourage cooperative experimentation in order to upgrade experimental systems. Efforts will continue to emphasize the development of projects related to the direct needs of the fire services, including new and improved fire equipment technology.

This work is not only designed to improve engineering practices but is also aimed at developing the information needed to bring building code standards and specifications into line with public safety expectations. The program is under continuous review to insure there is a quick and appropriate response to emerging problem areas.

In addition to the high technology orientation of research efforts supported under this program, the Foundation, in FY 1975, plans to undertake studies on the socio-economic responses to natural hazards.

Technological Opportunities

The objective of this program element is to support research in carefully selected areas of highly promising technological innovations with particular attention to increased productivity. The research activities in this element are: Advanced Industrial Processing; Excavation Technology; and Instrumentation Technology.

SOCIAL SYSTEMS AND HUMAN RESOURCES.....$12,100,000

The RANN program in Social Systems and Human Resources (SSHR) supports research which focuses on increasing the effectiveness of policies and programs dealing with selected urban and human service problems at the Federal, State, and local government levels.

The program has three principal objectives:

To identify, analyze, and contribute knowledge to improve productivity in the public sector.

To identify, analyze, and evaluate more effective, efficient, and equitable ways to delivering human services; and

To develop the data base and analytical techniques required for improving applied research on municipal systems and human service delivery.

The following specific criteria are used to evaluate proposed research prior to its support:

The research must address significant productivity problems in the public sector and have the potential to provide a significant increase in usable knowledge beyond that already available;

The research must be directly useful in assisting national, state, or local decision makers in solving problems in public sector productivity.

The research should contribute, where practicable, to advancing the state-of-the-art of social policy analysis; and

The costs of the research are the minimum required to carry out all research, utilization, and dissemination activities effectively.

Social Systems and Human Resources is subdivided into four elements: Municipal Systems and Services; Human Resources and Services; Social Data and Evaluation; and Public Regulation and Economic Productivity. This program is developed and managed through extensive coordination with the other Federal agencies and state and

local governments which can benefit from analysis which cuts across several mission responsibilities. This is accomplished through both the SSHR panel of the RANN coordinating committee and extensive day-to-day contact with program officials in the other agencies. In addition, detailed coordination on research tasks is made possible through the use of solicitation techniques and pre-review of solicitations by cognizant agencies.

Municipal Systems and Services

The objectives of this program element are to:

Provide knowledge which will help improve the use of existing municipal resources and improve the effectiveness of municipal governments in delivering public goods and services;

Evaluate attractive applications of new urban technologies, with emphasis on the ways in which social and technical systems can best be joined; and

Evaluate the benefits and costs of alternative organizations and institutional mechanisms for coping with the problems of municipal governments.

Human Resources and Services

The objectives of this program element are to:

Find more effective, efficient, and equitable means to deliver services consumed directly by individuals or groups of individuals;

Furnish data on the match between the demand for and supply of human services;

Produce information and analyses required for the development and evaluation of social programs and policies.

Programs are designed and implemented at many different levels of government to provide social services to the same individuals and groups. NSF research is designed to evaluate the combined effectiveness of these programs. In areas such as legal services, for example, the amount of basic and applied research has been relatively small, and major opportunities exist for effective innovations.

Social Data and Evaluation

Research objectives are to develop the data base and evaluation techniques needed to carry out more effective applied research in municipal and human service delivery systems. In addition, this program element supports analysis of alternatives for the implementation and utilization of the results of applied social research.

Public Regulation and Industrial Productivity

The objectives of this program are to:

Evaluate the effects of public sector economic regulation on industrial productivity and organization; and

Provide information and analysis to Federal, State, and local regulatory bodies and industry to increase the overall social effectiveness and equity of alternative regulatory instruments.

Publicly regulated industries now account for 12 percent of the GNP. They are a fast-growing sector of the economy (150 percent increase since 1950). The interactions between regulated industries and the unregulated sector have large impacts on industrial productivity,

on technology, and, most importantly, on the major social choices now facing the nation on organization of the national economy. From a public policy perspective, these productivity problems are addressed through choices made by Federal, State, and local regulatory commissions. There is a growing awareness of the commonality of economic problems and issues faced by regulators, despite vast differences in their statutory authority and methods. Because of their independence, autonomy, and specialized missions, regulatory bodies have limited capability to carry out research on, and capitalize upon these common features, even though an identification of common issues might provide a vital broader perspective from which the merits of various alternatives can be assessed, and their activities made more consistent. This program has been established in response to the expressed research needs of these agencies.

EXPLORATORY RESEARCH AND PROBLEM ASSESSMENT---- $3,700,000

The program of Exploratory Research and Problem Assessment (ERPA) provides RANN with needed flexibility and responsiveness to initiate studies on selected problems that have potential for major national impact. This permits the continuing development of new and innovative research approaches to important societal problems not being addressed elsewhere in RANN or in other agencies. Gaps in the spectrum of existing research relevant to national needs are approached through problem assessment and definition studies and through exploratory research projects. As projects or programs develop in ERPA, steps are taken to transfer responsibility to other major RANN programs or elsewhere for sustained research. ERPA undertakes both to stimulate the focusing of research on recognized national problems and to develop new approaches and perspective on longer range or poorly defined problems.

The basic objectives of the program of Exploratory Research and Problem Assessment are to:

Define and assess emerging societal problems to determine the potential applications of scientific and technical research to deal with them;

Support exploratory research on selected problems to bring them to the stage where they are suitable for a major research effort in RANN or in another Federal agency;

Define and assess the primary and secondary societal impacts of applications of new or modified technologies; and

Ensure that ERPA research results are fully reported and disseminated to appropriate policy and decision makers and to the appropriate scientific community.

Technology Assessment

Technology assessment includes the systematic study of the effects on society that may occur when a technology is introduced, extended or modified, with special emphasis on the impacts that are unintended, indirect and delayed. The assessment of a technology should attempt to anticipate and evaluate the impact—physical, biological, social, economic and behavioral—of a new technology on all sectors of society. Technology assessment can contribute to the generation of public

policy options to assist in the management of technology and can provide input to important decision-making processes.

Selected Research Topics

The processes of problem definition and assessment have identified four principal topics of societal and national need which have particularly high priority. For each of these, a research approach has been designed to assess existing knowledge, to develop a research agenda, to encourage and support novel exploratory projects and to build programmatic and institutional relations for transfer of research results and ultimately program elements to responsible users.

New Problems and Projects

The flow of research ideas to RANN is increasing, and support in addition to the targeted programs is essential to give attention to innovative approaches to societal problems. This program element makes possible a flexible response to new ideas in the scientific community and the stimulation by RANN of initial problem definition and exploration on promising topics for future development as problem focused research thrusts. Such problems may pertain to any of the major social systems—e.g., education, transportation, health or communications.

7. INTERGOVERNMENTAL SCIENCE PROGRAM..... $1,000,000

The Intergovernmental Science program has the mission of aiding State and local governments to increase their capability to employ science and technology effectively. The program is a continuation of earlier work and plays a significant role in understanding and analyzing the implications of New Federalism policies for science and technology.

The objectives of the Intergovernmental Science program are to:

Improve the capacity and capability of user institutions for defining their research and technology needs and seeking ways of facilitating the application of research to civil sector problems;

Promote and strengthen Federal-State-local government and private sector research and utilization relationships;

Stimulate development of public and private sector user capability to implement RANN research results.

8. INSTITUTIONAL IMPROVEMENT FOR SCIENCE..... $10,000,000

Authorization, fiscal year 1975

Institutional Grants for Science	$7,000,000
Institutional Grants for Research Management	3,000,000
Total	10,000,000
INSTITUTIONAL GRANTS FOR SCIENCE	$7,000,000

The Institutional Grants for Science Program provides annual grants for discretionary use by U.S. colleges and universities. The grants are intended to help maintain quality in academic science at those institutions that have demonstrated strength in this area. More than one-fourth of the Nation's colleges and universities participate annually in this program. These institutions enroll virtually all of the Nation's science graduate students and most of the undergraduates. Practically all institutions offering science programs of substantial quality are included among the recipients.

The grants are designed to support institutional initiative and autonomy, by giving campus administrators a necessary measure of control over their programs of research and education, enabling them to meet emergency situations and to take advantage of opportunities. They furnish freedom from rigid budgets and sometimes can be "spent" several times, in that commitments backed up by the grants are often later covered by other funds.

Universities find the funds especially valuable for small research grants to new Ph.D.'s who have recently joined their faculties, for summer support of research by graduate students, and for continuance of research experiments during lapses in outside funding.

The object of the expenditure varies with the type of institution. Doctoral institutions spend a larger share of their funds for support of personnel (faculty, students, technicians, visiting lecturers, etc.) and for renovation of facilities and computer operations than do undergraduate and Master's level institutions. Undergraduate colleges—including those with Master's programs—use the funds to replace outmoded laboratory instruments, to provide research experience for science majors preparing to enter graduate schools, to fill gaps in science libraries, to employ and retain able faculty members by providing them with research opportunities, and to meet many kinds of special local needs. About two-thirds of the expenditures of these institutions are for equipment, overwhelmingly instructional apparatus.

INSTITUTIONAL GRANTS FOR RESEARCH MANAGEMENT IMPROVEMENT $3,000,000

The Research Management Improvement program is concerned with the improvement of research management procedures and practices at institutions that receive considerable (more than $1 million/year) Federal support for research. Funds from this program enable the institutions to appraise their current management situations, to develop innovative managerial methods and procedures, and to test and evaluate the effectiveness of the methods and procedures developed. The program encourages institutions to examine the management problems that arise as a consequence of Federal requirements for research grant/contract administration and to devise solutions to these problems. As part of these activities the program also supports workshops and conferences for the discussion of research management problems and for the dissemination of information that will help solve such problems.

In FY 1973, obligations of Federal funds for research, both basic and applied, at universities and colleges and at other nonprofit institutions, were $2.76 billion. Thus, if the obligations continue at the present level, the Government will invest nearly $30 billion in research

at these institutions over the next 10 years. The Research Management Improvement program was initiated in FY 1973 in order to achieve better management of these funds. A wide response to NSF's announcement of the program and to the first call for proposals resulted in 157 proposals, requesting $16 million, from about 135 research institutions of higher education.

NSF is the only Federal agency providing funds to enable universities, colleges, and nonprofit research institutions to analyze current problems related to the administration of Federally supported research resources and activities and to develop, test, and evaluate alternatives to existing management procedures. The techniques that emerge from this program are expected to bring about increased productivity and greater cost effectiveness for the millions of dollars designated for Federal research at many institutions.

9. GRADUATE STUDENT SUPPORT **$13,200,000**

Authorization, fiscal year 1975

Graduate Fellowships	$9,700,000
Graduate Traineeships	2,000,000
Postdoctorals	1,500,000
Total	13,200,000

The primary objective of Graduate Student Support is to assure that at least a modest number of the Nation's most talented graduate students in the sciences obtain the education necessary to become a cadre of first-line researchers needed by our technologically-based society. Accordingly, the Graduate Fellowship Program focuses on the highest ability graduate students across all fields of science. Another objective is training of scientific and engineering manpower specifically to help meet the Nation's energy problems. The Energy Related Traineeships and Postdoctorals support this objective.

The Graduate Fellowship Program is the only sizable program—Federal or otherwise—available over the broad spectrum of the sciences in which the Fellows are selected solely on the basis of ability in a national competition. Since only about one of every 12 applicants is selected for an award, the Fellows represent the very best of the baccalaureates produced by our colleges and, thus help to set standards of academic excellence at the universities where they carry out their graduate training. In addition to those receiving fellowships, several thousand applicants each year, to whom NSF is unable to offer awards, are accorded honorable mention. In this way, the competition achieves a leverage in the identification of scientific talent that goes far beyond the number of individuals actually supported under the program. Their inclusion on the honorable mention list assures, for many individuals, alternative awards (teaching assistantships, university fellowships, etc.) without which they would be unable to undertake graduate study.

In FY 1974, Energy Related Graduate Traineeships were awarded to doctoral-granting institutions which were significantly involved in energy-related research in the areas of (a) coal and oil shale, (b) solar energy, and (c) geothermal energy. Also, in FY 1974 traineeships were awarded to a limited number of colleges and universities which historically have provided educational opportunities to disadvantaged ethnic minorities and which have been the most productive in awarding advanced degrees in the sciences. Minority Institution Graduate Traineeships offer help in a tangible way to highly capable students attending historically minority institutions to advance their scientific careers on the basis of their own capability rather than on a basis otherwise limited by financial resources. Both types of traineeships provide for three years of support.

FY 1975 GRADUATE FELLOWSHIP PROGRAM $9,700,000

For FY 1975, about 500 new awards will be offered for a period of three years, subject to the availability of funds, to individuals who by the Fall of 1975 will be beginning graduate students or will have completed no more than a year of graduate work. The second and third years of the award will be approved by the Foundation upon certification by the fellowship institution of the student's satisfactory progress toward an advanced degree in science. Awardees will be required to activate their fellowships not later than the Fall term following receipt of the award, but will be permitted to use the remaining two years of support within the following four years. This will enable them to engage in other activities approved by their institutions that contribute to their training and goals. For example, an individual could interrupt his formal training for a meaningful work experience in industry and, on his return to graduate school, modify his academic program to accommodate a newly discovered, specific career objective. Or he could take a teaching assistantship for a year or two and then activate the fellowship for the purpose of writing his dissertation.

A stipend of $3,600 for each of the three years is provided to the Graduate Fellow. There are no allowances for dependents. The U.S. universities that they attend receive a cost-of-education allowance of $3,000 per annum. The stipend is prorated in the case of awards for an academic year rather than a full twelve months.

Fellows attending U.S. universities receive their stipends directly from the universities they choose to attend. Beginning in FY 1974, the Foundation instituted formal agreements with these universities and issued task orders to cover payments in behalf of groups of specific students. Funds are obligated as each task order is issued, and a task order remains in effect for the support of the Fellows named therein who have unused tenure until the funds are exhausted.

The Graduate Fellowships are aimed at supporting the very best graduate students, irrespective of fields or career goals. However, the graduate fellows have high potential for contributing to the future solution of the Nation's problems including energy.

TRAINEESHIPS AND POSTDOCTORALS $3,500,000

NSF in its lead role in the Federal government activities for training energy R&D manpower plans to support activities at both the graduate level and at two and four-year college levels.

Energy Related Graduate Traineeships

Energy Related Graduate (ERG) Traineeships were initiated in FY 1974 to help meet the Nation's emerging needs for scientific and professional manpower especially trained in energy-related work by

bringing about an increase in the number of qualified individuals who focus their graduate studies on energy-related problems. In FY 1974, $2.6 million in support was provided for grants funded for a three-year period. A new cycle of three-year grants totaling $1.8 million will be awarded in FY 1975 to augment this approach to the scientific manpower training aspects of the national energy program. Specific disciplinary and topical areas to be supported in FY 1975 will, in great measure, be determined on the basis of experience gained under the FY 1974 program, but it is anticipated that environmental work directly related to energy processing will be included. Quality of training provided and perceived research needs will continue to be emphasized in the selection of universities for support.

Energy Related Postdoctorals

This activity also provides $1.4 million to assist in providing experience in energy-related work and research to approximately 100 postdoctoral scientists and engineers. This aspect of the program can be regarded as scientific manpower conversion or re-focusing. The addition of this program element reflects an effort to obtain quickly the necessary specialists, the Ph.D.'s being already more thoroughly grounded in the basic work than are graduate students.

The recipients of these postdoctoral awards will be chosen individually on the basis of their academic accomplishments and their potential contribution to the research areas being pursued. The participants selected will receive stipends which will allow them to undertake up to a year of research and/or other training to either refocus or further develop their competence to contribute to R. & D. efforts directed at energy problems.

The energy related activities as a whole—including both graduate student and postdoctoral components—contribute to both an immediate and a longer term national requirement for scientists and engineers with special training and interest in the Nation's energy problems.

For FY 1975 $3.2 million is planned specifically for energy-related programs compared with $2.6 million for FY 1974, the latter limited to graduate students only.

10. SCIENCE EDUCATION IMPROVEMENT..... $68,900,000

Authorization: fiscal year 1975

Improvement of Education for Careers in Science	$33,700,000
Improvement of Education for Scientific Literacy	20,600,000
Increasing Effectiveness of Educational Processes	13,600,000
Problem Assessment and Experimental Projects	1,000,000
Total	68,900,000

The major objectives of the NSF Science Education Improvement Program are:

To help assure the Nation of an appropriate variety, flexibility, quality, and number of scientific and technological manpower with greater participation of minorities and women.

To improve science education to meet the needs of a broader range of students and to increase substantially the number of persons who:

Make effective use of the processes and results of science in their work and personal lives whether or not they are engaged in scientific or technical occupations; and

Understand public issues involving science and technology.

To improve the effectiveness and efficiency of science education through the application of:

Improved programs involving modern educational technologies;

New instructional strategies and methodologies; and

Knowledge gained from research on the processes of learning and education.

To find ways to increase the impact and effectiveness of the Foundation's Science Education Improvement Activity through research and problem assessment which can point to necessary future program directions.

IMPROVEMENT OF EDUCATION FOR CAREERS IN SCIENCE.. $33,700,000

The central objective of this subactivity is to help assure an appropriate variety, flexibility, quality, and number of professional, scientific and technological manpower, with greater use of the talent of women and ethnic minorities. To accomplish this objective NSF supports science education efforts in the five programs listed in the table above. These efforts are addressed not only to the problem of maintaining the quality of training in the traditional science disciplines, but also to the development of new instructional patterns and new instructional programs, single- or inter-disciplinary, leading to a wider variety of scientific and technical career options for individuals ranging from secondary school graduates to graduate degree holders.

Within the several programs of this subactivity the Foundation plans to continue activities which are energy-related. These energy-related activities will include research training for undergraduate students, research participation for college and university faculty, the development of courses, curricula and degree programs for undergraduate and graduate students, and continuing education activities for scientists and engineers already in the labor force. In addition an add-on of $1,400,000 will be used to support technician education in selected energy-related areas. It will also include support for visiting foreign scholars whose expertise in energy-related sciences is needed to improve instruction in U.S. colleges and universities in this critical area.

Secondary School Program

The primary objective is improvement of science courses and curricula offered at the secondary school level to give high school students the best possible foundation for science or technology related careers. Since not all persons entering careers in technology require baccalaureate degrees, yet all need appropriate skills in mathematics and science, considerable flexibility in preparation of high school students is required. Objectives of the program include:

For students who will not go beyond high school, development of course materials attractive to a significant fraction of the en-

rollment which foster acquisition of problem-solving skills rather than provide training for specific jobs.

For students who will go to college, development of materials which represent alternatives to conventional discipline-oriented curricula, are presented in flexible format, are appropriate for individualized study and deal with real world problems.

Application of relevant educational technology to increase the efficiency and effectiveness of the educational process.

Reduction of required teacher reorientation.

In view of the major turnaround achieved in FY 1974, consolidation and extension of these changes will be the objective for FY 1975.

The program for FY 1975 will be centered largely on the component of Materials and Instructional Development. The second component, Institutional Improvement Implementation, will be focused on dissemination of information about materials to key decision-makers in the schools, and to developing leadership capacity for their implementation.

Materials Development, Testing, and Evaluation.—Approximately $500,000 of the amount planned for this program will provide for the continuation of development projects, including:

A senior high school interdisciplinary science course, modular in nature and suitable for self-paced or individualized study;

Resource and teachers' centers (3) in mathematics and science.

An estimated $500,000 will be required for initiation of the new projects designed to help develop problem solving skills and introduce students to interesting applications which are understandable to that age group;

Two junior high-level mathematics curricula, providing alternatives to the current mathematics and aimed specifically at applications in mathematics to science and technology;

An interdisciplinary mathematics/science course for senior high school which develops testable solutions to real-world problems;

Two modular or unitized interdisciplinary high school courses in the behavioral-social sciences.

Instrumental Improvement Implementation.—To foster the effective use of new materials, about 15 projects will be supported to inform school system decision-makers about alternative curricula and to develop leadership for local implementation of the new course materials.

Alternatives in Higher Education

Recognizing that current scientific and technological manpower needs evolved and are different from those of the 1960's, the Alternatives in Higher Education program element has as its objectives:

Developing and testing packages of educational materials in science, at both the baccalaureate and graduate levels, that deal with areas of societal need;

Creating and evaluating degree programs and instructional sequences that respond to student interests, increase the diversity of the scientific manpower pool, and enable the graduates of these programs of instruction to participate in solving the science-based problems of the Nation, such as the development of alternative sources of energy.

Stimulating the generation of new modes of instruction and delivery systems, such as those based on modular materials, and determining means for introducing viable ones into the existing system of higher education both economically and effectively.

Reducing the time lag in introducing the results of energy-related research and development in foreign countries directly into the educational program of colleges and universities;

Assisting on a limited scale test implementation of significant instructional improvements;

Enabling selected faculty to match post-secondary science education with real world challenges and constraints as exemplified in nonacademic laboratories.

Overall, this program element aims at maintaining existing strengths in college and university level science education, while at the same time encouraging a closer matching of academic training with the broadened range of scientific functions needed in society today. Supported projects are directed towards a form of higher education that prepares a cadre of scientific manpower more flexible in their subject matter usage than has been typical in the past, and better prepared to work in interdisciplinary situations.

In Fiscal Year 1975, the Foundation will again focus on the joint problems of increasing the versatility of students and enhancing their problem-solving skills. Along these lines, a major part of the Foundation's effort in Fiscal Year 1974 was aimed at projects producing science and engineering modules, on writing problem-oriented sequences, and on working with systems amenable to individualization of instruction. Building on this, the Fiscal Year 1975 program will continue such directions, and, because of progress made, begin to examine trial implementation where appropriate.

Five basic lines of activity characterize this program element: 1) Development of Instructional Materials and Modes, 2) design and implementation of prototype Alternative Degree Programs, 3) prototype program for technician and technologist education, 4) partial support of instructional scientific equipment necessary for a new or improved instructional program, and 5) additional training through practical research experience for science faculty members.

Development of Instructional Materials and Modes.—High priority will be given to creating flexibly formatted learning units and materials suitable for multi-purpose application. Considerable attention will be placed on completing a minimal block of prototype modules in biology, physics, and other basic science disciplines which can be used as core units in a variety of different technician education curricula. The development of modules in significant problem areas, such as energy, public, policy, and economics, will be pursued as will projects examining self-supporting mechanisms for subsequent module development/dissemination.

Materials development workshops, instituted by the Foundation in Fiscal Year 1974, will continue to apply the expertise of college faculty to the generation of classroom-ready materials and in the testing and adaptation of new modes of science instruction for subsequent implementation. A funding level of $700,000 is expected to maintain an impact-producing number of projects, assuming that the materials produced have the anticipated fan-out leverage.

Alternative Degree Programs.—Programmatic emphasis, thus far, in alternative degree programs has been at the master's and doctoral level. To make possible experimentation with and coordination with problem-oriented education, additional specially targeted pre-baccalaureate projects will be encouraged, as will exploratory studies on non-linear education. Priority will be given to programs involving combinations of specialties which enable their graduates to move rapidly and effectively from the academic environment into technical problem-solving roles. Particular attention will be given to projects which are related to problem-solving in the field of energy.

Science and Engineering Technician Education Program.—Support has been provided by the Foundation for a few major projects to produce flexibly formatted learning materials in the basic sciences that are applicable to many technical curricula. To enable and encourage institutions to experiment with and build on these novel core materials, support will be offered for prototype programs aimed at training technicians in specialized areas of documentable societal need. This element represents an effort to examine, in the context of technician/technologist education, requirements for transfer of high potential materials and methods from the national level to the more limited and special objectives of local user communities.

Particular emphasis will be placed on those programs dealing with areas of national concern such as environmental management and energy technology. This program includes $1,000,000 for energy related activities. These may involve the training of technicians and technologists in existing energy-relating training programs in addition to training program development.

Instructional Scientific Equipment Program.—The primary objective of this program component is the improvement of undergraduate instruction by providing partial financial support for the purchase of scientific equipment. Such equipment must be necessary for the implementation of new or improved undergraduate programs in one or more of the sciences. Any university, four-year college, or two-year college in the United States or its territories that offers instruction in the sciences at the undergraduate level is eligible for support through this program.

Grants are made on a matching fund basis in which the grantee provides at least 50 percent of the cost. All grants are for a two-year period.

In its eleven years of operation, the Instructional Scientific Equipment Program has made 7,000 grants to 1,173 institutions. In FY 1973, 213 grants were made against a total of 1,301 proposals. Funding at the level of $1,600,000 was sufficient to meet the funding needs of about ¼ of the proposals judged meritorious of support.

Recent curricular trends in the sciences have resulted in a greater reliance on instrumentation. Quantitative, data-gathering experiments in the social sciences, experiments on the quality of the environment, in biology, data processing, laboratory experience in mathematics, increased reliance on instrumental methods in chemistry, and new emphases in the teaching of physics require increasing numbers and types of equipment at all levels to assist in the limited implementation of instructional improvement.

Science Faculty Fellowships and Research Participation.—This program will permit faculty members at the less research oriented 4-year colleges and community colleges to obtain advanced graduate training and participate in meaningful research activities. It is designed to increase the quality of the science faculty members at these institutions which provide education for a large portion of the college students in this country. The program offers awards which permit college teachers, freed temporarily from routine academic duties, to spend up to 15 months on fellowship tenure, strengthening their educational resources in ways which promise to make them better teachers in the future. These awards were first given in FY 1957. A measure of the attitude of fellowship recipients toward this program is the declination rate. This is usually under one percent—by far the lowest rate to be found in any of the Foundation's fellowship programs.

This is the only major fellowship program funded by the Federal Government designed primarily to help college teachers of science improve their teaching at the undergraduate level.

Research Participation For College and University Teachers.—The primary objective of this program component is enhancement of the understanding of the relationship between science and those national needs and issues which must be better served by the Nation's scientific effort. By participating in appropriate research experiences offered by industrial and governmental laboratories, and selected research institutes, college and university teachers are provided the opportunity to reorient their course offerings based on this type of experience, and in particular, effect changes which better relate the instructional program to the needs of industry and the society.

In prior years the emphasis on research in traditional scientific disciplines served to enhance the professional development of the participants. The program is being reinstated in its revised form in FY 1974.

The provisions of opportunities for experience in R. & D. activities related to energy and other problems of national interests is an attempt to provide faculty with "real-world" experience that will lead them to modify their own courses by including more that is of direct applicability to the practical needs of employers and the society. The program may also be useful because the faculty participants will necessarily bring with them certain knowledge and points of view unfamiliar to the industrial laboratory personnel. The Nation's energy efforts in the next decade provide an excellent opportunity to develop close cooperation between college and university faculty and industrial scientists in order to insure that the training of scientists and engineers will meet the needs of industry as it attempts to solve problems of national import.

Visiting Foreign Energy Scholars.—The primary objective of this program component is to introduce into the educational programs of colleges and universities the latest results of energy-related research and development activities which are being carried out in foreign colleges, universities and research institutes. Several foreign countries have gained recognition for their advanced R. & D. in both conventional and non-conventional sources of energy. The Foundation plans to provide stipends and travel to enable selected foreign scientists having expertise in these critical areas of national concern to visit colleges

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and universities and confer with faculty about their research activities, thus reducing the time lag which exists between the discovery of new knowledge and its introduction into the classroom. In addition these visiting scholars will give guest lectures and consult with their U.S. colleagues who are conducting energy-related research, thereby providing an immediate benefit to the U.S. research efforts in energy.

Continuing Education for Scientists and Engineers

The objective of this program element is to develop and demonstrate effective ways of continuing the professional education of scientists and engineers.

A high technology society is characterized by and requires a rapid growth of scientific know-how. Additionally, as became more evident in recent years, unless effective means for transferring newly discovered scientific information to practicing scientists and engineers exist, the ensuing technological obsolescence poses unacceptable social and economic costs. These costs take the form of unemployment of highly trained and experienced scientists, a lessened flow of innovation into the industrial sector, and relative decreases in productivity leading to a weakened competitive position in world markets.

In the past colleges and universities have tended to offer more or less conventional graduate and undergraduate courses in their continuing education programs, while employers in their on-site training have focused on highly specialized needs, on the resolution of short term problems, or on matters of immediate proprietary concern. Together, these practices have left a gap which must be filled if career-long vitality, flexibility, and productivity is to be retained. Thus, there are clear reasons for examining and improving the processes of continuing and recurring education as they now stand.

Design of continuing and recurrent education systems which supplement present ones and which actively respond to the needs of a technologically driven society requires attention to:

Creating means for identifying relevant subject matter;

Producing materials incorporating the necessary content;

Delivering these to the scientist or engineer in an economical and effective fashion; and

Eliminating administrative, organizational, and structural factors that impede employer or employee involvement in containing education.

Projects on each of these aspects of extending continuing education availability and utility will be supported in FY 1975.

Student-Oriented Program

The central objective of the Student-Oriented program is to foster wider use in the Nation's educational institutions of teaching/learning techniques that go beyond the standard, formalized lecture, recitation, laboratory format—instructional modes that expect the student to begin to exercise more judgment, that call for more student initiative, and that demand that the student accept more responsibility in guiding his own learning. Such an approach:

Allows instructors wide latitude in devising and selecting ways to develop motivation for learning in their students;

Teaches the nature of scientific work through actual performance;

Encourages teaching that relates science to the world of the student;

Encourages student initiative;

Provides a realistic test of students' interests, abilities, and limitations in science at a time when their individual career decisions are still open.

The Student-Oriented Program includes three components—Secondary School Student Projects, Undergraduate Research Participation, and Student-Originated Studies. Each supports student-centered projects which allow instructors to experiment with and gain first-hand knowledge of ways and means to increase the student's assumption of responsibility for his own learning. Success is measured by the teachers' increase in freedom to concentrate on interaction with students about problems as opposed to repetitive drill for transferring to the student specific factual information.

The Student-Oriented Program awards are from proposals evaluated competitively for scientific and educational merit. Under the Secondary School Student and Undergraduate Research Participation components the proposals are developed by teaching scientists who describe subjects, establish criteria for selection of student participants, and determine the ways in which independence in learning will be cultivated among students. In the Student-Originated Studies component, proposals are generated and projects are operated by interdisciplinary teams of 5 to 12 students—mostly undergraduates, though the program is open also to graduate students. These teams engage in a 10–12-week period of full time research designed to collect data on a topic important to society or one on which local community decision-makers needed scientific data.

Ethnic Minorities and Women In Science Program

The objectives of this program element are to research and test educational mechanisms and to support experimental models aimed at discovering and promoting more effective methods of increasing the flow of women and ethnic minority group members into scientific careers. To reach the objective, the program will move along two lines: (1) Grants to educational institutions to establish model operating science education programs designed to advance the movement of these students into careers in science; and (2) grants, or contracts, to academic institutions or education-related, non-profit organizations to assist in developing a better understanding of the nature and origins of the barriers and in the design of methods of attacking them.

There are relatively few women and members of ethnic minority groups in science. The reasons for this are complex and differ between the two categories, but are loosely of three kinds: social sanctions, educational opportunity, and employment discrimination. There is little that the Foundation can do effectively by direct attack on the first and third factors, however, it can do something about the second factor, and thus help indirectly in the resolution of the other two. Experimental projects already supported have shown that the educational opportunity problem of ethnic minority group members is highly amenable to attack. The first tentative experiments suggest that this may also be true for women. The key seems to be in exposing

both groups to science in the right context. The importance of developing the undertapped scientific research potential of both of these groups is great.

The major element of the program will continue to be support for projects to improve science education at colleges which historically were created for the purpose of providing educational opportunities to disadvantaged ethnic minorities and which have persisted in that purpose. In FY 1975, however, additional colleges will be eligible to participate in the program: those institutions which are attended predominantly by native Americans, Spanish-speaking or Black students; in brief, institutions which are *de facto* primarily serving ethnic minority group students because the majority of the student body comprises students of such background.

Added to this form of institutional program development support will be studies aimed at better understanding the reasons for women's reluctance to consider careers in science. These studies were initiated during FY 1974 and, in addition, support will be continued for the design, conduct, and evaluation of experimental projects directed toward increasing the flow of women into science. In FY 1975 support will be provided for a limited number of experimental projects; some designed to provide test case implementation of recommendations from the studies and some to allow further evaluation of the most promising experimental approaches introduced in FY 1974. Similar applications of study and project results will be directed at ethnic minority group members.

IMPROVEMENT OF EDUCATION FOR SCIENTIFIC LITERACY ---------- $20,600,000

The Foundation's goal in this subactivity is to increase substantially the number of persons who are able to:

Use effectively the methodology of science, as well as the results of scientific discovery, in their work and personal lives, whether or not they are engaged in scientific or technical occupations.

Understand public issues involving science and technology.

The Foundation's science education programs arose and matured during an era deeply concerned with the quality of the Nation's scientific establishment. This resulted in a decided emphasis on materials, curricula and teacher orientation which would benefit most directly the student who had already decided, or who might decide, on a career in science. In recent years a closer balance has developed between supply and demand among scientific and technical personnel. Almost simultaneously the Nation has become aware of an understanding gap between those who deal with highly sophisticated technologies and the general public who are affected by these developments. Moreover, as our society becomes increasingly technologically based, more and more people are becoming engaged in activities or in making decisions that require a scientific or technical background, and there is an increasingly wide range of jobs at all levels for which some science training is highly useful, if not essential. Thus, under this subactivity, the Foundation is giving attention more specifically to the needs of people who might not become scientists, engineers or technicians. This attention is also required because our schools are now accommodating almost the entire school age population and are thus faced with an increasing diversity of talents, capabilities and career aspirations.

Meeting the science education needs of all students is essential for the development and acceptance of intelligent public policies on the complex issues facing society and to better equip the public to understand the advantages available to those living in a high technology society. This must be done both to obtain commitment to some of the hard choices which must be made, and to assure the capability of the working population in carrying them out. There must be available teaching materials that can be matched to the learning abilities of both the theoretically inclined student who learns readily from the printed page and the more practically oriented student who learns best from "hands-on" materials and tangible models.

The Improvement of Education for Scientific Literacy activity is subdivided into three elements: Elementary School Program, Secondary School Program, and Public Understanding of Science. The first two of these elements have certain education objectives in common. These include the development and implementation of materials which:

Offer a meaningful introduction to the field concerned;

Are based on topics of inherent interest to children or teenagers;

Require a "hands-on" learning approach;

Serve as a sound foundation for later educational experiences;

Offer superior educational returns for little or no increase in investment.

In FY 1975 the closer integration of the two components of the elementary School Program—Materials and Instructional Development and Instructional Improved Implementation—already begun in FY 1974 will be further strengthened.

Development, Testing and Evaluation of Teaching Materials.—Support approximating $1,700,000 is proposed for continuation of previously initiated projects which include:

An interdisciplinary (mathematics/science) problem-oriented course which requires "hands-on" participation by students;

Materials applying the principles of science to social systems;

Units based on decision-making processes;

Units based on regularities in human behavior.

Development of materials and strategies for alternative (out-of-school) patterns of education.

Initiation of new activities will require $300,000 for:

Studies of the usage levels of existing curricula and establishment of usage goals for each curriculum project;

Establishment of additional centers for experimentation with new materials and methods.

Instructional Improvement Implementation ($5,800,000).—Beyond the production of materials for both students and teachers there are the necessary phases of implementation, including:

Diffusion of information about new curricula and materials to decisionmakers, so that school officials are informed as to what is available and appropriate for them to put into the schools; 30 projects ($300,000).

Training of competent resource people in key positions within colleges, state education departments and local school systems to

help schools identify their needs and organize efficient implementation activities; 50 projects ($1,500,000).

Insuring a sufficient number of trained teachers to assure a fair trial and effective implementation of the new materials in the Nation's schools, through a combination of working through centers accessible to schools in large population centers and projects for teachers committed to trial introduction of materials but not within reach of accessible centers; 25 projects ($1,000,000).

Intensive installation of new materials in influential school systems through collaborative projects with neighboring colleges and universities.

Since the bulk of in-service implementation will have to be done under auspices of local school systems—there are far too many elementary school classrooms for NSF to deal with other than indirectly—the most appropriate role for NSF is to introduce materials widely enough to gain favorable attention and simultaneously to develop models or standards for implementation packages and help to start a limited number of successful, fully saturated installations in key school systems.

One new project will start implementation activities this year—Unified Science and Mathematics in the Elementary School (USMES) The remaining implementation projects will be devoted to increasing usage of curriculum projects made available during the last few years.

Secondary School Program

The Secondary School Program planned for FY 1975 will continue to improve the substance and practice of science education for a broader range of students. Several initiatives concerned with implementation activities begun in the previous year will be developed further and strengthened. These involve a fundamental reorientation of the Foundation's purposes in implementation of improved materials, the closer integration of materials development with implementation and the setting of program goals through appropriate analyses.

The Secondary School Program element consists of two components: Materials and Instructional Development and Instructional Improvement Implementation. The former provides support for development and evaluation of course materials, including continuing and new course development. The latter fosters implementation of new courses and materials in classrooms through a variety of dissemination strategies.

Course Material and Instructional Method Development.—Approximately $3,000,000 will be required for continued support of ongoing projects including:

Development of a modularized multidisciplinary high school science curriculum and related teacher training materials;

Development of a sequential interdisciplinary human science course for the middle grades;

Development of an interdisciplinary political science based curriculum;

Development of materials and strategies for alternative (out of school) patterns of education.

New curriculum development and associated activities include:

Two new junior high level mathematics courses, as alternatives to existing courses—These courses will be intended to enhance the understanding of the practical use of the subject by non-scientists and non-technicians and, although different in approach and degree of difficulty, will place more emphasis on applied mathematics including such topics as probability and statistics at an appropriate level;

A "hands-on" senior high school course relating science and technology to problems of the real world in which the student will develop and test under realistic conditions a variety of solutions in order to pick the most reasonable one;

A senior high level course in "futures" in which the student studies possible consequences of alternative decisions that may be made, for example, with respect to the use of resources, changes in foreign policy or other factors;

Problem assessment, including evaluation of barriers to implementation, more precise data on usage of NSF-supported materials and establishment of goals for usage of each curriculum project.

Instructional Improvement Implementation ($6,300,000).—In support of implementation of course and curriculum materials whose development has proceeded beyond the testing phase, several kinds of activity will be employed:

Dissemination of information to school system decision-makers about new and recently released curriculum projects; 10 projects ($100,000).

Development of resource personnel among leaders with responsibility for initiating in-service education, to help install new and recently released materials broadly within a geographic area, 25 projects ($700,000).

Orientation of influential teachers in new materials, who have verifiable responsibility to install them in their classrooms for demonstration and evaluation; 150 projects ($3,000,000).

Intensive implementation of new materials in a significant number of classrooms within a school system, through cooperative projects with nearby colleges or universities; 80 projects ($2,500,000).

The foregoing activities are intended to offer a balance between wide-spread dissemination of a curriculum project and intensive implementation within selected school systems. The objectives are to obtain a large enough mass of successful usage to gain attention for the curriculum project; to set standards for quality of implementation; to ascertain problems with materials after their release on a large scale which were not apparent during development; and to test the reality of usage goals for each curriculum project.

Systematic implementation of some projects will appear for the first time in FY 1975. The bulk of implementation, however, will be devoted to establishing bridgeheads or initiating massive implementation for projects whose development has been completed during the last four years.

Public Understanding of Science

The basic concern of this program element is the stimulation and support of activities designed to enhance citizen awareness and understanding of the roles and the meaning of science and technology in society today. Many of the most pressing problems facing the country and the world at large have scientific and technical underpinnings and their solution is dependent to a large extent on the understanding the general public has of these underpinnings. Scientists have a great responsibility to insure that the results and implications of their work are made available to the general public.

Specific objectives of this program include:

Motivate the scientific and technical communities to engage in dialogue on science and technology with the general public.

Support the broad dissemination by scientific groups and organizations of information about the role, implications, potential, and limitations of science and technology to the public.

Help public groups and organizations to relate their own interests and concerns to those of scientists and engineers and to understand the uses of science and technology.

Help develop skills in communications about science and technology in both scientists and professional communicators.

These objectives are achieved through the support of single-focus, generally short duration projects designed to communicate knowledge of science and technology to the general public and to such special segments as youth, minorities, rural populations, etc. Such projects may include seminars and public forums relating science and technology to societal problems and needs, innovative film and television programs for lay audiences, museum exhibits and travelling programs on major themes of scientific investigation or societal problems related to science and technology, and special articles and publications for non-scientific audiences. Many of the projects supported receive "seed money" from NSF, with other funds being obtained by the recipient for follow-on or operational support.

Another and contributing approach is to provide coherent area support to a small number of interdisciplinary groups for broad programs in public understanding of science serving mass or specific audiences of a national, regional, or community nature or other discrete geographic area. These programs may be interinstitutional in nature involving universities, civic organizations, professional societies, public agencies, media centers, and industry. These groups are also expected to secure additional financial support from other sources for their efforts, hence multiplying the effect of NSF support.

INCREASING EFFECTIVENESS OF EDUCATIONAL PROCESSES ---------- $13,600,000

That the costs of education in the United States have in recent years been rising at a rate greater than any other cost save that of health care is well known and has been fully documented. That the effect of such cost increases has been a severe strain on State and local budgets, and an even greater strain on individual family budgets as an increasing number of students take advantage of the educational opportunities offered by the Nation's schools and colleges, is equally well known. These two factors, rising costs and the increasing difficulty of meeting

these costs, make it clear that an attempt to put a brake on the cost escalation is not merely desirable, but necessary. The alternative can be a deterioration in the quality of education, a limitation on its quantity—even to the closing of schools and colleges. All of these are already taking place.

One possibility for improvement lies in the selective application of technology to the educational process. Various kinds of technology—films, slides, projectors, record players, radio and TV and the like—are already in use, mainly as course enrichment devices. Their further use, in conjunction with multi-media learning packages, is still to be explored in sufficient breadth and depth to determine the extent to which cost reductions can be attained. Computers—especially when used as managers or aids in computer-managed or computer-assisted instructional modes are already being investigated for both enrichment and cost-controlling effects. One can view the computer as an instrument showing "promise" in curbing cost increases, but much still remains to be explored before a definitive answer is obtained.

It is clear, therefore, that one major line of attack on the problem of obtaining for education much more favorable cost-benefit ratios—to state the problem in economists' terms—is the careful investigation of the applications of technology. This is one facet of the Foundation's program aimed at increasing the effectiveness of education.

It is also clear, however, that to focus exclusively on applications of technology as a means of stemming the rising costs of education would be to ignore other approaches which, while perhaps not so spectacular, may well lead to economies just as important as those envisioned by the staunchest proponents of "technology." The organization and management of the entire educational enterprise is not notably efficient. The use of the student's time and the teacher's time, in the classroom and out of it, might well be altered to good effect. The concept that all teaching (or learning) must go on at a particular location or within prescribed time limits is already being questioned, and more imaginative variations may lead to marked changes in our views of what constitutes an appropriate learning "site." There is a large number of promising avenues to be pursued:

Cooperation among institutions (high schools and colleges) in the sharing of staff and facilities;

Cooperative projects including appropriate state education agencies and schools for better uses of local, state, and federal funds;

Cooperation between schools and other local agencies, including industry, to bring outside help into the classroom and to take students, part of the time, out of the classroom;

Delivery systems that eliminate inflexibility in curricula and in courses, that permit student self-pacing, that allow for individualization of sequences of learning units in courses and sequences of courses in curricula, that provide increased options to move in and out of the educational system or that permit alternating periods of work and study matched to the student's financial resources and career goals.

All of these may lead to increased effectiveness of education and decreased costs. Therefore, this program has a second component aimed

at fostering examples, or models, of complete restructuring of certain specified educational targets.

Technological Innovation in Education

The objectives of the Foundation's Technological Innovation in Education program are:

To increase the availability of low-cost, flexible hardware and software designed specifically for instructional use;

To increase the availability of technologically-based instructional concepts, applications, and curricular materials; and

To increase the availability of effective and efficient technologically-based models for instruction in traditional and non-traditional educational settings.

The purposes behind these objectives are (1) to achieve quality improvements in educational outcomes and (2) to break the rising cost of education.

Support is provided for:

Research in computer technology and techniques applicable to instruction;

The development, field-test, and evaluation of prototype systems of exceptional technological innovation and promise;

The development, test, and evaluation of innovative applications and courseware in selected disciplines, to stimulate new instructional uses for computing and communications technology;

New instructional concepts related to computer-based education;

Mechanisms to facilitate the widespread use of these products and concepts; and

The development and evaluation of prototype delivery systems based upon modern communication technologies, especially for systems designed to provide computer-based instruction for continuing education in non-traditional settings.

Educational Program Restructuring

The general goal of Educational Program Restructuring is to improve effectiveness and efficiency in science education. To this end, the National Science Foundation will provide support to assist in the design, development and evaluation of a few major experimental models of new approaches to the organization, management, delivery and content of science education. Emphasis will be placed on design and development for outcomes that can be evaluated and documented. The aim is the development of generalizable and transportable models, derived through systematic procedures, applicable to systems of science education. Experimentation with Educational Program Restructuring will occur in three main areas:

Extensive revision of pre-service teacher education programs;

Restructuring of the undergraduate learning environment; and

State, regional or urban systems of science education.

A characteristic unifying these three areas of experimentation in Education Program Restructuring is a total system approach to problems in science education in contrast to fragmentary approaches.

Grants will be made to colleges, universities or other appropriate organizations and institutions for the following purpose:

Extensive restructuring of programs for the pre-service education of school teachers of science. Improved coordination of on-campus resources and faculties, and coordination between colleges and schools will be fostered to provide models for the initial education of prospective science teachers. Mastery of subject matter and the development of competence in fostering learning, evidenced by the pre-service teacher's ability to produce or modify teaching materials, are expected objectives of such models.

The creation of a limited set of dramatically different complete learning environments for undergraduate science students. These new environments will be developed as extensive changes in existing institutional structures, or through the creation of new (possibly as yet unconceived) learning environments.

Experimentation with models of new approaches to the coordination of efforts of schools, colleges, universities, state and local government, and private agencies in selecting a substantial specific objective as a target for educational reform, and developing and executing a coordinated plan for achieving it.

While this is essentially a new program element within the Fiscal Year 1974 structure, two of the three components included are, in fact more sharply focused versions of earlier programs (Pre-Service Teacher Education Projects and State and Urban School System Projects, which were under Experimental Models and Demonstrations in FY 1973). The third has grown out of the College Science Improvement Programs (COSIP) for four-year colleges. The three program components are described individually below under FY 1975 Program.

Experiments in Pre-Service Education of Teachers of Science.—Through experiments in preservice teacher education, the Foundation supports attempts to develop teacher training curricula calculated to lead to the knowledge and skills needed to teach science. The expectation is that scientists should be able to apply the methods of science to science teaching.

The Foundation's support is channeled to efforts to connect cause and effect in teacher education, and to disseminating the resulting information nationwide. The FY 1975 request should provide for continuation of 6 projects and the initiation of 2 to 5 new ones.

Experiments in Restructuring the Undergraduate Learning Environment.—Significant support will be provided to a limited number of institutions for several years to enable them to attempt a major breakthrough in the style and type of science education offered at the post-secondary level. This approach is based on the premise that institutions of higher education know how to effect progress in small increments, but that a few large scale experiments in more pervasive restructuring are now needed.

Types of education formats to be tested are those implied by terms such as the "university without walls", "the learning laboratory", and "individualized", "self-paced", "self-directed" study. The FY 1975 request includes $2,000,000 to provide for 4 to 5 institutions to undertake a total restructuring of their science education programs.

Experiments in State, Regional or Urban Systems of Science Education.—The Foundation proposes to experiment with mechanisms

for coordination of efforts which will lead to the identification of those mechanisms which contribute most to increasing effectiveness and efficiency of science education. The approach taken will involve design and development of action programs, and at the same time subject these to research and evaluation. The evaluated models are intended to provide examples that other states and cities might utilize in order to make optimal use of resources—local, state and federal—which may be made available for education.

The proposed allocation will permit continuation of 3 projects already under way and permit the addition of 2 to 5 design efforts and 2 new development efforts.

PROBLEM ASSESSMENT AND EXPERIMENTAL PROJECTS.. $1,000,000

The Foundation's science education activities are designed to act on certain key points or areas in the educational system where problems exist, and where the infusion of relatively small amounts of money can have a significant influence in reducing or erasing the problems, and in improving the effectiveness and efficiency of educational operations. They are not designed to provide sustaining support for on-going programs of education in the sciences as normally conducted in the Nation's schools and colleges. The three main components previously described—Improvement of Education for Careers in Science, Improvement of Education for Scientific Literacy, and Increasing Effectiveness of Educational Processes—are intended to do just that, in areas where problems have been identified and reasonably well-defined, and where solutions, either proven or shown to be feasible, are also reasonably well-defined.

It is clear, however, that there are other problems for which solutions are not known—some for which suggested solutions have not yet been shown to be feasible, some for which solutions are still to be invented and tested. And beyond these, there are problems, unidentified or only vaguely suspected, that must be identified and defined so that the next step—the search for a solution—can be initiated.

It was in response to the need to identify these other problems and to define them with sufficient clarity that solutions can be invented and tested for feasibility that the Foundation's fourth science education element, Problem Assessment and Experimental Projects, was initiated in Fiscal Year 1974. The emphasis in FY 1975 will continue to be on the search for effective solutions to problems with particular attention being given, as studies are completed, to their implications for future directions of science education programs.

Problem assessment studies, focusing on problem analysis, evaluation, and dissemination, are designed to result in recommendations, some of which are suitable for implementation by various Education Directorate program elements, some leading to promising areas for further study and analysis, and some appropriate for action by other organizations.

Some of the assessment studies begun in FY 1974 were designed to provide understanding of the problems connected with effective dissemination of information about new educational developments and the barriers to acceptance and implementation of these developments. Other study topics included continuing education for scientists and engineers and barriers to the movement of women and ethnic minority

group members into careers in science and technology. In addition, support was provided for exploratory studies to discover effective means for conveying science career information to students for guidance purposes.

11. PLANNING AND POLICY STUDIES..... $2,700,000

Authorization, fiscal year 1975

Studies of Science Resources	$1,850,000
Science Planning & Policy Analysis and Program Evaluation Studies	850,000
Total	2,700,000

The objectives of the Foundation's Planning and Policy Studies activities are to:

Illuminate science policy issues and existing and impending problems bearing on science policy.

Provide the factual data and analytical bases for sound decisions leading to the development of effective policies and improved plans for the advancement and utilization of science and technology.

Provide information for use by NSF, the President's Science Adviser, and other governmental and nongovernmental bodies in assessing problems, evaluating alternatives, establishing priorities, and developing recommendations regarding NSF and national science activities.

Provide data on national technical manpower and financial R. & D. resources expended for energy research and development to assist in assessing current and planned programs designed to help meet the nation's energy requirements and to contribute to the achievement of U.S. independence of foreign sources of energy.

This activity is divided into two program elements: (1) Studies of Science Resources and (2) Science Planning and Policy Analysis and Program Evaluation Studies, which are discussed in the following sections.

STUDIES OF SCIENCE RESOURCES..... $1,850,000

The Foundation's program of Science Resources Studies encompasses the acquisition, organization, and analysis of data relating broadly to: the funding of scientific and technological activities; the development and utilization of scientific and technical manpower; the institutional framework of science and technology; and the interrelationships between science; technology, and other elements of the national economy. Studies are carried on directly by Foundation staff or by contract and grant arrangements with other performers, including Government agencies, universities, and nonprofit institutions.

The broad objective of this program is the development of the factual and analytical basis for national planning and policy formulation in the area of science and technology resources. This includes the production and continuous improvement of the national system of relevant science resource statistics as well as analyses of data available from all sources. Special emphasis is placed on science manpower and funding. Sub-objectives cover provision of time series and indicators; development of models and projections; and analyses and surveys to

provide insight into current and long-range science and technology policy issues, such as those related to U.S. energy needs.

SCIENCE PLANNING AND POLICY ANALYSIS AND PROGRAM EVALUATION STUDIES $850,000

The NSF Science Planning and Policy Analysis and Program Evaluation Studies program provides:

Directed studies requested by the NSF Director, the National Science Board, or national science policy groups, which require research and related capabilities of university, non-profit, and other qualified organizations.

Issues analyses, including special studies of particular interest for NSF program planning purposes, including long-run implications of existing issues.

Special program evaluation and related science management studies, to assess the accomplishments and status of existing NSF programs and to provide a factual basis for determining the need to revise on-going programs or undertake new ones.

Studies and evaluations are performed in-house by NSF staff members and, under grants and contracts, by universities, non-profit organizations, and other appropriate groups.

Directed Studies and Issues Analysis

This program element has the objective of analyzing and reporting on the NSF role in the Federal Government's support of science; anticipating and identifying emerging problems relating to science policy; and recommending alternative courses of action for consideration by the NSF Director, the National Science Board or national science policy groups. Studies may be accomplished through contracts or closely managed grants. Issue analyses, frequently done by the program's internal staff in collaboration with staff from other elements of NSF, include short-term analyses of existing or impending problems and longer-term and broader-gauge analyses designed, in combination with the directed policy studies, to put NSF in a better position to respond to problems concerned with various aspects of science policy.

The program also provides support to the National Academy of Sciences and the National Academy of Engineering for the "core" activities of the central Committees of COSPUP and COPEP and for selected special studies or reviews of fields of science carried out under their auspices.

Program Evaluation Studies

This program element has as its objective, the assessment of the effectiveness, accomplishments, impacts and adequacy of the Foundation's programs in meeting their objectives and their contributions to broad NSF goals. The studies identify promising courses of action to achieve these goals. They provide the factual basis for budget requests leading to expansion or reorientation of current programs or to the initiation of new programs. Evaluation also provides an assessment of the effect of changes in type and level of science support on the generation of new knowledge, the supply of scientific manpower, and on the institutions which produce this knowledge and manpower.

Quantitative Program Data

It is difficult to provide quantitative program data for programs supported by the Planning and Policy Studies activity, because such data do not accurately reflect the effort involved. Many of the programs in this activity include a combination of substantial effort by staff and by grantees. In addition, a large fraction of the program funds support analyses and studies undertaken by the National Academies of Science and Engineering. These activities are normally performed by Academy members without compensation for their time.

12. PROGRAM DEVELOPMENT AND MANAGEMENT $39,500,000

The Program Development and Management (PD&M) activity provides for the operation, support, management and direction of all NSF programs and activities previously described, and includes all necessary funds to develop, manage, and coordinate these program activities. It includes salaries and operational expenses of all NSF employees. Also included is the staff and operational support for the Director of the Foundation in his role as the President's Science Adviser and Chairman of the Federal Council for Science and Technology.

The PD&M activity is budgeted at $39,500,000 for FY 1975. Although this represents an increase of $7,840,000, the PD&M request is austere when compared to the major additional program management and administrative requirements placed upon NSF in FY 1975. These requirements include the following:

For the first time in its history, NSF is required to reimburse GSA for office space and some related costs. This accounts for over $2.5 million of the PD&M request in FY 1975.

Energy related research in Scientific Research Project Support in the science disciplines; energy-focused research under Research Applied to National Needs, and parts of the International Decade of Ocean Exploration program and International Cooperative Scientific Activities, as well as energy related manpower activities in Science Education, account for $116.1 million of the Foundation's overall budget increase of $141.8 million for FY 1975. This represents a new thrust that will, in most instances, require a greater level of management oversight on the part of NSF. An additional $4.0 million in PD&M funds is included to cover these additional program management requirements. It should be noted that the ratio of PD&M funds to program dollars requested to manage the additional energy related research and manpower activities is less than the overall ratio of PD&M funds to program dollars. In addition, the amount of PD&M funds requested as a result of the energy related thrust is a little more than 3 per cent of the total of $116.1 million included for this purpose. This is also significantly below the overall percentage of PD&M to program dollars.

The remainder of about $1.0 million in increased PD&M funds is for staffing and related costs needed in connection with the additional $18.0 million requested for research in Astronomy, Biological Sciences, Physics, and other science disciplines; for

the Very Large Array (VLA); and for other items not included in the energy related activities. This small PD&M amount is barely sufficient to meet the additional staffing, consultant, and travel requirements in this category.

SUMMARY BY FUNCTIONAL AREA

	Actual fiscal year 1973	Estimate fiscal year 1974	Estimate fiscal year 1975	Difference fiscal year 1975/74
Research	$5,485,845	$6,084,000	$7,429,700	$1,345,700
National and international programs	3,532,220	3,849,000	4,098,200	249,200
Research applications	2,470,475	3,148,000	4,243,400	1,095,400
Education	3,537,729	3,693,000	3,942,400	249,400
Executive management and special research	2,772,250	4,555,572	5,041,400	485,828
Central support services and administration	10,820,679	10,330,428	14,744,900	4,414,472
Total	28,619,198	31,660,000	39,500,000	7,840,000

The management of the NSF programs is accomplished through an organizational structure oriented to the end objectives of the NSF programs. The Executive Management and Special Research functional area provides policy direction and top management through the National Science Board; the Director and his staff offices; and direction of special research programs through the Offices of Experimental Research and Development Incentives and National Research and Development Assessment. Since FY 1974, the functional area also includes the direct support provided to the Director, in his role as Science Adviser to the President, by the Science and Technology Policy Office and the Office of Energy R. & D. Policy. Major groupings of programs are managed by four Assistant Directors; one each for Research, Education, National and International Programs and Research Applications. Agency-wide management, logistic and administrative support is provided by an Assistant Director for Administration. A section describing each of the major programs and functional areas follows:

RESEARCH ($7,429,700)

This Program area is managed by the Assistant Director for Research and includes the Scientific Research Project Support Program and the Global Atmospheric Research Program, with budgets which total $368 million and provide the major portion of basic scientific research, the core mission of the Foundation. In FY 1975, these programs will account for 47 percent of the total NSF request and are increased by $76 million over FY 1974, principally for expansion of support in the biological, physics, chemistry, social sciences and materials research disciplines with increased emphasis on energy-related research.

Research project grants selected on the basis of scientific merit provide support to individual scientists or groups of scientists. These grants are awarded on the basis of proposals submitted which provide detailed information on the proposed research, how it fits into the state-of-the-art, how the research will be carried out, what the researcher hopes to gain scientifically from the research, what funds are needed for facilities and associates, etc. An NSF program officer receives the proposal, reviews it for scientific merit and appropriateness for NSF support and must make the initial crucial decision as to whether or not to recommend it for NSF support.

In addition to evaluating the substance of proposals, program officers must participate in the various aspects of the grant award and declination process, administer the technical aspects of grants and exercise leadership in their field. Further there has been an increasing demand from other areas, both within the other NSF Directorates and outside NSF for technical assistance in addition to duties associated with direct operation of the programs.

The special effort in energy-related research planned for FY 1975 will require more coordination and monitoring of awards than customary in the past. This in turn, requires more staff time per award and per proposal. The FY 1975 estimate includes 60 additional positions, initially funded on a part-year basis, to provide for this as well as for the increased workload resulting from the modest growth of the other parts of the program.

A number of factors affect the size of the staff required. These include the number of proposals, number of grants awarded, size and scope of program, number of institutions with grants, relationship to programs in other agencies, proposal processing time, and so on. Average time needed to process a proposal is a key indicator. An average of five working days is used for each grant awarded including post-award technical monitoring. This encompasses the review of about 2.3 to 2.5 proposals for each grant awarded. It does not consider site visit time, travel to visit the current grantees, attendance at professional meetings, support provided other parts of NSF, interagency coordination, normal staff work such as program and budget preparation, special studies such as for the Science Adviser or preparation of informational replies to the public and others. Because of the additional monitoring and coordinating needed by the energy research program, the average time required for a grant in FY 1975 will be 5.5 days.

In order to partially overcome the demands on existing staff, the number of coherent area grants have been increased, use of continuing grants have been increased and greater utilization has been made of mail reviewers and advisory panels.

A number of advisory panels are utilized to aid program managers in the review of proposals and to provide a mechanism for members of the particular scientific community to participate in expanding the state-of-the-art and identifying new research opportunities. These panels consist of recognized scientists in the various fields who meet 2 or 3 times a year for the purpose of reviewing proposals and assisting the program officer in making his decision to support particular proposals. Panel members bring to the decision process a current working knowledge of the field and are able to detect promising opportunities for research, prevent unnecessary duplication of research and identify gaps in research which should be filled. The qualitative scientific assistance provided by these panels has been invaluable in NSF efforts to keep the administrative costs of proposal review and selection to the minimum while still insuring the selection of the most meritorious research.

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In FY 1975 there will be an advisory committee providing advice and guidance to the Research Directorate from the viewpoint of science as a whole, 29 advisory panels to provide advice and to assist in the project selection process, and one special panel to advise on grants to young investigators in the engineering activity. In addition, about 270 consultants will be used. The following table reflects the number of days and related costs of consultants and committee members' compensation and travel. These data do not reflect the required number of consultants, but represent a balance between the optimum schedule of panel meetings (at least 3) and ad hoc consultants and available funds. Adjustments are made as needed by extending the length of meetings or reducing the number of meetings to be held and making do with fewer ad hoc consultants as on-site evaluators.

An integral part of the program officer's job is to travel to visit prospective grantees and current grantees as well as to attend professional meetings. There are about 450 institutions at which NSF has project grants involving between 7,000 and 8,000 investigators who should be visited. As a general rule, the research program officer should travel about 30 working days a year, exclusive of weekend travel, to monitor the progress of research, determine the capability of prospective grantees to perform as they propose, and to keep abreast of developments in his field so that he can make quality judgments. The travel required for that portion of the program which is energy-related (about one-third) will be 45 days. Thus the overall average should be 35 days.

A total of $385,000 is included in the FY 1975 estimate for staff travel which will fund approximately 4,812 travel days or approximately 27.5 travel days per professional employee.

NATIONAL AND INTERNATIONAL PROGRAMS.....($4, 098, 200)

The Assistant Director for National and International Programs is responsible for a set of program activities which require a high degree of management attention and involve extensive intergovernmental and international coordination. The Arctic and Antarctic Research Programs, among others, require major logistic planning efforts in support of extensive field operations. Seven staff activities report to the Assistant Director for National and International Programs:

Office for the International Decade of Ocean Exploration (IDOE);

Office of Polar Programs—Responsible for the Arctic Research Program and the U.S. Antarctic Research Program;

Office for Oceanographic Facilities and Support;

Office of National Centers and Facilities Operations—Responsible for coordinating and supervising the activities of the five National Research Centers and the Ocean Sediment Coring Program;

Office of Science Information Service;

Office of International Programs; and

Research Management Improvement Program.

The Foundation's Special Foreign Currency Program is administered through the Office of International Programs.

The programs supervised by the Directorate are accomplished through a combination of grants and contracts.

The workload of programs in this Directorate is discussed below. The different degree and nature of the program management required by the separate activities as well as the differences in the required external coordination activities account for the variations in program funds administered per professional.

The Arctic and Antarctic Research programs require extensive international and Federal agency coordination to insure the attainment of the research objectives. Extensive logistic support is required for the polar programs which are conducted in hostile climates and geographical environments. The NSF responsibility for planning, managing and funding the logistics support for the Antarctic program and the program for the extension of Arctic research has placed significant workload requirements on the program. The polar operations staff is responsible for the logistics support agreements which require constant monitoring of the operations carried out by the Navy and contractors. The polar science staff will process approximately 130 grants in FY 1975 for polar research projects. While this is only slightly more than the 126 grants estimated for FY 1974, the planned awards will support highly complex, integrated interdisciplinary programs such as the Antarctic drilling projects and AIDJEX. The office makes extensive use of advisory groups, including an advisory panel, the Committee on Polar Research of the National Academy of Sciences, and numerous consultants in planning, evaluating, and managing the polar research activities.

Management of NSF support to the academic community for acquisition, operation, and utilization of oceanographic facilities is accomplished through the Office for Oceanographic Facilities and Support. This program is coordinated with, and is in support of, the oceanographic research requirements of the Research Directorate and the IDOE. Also, the staff coordinates with the Navy on matters of joint funding, ship use scheduling, and ship construction and conversion programs. Twenty major research ships, 100 feet or more in length, and 11 coastal vessels operated by 16 separate academic institutions are partially supported through this program. Projects also provide for shipboard equipment and other shared equipment and facilities, shipboard technicians, and operation of other research platforms such as submersibles and aircraft. In the decisionmaking process, separate ship construction and ship operations review panels are utilized.

RESEARCH APPLICATIONS.....($4, 243, 400)

The Assistant Director for Research Applications is responsible for the Foundation's major coordinated efforts directly concerned with the Research Applied to National Needs (RANN) program involving problems concerned with Energy, Environment and Productivity as well as efforts to conduct Technology Assessment. This program is composed of five major areas: Energy Research and Technology, Advanced Technology Applications, Environmental Systems and Resources, Social Systems and Human Resources, and Exploratory Research and Problem Assessment. An essential supporting element to RANN is the Intergovernmental Science (ISP) program which provides an important mechanism for transferring RANN research results into the action program of State and local governments and to the private sector.

Program Development and Management funds required for the Research Applications Directorate total $4,243,400 in FY 1975, an increase of $1,095,400. Included in the estimate are 83 new positions initially funded on a part year basis. In determining minimum staffing needs consideration is given to growing demands placed on RA program managers. These demands include: participation in government-wide energy and other task forces, panels and committees; international commitments; intensified Executive and Legislative Branch requests for data, coordination, and presentations; and carrying out lead agency responsibilities assigned to NSF/RANN for Terrestrial Solar Energy and Geothermal Energy. Also, there is extensive interagency coordination on research proposals and status of projects because research supported by RANN is expected to be transferred to mission agencies when it reaches the implementation stage.

Starting with FY 1974 and accelerating in FY 1975, the energy research responsibilities of the National Science Foundation under the RANN program are greatly increased, from $29.1 million to $102.9 million. This increase will be reflected both in program content and in intensity of program management, and requires additional positions and support costs.

Largest increases in FY 1975 are in the solar energy and geothermal energy programs, for which the National Science Foundation has a lead Federal responsibility. The programs in energy conservation and storage, coal research, environmental effects of energy, and socio-economic aspects of changes in the nation's systems for production and consumption of energy are also substantially increased.

The enlarged NSF responsibility in energy will require changes in management approaches. There will be a much heavier emphasis on project management, necessitating time-phased planning and intensive monitoring of progress. There will also be much greater use of program solicitations to focus research efforts where they are most urgently needed. The use of contracts and research agreements will increase to achieve a higher confidence in performance as planned, and as a consequence the average size of awards is expected to be substantially larger. All of these changes contribute to the need for additional staff and supporting Program Development and Management funds.

The multi-disciplinary nature of RANN and ISP, together with their application and utilization requires that each research proposal be reviewed systematically and thoroughly. In order to ease the preparation burden on potential grantees, preliminary unsolicited proposals containing summary-type data are submitted to the RA staff for evaluation of appropriateness to RANN/ISP objectives. This is followed by full scale evaluations after submission of a formal proposal in those cases where the preliminary proposal shows promise of significant results. Review of a formal proposal in most cases requires a site visit by an ad hoc panel which includes staff representation and at least two highly recognized experts who serve as consultants to the program manager.

After approval of an award, semi-annual consultations are held with grantees to insure that progress is being made towards achieving objectives and milestones set forth in the proposal. More frequent consultations are required when large contracts and complex projects are evaluated. The consultations often involve site visits by the program manager who is accompanied by a panel of experts.

EDUCATION ($3, 942, 400)

The Assistant Director for Education manages the Science Education Improvement Program and the Graduate Student Support Program, the Foundation's major programs in support of science education. Also included under his responsibilities is the Division of Science Resources Studies, for the most part an in-house activity, which makes factual and statistical studies with emphasis on scientific and technical manpower, science education, and research and development expenditures, that are required for the development of National, Federal and Foundation policies in the area of science and technology.

The science education programs are conducted through an organizational structure consisting of a Division of High Education in Science, a Division of Pre-College Education in Science, and an Office of Experimental Projects and Programs. In FY 1975, the Science Education Improvement Program will continue to focus on specific problem areas with larger and more comprehensive grants, thus the total number of awards will be maintained at a level lower than in years prior to FY 1973—1,500.

NSF, in its lead agency role in Federal government activities for the training of energy R. & D. manpower, plans to support activities at the graduate level, and two and four year college levels. Manpower studies related to energy R. & D. are also planned. To carry out these activities which total $5,000,000, two additional positions will be added in FY 1975.

EXECUTIVE MANAGEMENT AND SPECIAL RESEARCH ($5, 041, 400)

Policy direction, top management of the NSF, and direction of the special research programs and support for the Director in his role as Science Adviser to the President are included in this functional area. The National Science Board and the Office of the Director have the responsibility and authority for policy direction and management of the Foundation; the Office of the General Counsel assists the Board and the Director in interpreting the legal aspects of the Foundation's activities, and the Office of Government and Public Programs is the focal point for liaison with Congress and the public. The Office of Experimental Research and Development Incentives is responsible for the conduct of programs which experiment with and test incentives which can be employed to stimulate more rapid utilization of proven technologies and to increase non-Federal investment in research and development. The Office of National Research and Development Assessment analyzes patterns of research and development and technological innovations, the incentives and decisions which underlie existing patterns and the implications which options will have in shaping future research and development patterns. The Science and Technology Policy Office and the Office of Energy R. & D. Policy have the responsibility for providing the direct support required by the Director in his role as Science Adviser.

The National Science Board consists of twenty-four leading scientists, academicians, administrators, and industrialists, appointed by the President, and the Director of NSF and develops the broad policy guidelines under which Foundation activities are carried out within the framework of the National Science Foundation Act. Public members of the Board are compensated for their attendance at meetings of the NSB and its committees and for travel costs incurred in carrying out its responsibilities. Duties of the NSB are specified in the National Science Foundation Act and include the preparation of an annual report to the President, for submission to the Congress, on the status and health of science and its various disciplines.

The Director is the chief executive officer of the Foundation and is responsible for the execution of the Foundation's programs in accordance with the National Science Foundation Act and the broad policy guidelines of the Board.

The Office of the General Counsel provides advice and counsel to the Board and the Director concerning substantive details of legislation pertaining to the Foundation as well as contractual, patent, and other legal matters. Two additional attorney positions have been added in FY 1975 to help meet the increasing workload in the legal aspects of the patent and procurement areas of NSF operations.

The office of Government and Public Programs advises and assists the Director and Coordinates the Foundation's liaison with Congress and State and local governments as well as with professional societies and other nongovernmental organizations; provides services and materials for use by general and specialized media including radio, TV, and motion pictures; and edits official publications of NSF, including the National Science Foundation Annual Report to the Congress. This office administers the Public Understanding of Science Program designed to build a basic public awareness and understanding of the nature of research and the role of science and technology in society. NSF participation in the Nation's Bi-Centennial activities is also administered through this office.

The Science and Technology Policy Office (STPO) provides assistance to the Director in his role as Science Adviser, in such areas as national civilian science and technological policy, developing technical options for the solution of national problems in the civilian area, appraising the overall effectiveness of ongoing Federal and national research and development efforts, coordinating Federal research and development programs, interacting with academic and industrial scientific communities on broad matters of science policy and in furthering U.S. international science and technology objectives.

A second office, the Office of Energy Research and Technology Policy (OEP) also supports the Director in his role as Science Adviser to the President. Specific functions of the office include providing analyses of specific issues and selected programs relating to energy research and development, developing a general systems framework for the evaluation of energy research and development programs, assessing the merits of individual technological approaches, identifying critical energy research and development needs, and determining ways

in which universities and other research organizations can make most effective contributions to energy research and development.

CENTRAL SUPPORT SERVICES AND ADMINISTRATION--- ($14,744,900)

The Assistant Director for Administration manages the Central Support Services and Administration area which encompasses those agency-wide administrative and support services best provided on a centralized basis and those costs which cannot be directly associated with the operation of any one directorate.

Included in the Administration sub-area are the salaries and travel costs associated with the development, coordination, and accomplishment of agencywide administrative, personnel, planning, programming, budgeting, accounting, contracting, and data processing activities. There are 10 staff units reporting to the Assistant Director for Administration. The Administrative Services Office is responsible for logistics and housekeeping for the NSF. Employee-oriented functions are assigned to the Personnel Office and the Health Services Unit. The Management Analysis Office and the Financial Management Office provide management and accounting services. The Grants and Contracts Office and the Audit Office along with the Financial Management Office work closely with the business offices of universities and institutions performing the research supported by NSF. NSF plans, program and budget are the functions of the Office of Budget, Programming and Planning Analysis and the Program Review office. Data support is provided by the Management Information Office.

In general, the workload of the staff providing central support services and overall administrative support increases in direct proportion to increases program funds and the administrative funds available to directorates. As the total number of proposals received and reviewed increases and the number of awards increases so do the support services such as grant and contract negotiation, the physical processing of the actual proposal documents, an estimated 50 million individual pieces of paper in FY 1975, and the financial and administrative followup. Also, increases in staff, consultants and travel funds mean direct increases in processing, payrolling, voucher auditing, processing travel request, and myriad other administrative functions. The FY 1975 budget increases the central support services staff by 25 positions to meet workload directly generated by the significantly higher program funding levels proposed. While the program dollar increase exceeds 20 percent, indicating a similar percentage increase in workload, the supporting staff will increase by only approximately seven percent. Better utilization of existing resources and staff, including training, upgrading of clerical and semiprofessional employees, introduction of labor-saving devices where applicable and reorganization of office arrangements in line with work flow will meet the balance of the workload requirements.

13. SPECIAL FOREIGN CURRENCY PROGRAM---------- $5,000,000

Obligations

Scientific Research and Related Activities----------	$4,000,000
Scientific and Technological Information----------	1,000,000
Total ----------	5,000,000

The Special Foreign Currency Program utilizes U.S.-owned excess currencies in certain foreign countries to support cooperative scientific projects, seminars, and the travel of U.S. and foreign scientists involved in mutually beneficial efforts. The Foundation awards grants to both U.S. and foreign institutions and scientists. The funds used in this program are those which the United States has accumulated abroad, principally through the sale of agricultural commodities, the repayment of loans, and the payment of interest on outstanding loans. The "excess" funds may be used for U.S. purposes in the country of origin, with the concurrence of the concerned foreign government. The Department of the Treasury determines when, where, and how much of these funds are excess to the U.S. Government's requirement. There are eight special foreign currency countries: Burma, Egypt, Guinea, India, Pakistan, Poland, Tunisia, and Yugoslavia.

Two categories of activity are included under this program: (1) cooperative research programs, joint seminars, and travel of scientists, and (2) translation, publication and dissemination of foreign scientific and technical information to U.S. scientists and engineers.

The objectives of the program are to support cooperative scientific activities of significance to the U.S.A. and the cooperating foreign country; supplement our domestic research effort through use of U.S.-owned foreign currencies; obtain access to unusual research environments and facilities; arrange for the translation of foreign scientific and technological literature for distribution to U.S. scientists; and promote the exchange of information between U.S. and foreign scientists.

SCIENTIFIC RESEARCH AND RELATED ACTIVITIES---------- $4,000,000

The program makes awards, payable in U.S.-owned special foreign currencies, to U.S. and foreign academic institutions for cooperative research projects, joint seminars and symposia, and international travel. The proposals submitted by U.S. and foreign academic institutions are subject to the same review process as applications for dollar support. The primary criteria for judging special foreign currency proposals are (1) potential for advancement of scientific knowledge, (2) probable contribution to U.S. and foreign scientific progress, (3) the likelihood of lasting relationships between the U.S. and foreign cooperating institutions, and (4) the availability of adequate resources and experienced personnel.

The objectives of the program are those stated in the summary program description above.

The FY 1975 program will include cooperative research projects and joint meetings and seminars in the following countries and in the subject areas indicated:

Egypt—engineering, the physical sciences, and science education.

India—the mathematical, biological, and physical sciences; engineering; and the social sciences.

Pakistan—the natural sciences and engineering.

Poland—the mathematical, biological, and physical sciences; and engineering.

Tunisia—the natural sciences, science education, and the social sciences.

The Foundation will encourage the development of cooperative projects with Burma, especially in biology and geology. Projects in Yugoslavia will be supported through the U.S.-Yugoslav Board on Scientific and Technological Cooperation. The Board was established on May 18, 1973, to provide a "joint fund in dinars to be used for continuing previously agreed-upon scientific and technological projects and thereafter, to the extent monies from the fund are available, to finance additional cooperative projects of mutual interest and advantage."

The Foundation will continue to support, at the same level as in FY 1974, the international travel of U.S. scientists and project managers to and from special foreign currency countries to participate in scientific meetings, deliver lectures, convene seminars, and confer with their colleagues on program planning and development. Approximately 200 travelers will be supported by special foreign currencies in FY 1975 at an estimated cost of $200,000.

SCIENTIFIC AND TECHNOLOGICAL INFORMATION---------- $1,000,000

This program provides special foreign currency funds to overseas contractors for the collection, translation, and printing of foreign scientific and technical information for distribution to U.S. scientists and engineers. The Foundation's six overseas contractors (two in India and one each in Egypt, Pakistan, Poland, and Tunisia) translate foreign scientific literature from more than fifteen languages (Russian, Polish, Serbo-Croatian, Czech, Japanese, and others). In addition, the Foundation coordinates translation requirements of various Federal science agencies and orders translations from the overseas contractors under an interagency agreement with the National Technical Information Service (NTIS) of the Department of Commerce. The NTIS also receives and distributes the output from the Foundation's overseas contractors.

The objectives of the program are to (1) translate significant foreign scientific and technical literature into English and (2) assure the availability of this information to U.S. scientists and engineers.

The Foundation plans to continue to arrange for the collection, translation, and dissemination of foreign scientific and technical literature through overseas contractors in Egypt, India, Pakistan, Poland, and Tunisia.

NATIONAL SCIENCE FOUNDATION FISCAL YEAR 1975 PROGRAM, BY SCIENCE DISCIPLINE, AS REQUESTED

[In millions of dollars]

	Support of research															
	Atmospheric sciences	Earth sciences	Oceanography	Biological sciences	Physics	Chemistry	Astronomy	Mathematics	Social sciences	Engineering	Materials research	Computer sciences	Other research	Subtotals research	Other programs	Total NSF
Scientific research project support	14.6	13.7	15.9	85.4	44.8	37.1	11.5	17.1	29.0	37.9	45.4	11.3		363.7		363.7
National and special research programs:																
Global atmospheric research program	4.0													4.0		4.0
Experimental R. & D. incentives program													1.0	1.0		1.0
National R. & D. assessments program													3.0	3.0		3.0
International decade of ocean exploration			15.5											15.5		15.5
Ocean sediment coring program			11.0											11.0		11.0
Arctic research program	1.2	0.2	1.1	.4					0.5				.1	3.5		3.5
U.S. Antarctic research program	10.3	10.4	1.9	2.7									.5	25.8		25.8
Oceanographic facilities and support			15.0											15.0		15.0
Solar eclipse support														0		0
Science and technology policy research													1.5	1.5		1.5
Energy R. & D. policy research													4.5	4.5		4.5
Subtotal	15.5	10.6	44.5	3.1					.5				10.6	84.8		84.8
National research centers:																
National Astronomy and Ionosphere Center	1.1						2.2							3.3		3.3
Kitt Peak National Observatory							7.8							7.8		7.8
Cerro Tololo Inter-American Observatory							3.0							3.0		3.0
National Radio Astronomy Observatory							20.5							20.5		20.5
National Center for Atmospheric Research	17.9													17.9		17.9
Subtotal	19.0						33.5							52.5		52.5
Science information activities													5.0	5.0		5.0
International cooperative scientific activities													8.0	8.0		8.0
Research applied to national needs	7.0	3.0	1.2	14.7	2.0	5.0		0.5	20.0	70.9	5.0		19.6	148.9		148.9
Intergovernmental, scientific and research utilization													1.0	1.0		1.0
Institutional improvement for science													1.0	1.0	2.0	3.0
Graduate student support													3.2	3.2	9.5	12.7
Science education improvement													25.0	25.0	36.4	61.4
Planning and policy studies													2.7	2.7		2.7
Program development and management													13.2	13.2	26.3	39.5
Subtotal	56.1	27.3	61.6	103.2	46.8	42.1	45.0	17.6	49.5	108.8	50.4	11.3	89.3	709.0	74.2	783.2
Special foreign currency program													5.0	5.0		5.0
Fiscal year 1975 total	56.1	27.3	61.6	103.2	46.8	42.1	45.0	17.6	49.5	108.8	50.4	11.3	94.3	714.0	74.2	788.2
Fiscal year 1974 total (obligations)	49.9	22.9	60.2	74.9	38.4	31.4	34.3	15.2	35.6	59.6	40.7	9.5	96.1	568.7	77.7	646.4
Fiscal year 1973 total (obligations)	48.9	20.6	54.2	71.1	37.5	28.9	32.1	14.5	37.3	50.7	37.5	9.9	93.8	537.0	73.3	610.3

COMPARISON OF FISCAL YEAR 1974 WITH FISCAL YEAR 1975, NSF REQUEST AND COMMITTEE ACTIONS

[In millions of dollars]

Categories	(1) Fiscal year 1974 obligations	Fiscal year 1975 requests: (2) Request to Congress	(3) Change from 1974	(4) Percent change from 1974	Fiscal year 1975 committee action: (5) Approved	(6) Change from request
1. Scientific research project support	291.3	363.7	+72.4	+24.8	354.0	−9.7
2. National and special research programs	91.6	84.8	−6.8	−7.4	86.0	+1.2
3. National research centers	42.5	52.5	+10.0	+23.5	52.5	0
4. Science information activities	8.0	5.0	−3.0	−37.5	8.3	+3.3
5. International cooperative activities	6.4	8.0	+1.6	+25.0	8.0	0
6. Research applied to national needs	75.1	148.9	+73.8	+98.2	139.1	−9.8
7. Intergovernmental science program	1.0	1.0	0	0	1.0	0
8. Institutional improvement for science	10.0	3.0	−7.0	−70.0	10.0	+7.0
9. Graduate student support	13.0	12.7	−.3	−2.3	13.2	+.5
10. Science education improvement	67.5	61.4	−6.1	−9.0	68.9	+7.5
11. Planning and policy studies	2.6	2.7	+.1	+3.8	2.7	0
12. Program development and management	31.6	39.5	+7.9	+25.0	39.5	0
Subtotal	640.6	783.2	+142.6	+22.2	783.2	0
13. Special foreign currency program	5.6	5.0	−.6	−10.7	5.0	0
Total, NSF	[1] 646.3	[2] 788.2	+142.0	+21.9	788.2	0

[1] The fiscal year 1974 total of new funds obligated is $577,400,000—while the total shown is $646,300,000. This is due to the following: (1) $64,400,000 in prior year regular funds brought forward; (2) $1,860,000 added by a pay increase supplemental; (3) $2,660,000 in prior year excess foreign currencies brought forward.

[2] Includes $116,100,000 for energy related budget amendment.

COMMITTEE ACTIONS

H.R. 12816, the 1975 authorization bill for the National Science Foundation, was introduced by Mr. Teague on February 13, 1974. It represents the Administration's request. H.R. 13999 is the clean bill reported by Committee.

H.R. 12816 requested a lump sum of $783.2 million in new obligational funds, plus $5 million in excess foreign currencies to be used in support of the Foundation's research activities abroad. The total request was thus $788.2 million.

The Committee has included all of the provisions of H.R. 12816 in H.R. 13999 but it has put the Foundation's budget in line-item form, as in past years, according to the 12 major categories requested plus the special foreign currency program.

In making the foregoing change, the Committee added $19.5 million to the Administration request in five of the categories and reduced the request by $19.5 million in two other categories. This leaves the total budget at the same figure requested by the Administration—$788.2 million.

This compares with an authorization for FY 1974 of $635.6 million—an increase of $152.6 million; it compares with a 1974 appropriation of $569.6 million—an increase of $218.6 million; it compares with estimated new-money obligations in 1974 of $577.4 million—an increase of $210.8 million. However, due to prior year carryovers plus a supplemental pay increase amounting to an aggregate of $68 million, the actual increase over FY 1974 estimated obligations is $142 million.

A detailed account of the actions taken by the Committee follows:

LINE ITEM BUDGET

The Committee approved a line item budget rather than the lump sum authorization requested by the NSF. The line item budget was first incorporated into the fiscal year 1972 Authorization Act, Public Law 92–86.

There are 12 budget categories in Section 1 of the bill this year.

The line item budget categories and the funds recommended for each are shown on page 120 of this report.

COMMITTEE BUDGET ACTIONS

The changes to the budget request submitted by the Administration were as follows:

Changes in Section 1

A line item budget is recommended with totals for each category as shown in the table on page 120. This mode of authorization has been followed by the Committee since FY 1972.

INCREASES

The $19.5 million by which the Committee increased the Administration request is distributed as follows:

National and Special Research Programs

Administration Request	$84, 800, 000
Committee Increase	1, 200, 000
Committee Recommendation	86, 000, 000

Category 2.—An increase of $1.2 million which would be applied to the Experimental R. & D. Incentives Program over and above the $1 million requested. NSF requested $11 million for this important technology transfer activity but the amount was reduced to $1 million by OMB. The Committee believes that the addition indicated will provide a minimal level of activity to prevent complete deterioration of the program.

Science Information Activities

Administration Request	$5, 000, 000
Committee Increase	3, 300, 000
Committee Recommendation	8, 300, 000

Category 4.—An increase of $3.3 million which would restore this program to the level originally requested of OMB bythe Foundation—and also permit an increase of $300,000 over last year. The program needs emphasis, development and coordination with other similar Federal efforts in order to become broadly effective.

Institutional Improvement for Science

Administration Request	$3, 000, 000
Committee Increase	7, 000, 000
Committee Recommendation	10, 000, 000

Category 8.—An increase of $7 million which would restore the Institutional Grants for Science Program to last year's level. This program is of great importance to the nation's colleges and universities since it is one of the very few in existence which is devoted essentially to building up and improving the entire science departments of those institutions which qualify for support. This program operated last year at the $7 million level but the Foundation had planned to eliminate it for FY 1975. The Committee is strongly of the opinion that the program should be neither dropped nor reduced.

Graduate Student Support

Administration Request	$12, 700, 000
Committee Increase	500, 000
Committee Recommendation	13, 200, 000

Category 9.—An increase of $500,000 which would restore the $300,000 cut from the 1974 level of this program and provide a small incremental increase of $200,000. The Committee has been a strong advocate of the Graduate Student Support program, although that program has consistently been reduced over the past 4 or 5 years. The Committee believes that, particularly in view of the general scarcity of graduate student support and of the highly-trained manpower it provides, this program should recede no further and that the $200,000 increase will barely make up for inflationary factors.

Science Education Improvement

Administration Request	$61, 400, 000
Committee Increase	7, 500, 000
Committee Recommendation	68, 900, 000

Category 10.—An increase of $7.5 million to bolster the only major science education program which the Foundation retains. This program is designed to provide improvement in education methods and curricula, as well as assistance to students from the elementary level up to the post-graduate. The increase contemplated would restore this program to the 1974 level and includes $1.4 million to compensate for funds diverted to technician training and aid to scholars from abroad in energy-related study.

DECREASES

The $19.5 million by which the Committee decreased the Administration request is distributed as follows:

Scientific Research Project Support

Administration Request	$363, 700, 000
Committee Decrease	9, 700, 000
Committee Recommendation	354, 000, 000

Category 1.—Scientific Research Project Support, the largest single component of the Foundation's overall program, was increased from $291.3 million in FY 1974 obligations to $363.7 million for FY 1975: a 24.8% increase. This occurred although the Foundation had requested of OMB an increase of only $41.7 million to a level of $333 million: a 12.2% increase. The Committee action has placed the 1975 level for this category at $354 million.

Research Applied To National Needs

Administration Request	$148, 900, 000
Committee Decrease	9, 800, 000
Committee Recommendation	139, 100, 000

Category 6.—Research Applied to National Needs (RANN), the second largest component in the Foundation's budget, was increased from $75.1 million in FY 1974 to $148.9 million in FY 1975: an increase of 98.2%. This occurred although the Foundation had requested of OMB an increase of only $6.9 million to a level of $82 million: an increase of 8.4%. The Committee action has placed the 1975 level for this category at $139.1 million.

The reason for the decreases in these areas is to keep the total authorization within the amount requested by the Administration. The categories chosen for reduction were those which had received, by far, the largest budget request increases over FY 1974, both in dollars and in percentages.

It should be noted that both Research Projects and the RANN program received dollar increases of approximately $73 million. Under the change which the Committee has made in H.R. 13999, Research Projects will still receive an increase of just under $63 million—$21 million more than it requested from OMB—which amounts to a boost of 21.6%. For RANN, the change made by the Committee will still mean an increase of $64 million—or $57 million more than was requested of OMB originally—which amounts to a boost of 85%.

It is important, however, that it be understood that the chief reason for the large increases in both categories was to stimulate and accelerate the national energy R. & D. program. The Committee is of the opinion that the small cuts made will in no way hamper the overall energy R. & D. effort.

Limitations in Section 2

Subsections (a), (b) and (c) placed floors under the authorized amount in each of the education categories described in Section 1—i.e., Categories 8, 9, and 10 shown in the table on page 120. These provisions mean that not less than the amount stipulated shall remain available for such purposes. They have been included to assure that funds in these areas shall not be transferred to or merged with other programs.

Subsection (d) places a similar floor under the Experimental R. & D. Incentives Program contained in Category 2 in accordance with the same rationale.

Subsection (e) places a floor of $2 million for fire research in the RANN program. The reason for this requirement is to assure that the scientific and technological research capability in the field of fire research continues as a part of the RANN program, Category 6.

Subsection (f) places a floor of $1.5 million under the Science Faculty Fellowship Program in Category 10. Last year the Committee on Science and Astronautics, as well as the Senate Committee, stipulated that this modest program to assist faculty fellows should be maintained. In spite of that directive, the Foundation has planned in its 1975 budget to merge the Fellowship Program into the Research Participation Program. While the two programs may reasonably be jointly administered, there are marked differences between them and the Committee is of the opinion that the Faculty Fellowship Program should not lose its identity. This floor does not involve any addition or deletion of funds; it simply allocates the $2.5 million scheduled for Research Participation into two programs so as to reinstate the Fellowship Program.

Subsections (g) and (h) place a floor of $3.8 million and $2 million under Student Programs and High School Student Projects, respectively, also in Category 10. These floors have been established to assure that funding for lower-level science education programs shall not be merged with other programs or only partially funded.

It must be emphasized that all of the limitations which are directed toward making sure that the Foundation does not slight its programs for science education stem from a long-standing interest which the Committee has had in this field—and from its conviction that without adequate manpower, both in numbers and in training, our best efforts in research and development in every area will prove ineffectual. The Committee notes with grave concern that support of science education in the Foundation, in spite of numerous Congressional warnings, has been steadily waning over most of the past decade. In FY 1970, for example, support of science education amounted to 36% of the total Foundation budget. That support now stands at 9.7%. Although the overall budget for the Foundation has increased dramatically during the same period, the actual number of dollars for science education has dropped by more than 47%—from $165 million in FY 1970 to a request of $87 million in FY 1975. If inflationary factors are taken into account this falloff is much greater.

It is further a glaring indication of the attitude of the Foundation and of OMB that the major areas which both sought to reduce in the request for the current budget were the three categories involving science education support. The Committee trusts that the Foundation will keep these observations in mind in the future—as well as those enunciated on this topic under "Committee Views," which follows.

Subsection (i) is designed to assure that, in the conduct of its Solar Energy Research and Technology program in Category 6, the Foundation coordinates that program with NASA in such a way that maximum advantage will be taken of the special capabilities of each agency. It requires that the two agencies report on their plans, schedules and other findings to this Committee and its counterpart in the Senate not later than 90 days after this Act becomes effective. It further provides that where it is found that NASA can appropriately carry out parts of this program, particularly in the engineering and demonstration phases, it shall be so assigned and funded through NSF.

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COMMITTEE VIEWS

APPLIED RESEARCH

The Committee gave careful consideration to trends toward applied research which the Foundation has been following since it received limited authority to engage in such research in 1968. These trends show that NSF has increased its support for applied research from less than 10% of its total research effort in 1970 to 21% in 1975. Its ratio of applied-to-basic research has gone from 12% to over 25%.

The Committee's concern stems from the following: (a) the chief function of NSF is to support basic research; (b) the Congressional intent of the 1968 Amendments which authorized support of applied research appears to have been severely stretched; and (c) there are almost twice as many Federal entities engaged in applied R&D as there are in basic research, and they support it at a level over six times as great. The Committee, as it has done several times before, cautions the Foundation about these trends. In addition, the Committee is giving consideration to a separate examination of this problem, apart from its annual authorization activities, prior to the next budget submission by the Foundation.

PROOF OF CONCEPT

The National Science Foundation has testified that RANN supports research projects through the proof of concept stage. According to the Foundation, proof of concept follows basic research and applied research within the research and development process.

The Committee has spent considerable effort in trying to develop an operational definition of proof of concept. This effort has included a review of how various Federal agencies and industrial organizations use the term within the context of their own activities. NSF has stated that proof of concept experiments are limited to testing systems technology as well as investigating the social, economic, institutional and environmental barriers to introducing the system into widespread use.

The limit to NSF research is determined on a case by case basis. General NSF criteria, however, include:

(*a*) The size of the project is small, and not on a commercial scale.

(*b*) The experimental systems are all different, and are never identical.

(*c*) Critical components can be tested within a general system.

(*d*) An experimental system may be designed for demonstrating commercial viability if it is not in continuous operation.

Other Federal agencies evidently use different definition of proof of concept. According to one agency, a proof of concept experiment is one which is undertaken to prove that some reaction which is possible in theory or principle can in fact be achieved in a laboratory situation. This is much narrower than the NSF definition.

Another agency defines proof of concept as a method by which an advanced design or principle is tested for feasibility by means short of actual incorporation in a pre-production prototype or device. This definition places proof of concept within the development phase, a step beyond its placement by NSF.

In industry, proof of concept can mean several different things, depending on whether it involves only technical issues or also includes such questions as costs, ease or desirability of use, reliability, and so on.

No acceptable, unambiguous definition of proof of concept has been developed by the Committee so far. However, the Committee feels that more effort should be expended in attaining the objective of an operational definition for proof of concept during the coming year.

In the meantime, the Committee recommends a two-fold approach be implemented in dealing with the question of precisely how far NSF should take its RANN research programs toward actual development and demonstration.

(1) General Criteria

The National Science Foundation should maintain its character as a science agency—the Federal organization with primary responsibility for basic research and education in the sciences. In general, therefore, the Committee endorses criteria specifying that proof of concept relates only to a laboratory demonstration of some possible theory or principle.

(2) Special Cases

It is recognized that different situations can arise because the state of technology varies greatly in different areas as well as in the involvement of Federal mission agencies. At least for the interim, therefore, a flexible definition for proof of concept is necessary.

The Committee recognizes that a transfer of an activity from applied research to development occurs gradually rather than abruptly and is marked by close working relationships at both the technical and managerial levels. This means that coordination between research agencies such as NSF and the user agencies should be required, with an upgraded reporting mechanism.

The Committee recommends the following specific actions be taken with regard to the projects in the RANN category:

(*a*) Identification of a user for each individual RANN work unit.

(*b*) Investigation of the feasibility of users approving each RANN contract.

(*c*) Establishment of utilization programs in each user organization so that RANN projects can be tracked by the users from their inception in order to assure optimum utilization of RANN results.

The NSF is requested to report to the Committee not later than October 31, 1974, on its implementation of the foregoing approach.

PROPORTION OF BUDGET FOR SCIENCE EDUCATION

The Committee is concerned about the steady decline in the percentage of the NSF's budget which is devoted to Science Education. In 1970, 36% of the Foundation's budget was devoted to science education activities. In 1972 that percentage had gone down to 19 percent. In the proposed budget for FY 1975 less than 10 percent would be devoted to science education activities. This year the Committee again found it necessary to restore funds to the budget for certain science education activities which the Committee in past years has strongly supported. As a result the percentage of science education funds has been raised to just under 12 percent, a figure still far below the percentage just a few years ago. In addition, while the Committee has supported the very substantial increase in science education research activities, there has clearly not been a continuation of support for the types of science education programs which constituted the bulk of the Foundation's science education program in previous years. In the Committee's view the balance between research and sustaining activities in the science education program must be redressed. The Committee invites the Foundation's attention to the strong interest in science education which is evidenced in the hearings on this subject, and as evidenced in the amendment to the NSF's organic act adopted by the Congress in 1972, specifically making the Foundation responsible for the Federal effort toward the health and growth of science education in the United States. A thorough review by the NSF of the long-range future of the science education program in light of these comments would appear to be in order.

INSTITUTIONAL IMPROVEMENT FOR SCIENCE

The Committee wishes to emphasize that the $7 million restored to this program is specifically for the purpose of maintaining Institutional Grants for Science at the 1974 level. It is not intended that these funds be utilized within the general improvement for science category on behalf of the separate program for the improvement of university research management.

INTERGOVERNMENTAL SCIENCE PROGRAM

In past years the Committee has provided funds under a separate line item for the Intergovernmental Science Program. This program is aimed at bringing science and technology to bear on the problems of State and local government. In the past the program has produced some notable successes in providing advice of a scientific and technological nature to many of the State governors, and more recently an effort has been made to bring the same kinds of advice to several of the State legislatures. The Committee believes that this small, but promising program should continue at the current funding level of $1 million and has provided authorization for that sum in fiscal year 1975. In its budget request the NSF asked for $1 million for "Intergovernmental Science and Research Utilization". This reflects the Foundation's desire to use a portion of the Intergovernmental Science funds for the dissemination of the results of the RANN program. The

Committee has repeatedly urged the Foundation to make a stronger effort to disemminate the results of RANN's work. However, this should not be done at the expense of the Intergovernmental Science program, with its very modest funding level. While the Intergovernmental Science program has been merged organizationally into the RANN organization, and while many of the Foundation's staff in this field have expertise in both the Intergovernmental Science field and in the RANN dissemination field, the Committee believes that the funds contained in the authorization line item for "Intergovernmental Science", should remain available for that program only.

SECTIONAL ANALYSIS OF THE BILL

A bill to authorize appropriations for activities of the National Science Foundation, and for other purposes.

SECTION 1

This section authorizes appropriations to the National Science Foundation for fiscal year 1975 in the amount of $783,200,000. The categories authorized are as follows:

(1) Scientific Research Project Support, $354,000,000.
(2) National and Special Research Programs, $86,000,000.
(3) National Research Centers, $52,500,000.
(4) Science Information Activities, $8,300,000.
(5) International Cooperative Scientific Activities, $8,000,000.
(6) Research Applied to National Needs, $139,100,000.
(7) Intergovernmental Science Program, $1,000,000.
(8) Institutional Improvement for Science, $10,000,000.
(9) Graduate Student Support, $13,200,000.
(10) Science Education Improvement, $68,900,000.
(11) Planning and Policy Studies, $2,700,000.
(12) Program Development and Management, $39,500,000.

SECTION 2

Subsections (a), (b) and (c) place floors under the authorized amount in each of the education categories described in Section 1—i.e., Categories 8, 9 and 10.

Subsection (d) places a floor of $2,200,000 under the Experimental R&D Incentives Program contained in Category 2.

Subsection (e) places a floor of $2,000,000 under the Fire Research program, a part of Category 6.

Subsection (f) places a floor of $1.5 million under the Science Faculty Fellowship Program, a part of Category 10.

Subsections (g) and (h) place a floor of $3.8 million and $2 million under the Student Programs and High School Student Projects, respectively, also in Category 10.

Subsection (i) requires the Foundation to coordinate its Solar Energy Research program, a part of Category 6, with the National Aeronautics and Space Administration, to report back to the appropriate House and Senate committees on the joint plans within 90 days of the effective date of this act, and to place such projects as may be appropriately carried out by NASA under its management but through regular Foundation funding channels.

SECTION 3

This section provides $5,000 to be expended at the discretion of the Director of NSF for official consultation and other unusual expenses.

SECTION 4

This section authorizes $5 million in excess foreign currencies for NSF research outside the United States.

SECTION 5

This section provides that funds appropriated pursuant to this Act shall remain available for expenditure and obligation according to such provisions as the Appropriations Acts may specify.

SECTION 6

This section provides that funds may be transferred, subject to any restraints in other parts of the Act, into or out of any category in Section 1 up to an amount equal to 10 percent of that category. If the Foundation wishes to transfer sums in excess of 10 percent, it must first notify the appropriate House and Senate committees and then observe a 30-day waiting period unless each committee agrees to the action prior to that time.

SECTION 7

This section is a standard requirement withdrawing NSF support from any individuals receiving such support who may have committed serious offenses or caused violent disruption to or within their respective research institutions.

SECTION 8

This section requires that the Director of the Foundation keep the Committee and its counterpart Senate committee fully and continually informed with respect to all Foundation activities—completed, underway or contemplated.

SECTION 9

This section provides for the short title of the bill.

COST AND BUDGET DATA

The bill will authorize appropriations for fiscal year 1975 in the amount of $788.2 million in new obligational authority, including $5 million in excess foreign currencies.

In accordance with the requirements of Sec. 252(b) of the Legislative Reorganization Act of 1970, the Committee notes that H.R. 13999 is an authorization bill for one year only. If the programs it authorizes remain unchanged during the next 5 years but the same level of effort is expended, there will be no change in costs other than those occasioned by inflation or Federal salary increases.

COMMITTEE RECOMMENDATIONS

A quorum being present, the bill was passed by voice vote.

AGENCY RECOMMENDATIONS

The following recommendation from the National Science Foundation accompanied the draft bill introduced on February 13, 1974, as H.R. 12816 in the amount of $788.2 million, including $5 million in excess foreign currencies.

NATIONAL SCIENCE FOUNDATION,
Washington, D.C., February 4, 1974.

Hon. CARL ALBERT,
Speaker of the House of Representatives,
House of Representatives, Washington, D.C.

DEAR MR. SPEAKER: Public Law 90–407 provides that appropriations for the National Science Foundation to carry out its powers and duties have prior authorization from the Congress. Pursuant to this requirement, there is enclosed herewith a draft authorization bill for fiscal year 1975 for the National Science Foundation, together with a sectional analysis.

The major differences between the proposed legislation and P.L. 93–96—the National Science Foundation Authorization Act, 1974—includes: Line item amounts which appeared in P.L. 93–96 are eliminated in favor of the more flexible lump sum authorization, and consequently, no provision comparable to section 6 of P.L. 93–96 appears. Also, unlike P.L. 93–96, no minimum amounts have been specified for particular NSF programs.

A provision commonly known as the "student unrest clause" is omitted because of doubts as to the constitutionality of such a clause; an unappealed decision by a Federal District Court has held an almost identical clause in certain DHEW legislation to be unconstitutionally vague.

Finally, a provision comparable to section 10 of P.L. 93–96, which prohibited the use of NSF funds for the conduct or support of research on "a human fetus which is outside the womb of its mother and which has a beating heart," is omitted inasmuch as the Foundation has never conducted or supported such research and does not intend to do so.

The Office of Management and Budget has advised us that enactment of the proposed bill would be in accord with the program of the President.

Sincerely yours,

H. GUYFORD STEVER,
Director.

ADDITIONAL VIEWS OF THE HONORABLE ALPHONZO BELL, CONCURRED IN BY THE HONORABLE GEORGE E. BROWN, JR.

The National Science Foundation (NSF) authorization bill, which the Committee on Science and Astronautics has approved, is a sound proposal and merits our general support. This measure provides the means for continuing our nation's leadership in science and technology. The research, both basic and applied, which the current bill supports will set the stage for dividends which we will collect for many years to come.

In this regard we believe that there is no more urgent national priority today than the expeditious resolution of our energy shortcomings. The problem permeates virtually every sector of our economy and daily lives. Our response must meet the challenge. The energy challenge warrants no less than a maximum effort.

For this reason we take exception to the Committee's reduction of funding for NSF programs largely devoted to research into solving the energy problem. This is anomalous since with its arsenal of talent and knowledge the NSF should be in the vanguard of this effort.

In particular we are concerned with a cut of $9.8 million in funding for Research Applied to National Needs (RANN). Almost two-thirds of the RANN budget is earmarked for programs designed to cope with the energy problem. The amount originally requested for RANN in FY 1975 was $148.9 million. This figure was first reduced to $144.6 million and then to $139.1 million. The FY 1974 RANN allocation was only $75.1 million. In terms of absolute dollars, the increase is of course significant. But is it enough to meet the challenge? We believe not. Furthermore, the funding for Scientific Research Project Support (SRPS) was cut by $9.7 million, i.e., from $363.7 million to $360.0 million and finally to $354.0 million. SRPS also participates significantly in research aimed at increasing our energy supply.

The FY 74 RANN allocation was determined before the energy crisis was fully appreciated. Hence it was unrealistically low. It would be self-deceptive to measure our progress by the mere statistical increase in its allocation. We should focus on providing the funds necessary to do the job at hand *today*. After years of inattention to the looming energy problem an accelerated effort is needed here. RANN serves as an important bridge between NSF's basic research programs and the implementation of this research in solving current practical problems. It is the focal point for transforming impersonal graphs, charts, and reams of numbers into lower power costs, stabilized employment, and the preservation of our high standard of living. In our opinion, to economize here is shortsighted and imprudent. After years of supporting basic research, the American taxpayer now deserves a full return

on his investment. It would take great temerity to suggest he deserves anything less.

At the same time the committee reduced RANN's allocation below the amount requested, it proceeded to increase the funding of two other areas above that request, *viz.*, Graduate Student Support by $0.5 million and Science Education Improvement by $7.5 million. While both these areas deserve our support, the needs in these areas have remained relatively stable as compared with the need for immediate energy research. We believe the allocation of funds requested of Congress for FY 1975 represented an optimal distribution.

It is imperative that Congress provide the leadership, direction, and perseverance necessary to resolve our energy problems. The gas lines may return as rapidly as they disappeared. We are apprehensive that a reduction in research directed toward solving our energy problems may be interpreted as indicating either that Congress' concern with this topic is ebbing or that the Congress no longer believes the problem serious. Either inference would be erroneous. While the average citizen may lose sight of the energy shortage as the gas lines disappear, Members of Congress have too good a perspective to allow them to minimize the seriousness of the problem. If Congress fails to maintain the momentum in solving the energy shortage, it will likely founder.

We are also concerned that the $9.8 million reduction for RANN may have a more pervasive impact than generally appreciated. Federal funds often are matched by private funds in a given project to underwrite an effort much greater than otherwise possible. Federal funds also provide the seed money by which new ideas can be investigated. Thus, a cut in Federal funding can trigger a domino effect whose impact will reach far and wide. Because of this the effect of the $9.8 million cut could be significant. Its importance is not limited to the amounts involved, but rather to the psychology of appearing as though the energy problem or the drive for self-sufficiency is no longer important.

We appreciate the danger of trying to infuse too much money into a program too early; that is, before the money can be profitably spent. This is not the situation with RANN. In hearings before the Subcommittee on Science, Research and Development it was stated that worthwhile programs were ready for pursuit which would require the full request of $148.9 million. The bill as approved by the Full Committee allocates $139.1 million to RANN.

The energy crisis was thrust upon our nation after years of inattention and will be resolved only after years of dedication. Our belated start means that we must capitalize fully on the scientific knowledge already discovered as well as pushing toward new ideas. After years of sowing money in scientific research it is foolish to skimp on harvesting the rewards. Efforts like RANN are pivotal in transforming abstract scientific principles into concrete, everyday benefits and should be given the fullest support.

ALPHONZO BELL,
GEORGE E. BROWN, Jr.

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SENATE

REPORT
No. 93-848

NATIONAL SCIENCE FOUNDATION AUTHORIZATION ACT OF 1975

MAY 15, 1974.—Ordered to be printed

Mr. KENNEDY, from the Committee on Labor and Public Welfare, submitted the following

REPORT

[To accompany S. 3344]

The Committee on Labor and Public Welfare, to which was referred the bill (S. 3344) to authorize appropriations for activities of the National Science Foundation, and for other purposes, having considered the same, reports favorably thereon with an amendment and recommends that the bill as amended do pass.

I—SUMMARY

The purpose of S. 3344, as amended by the Committee, is to authorize appropriations to the National Science Foundation for fiscal year 1975 in the amount of $829,800,000, and in foreign currencies which the Treasury Department determines to be excess to the normal requirements of the United States, $5,000,000 for fiscal year 1975.

II—BACKGROUND

To insure the continued strength and well-being of science in the United States, the National Science Foundation enabling legislation provides a broad Congressional mandate for support of basic and applied research in all areas of science. Scientific research, both basic and applied, extends the frontiers of science and provides the new knowledge that will eventually permit the United States to conquer not only technological problems, but also the social and economic challenges that confront the nation. The National Science Foundation is the only Federal agency charged with the responsibility of maintaining the health of U.S. Science. Its grants, contracts and facility support are designed to meet the diversified needs of U.S. Science and to be [illegible]

sive in identifying problems of national concern. Equally significant are the Foundations science education programs which are designed not only to improve the effectiveness of science education at all academic levels but to enhance science literacy and provide the scientific and technical manpower so vital to our country's future.

For fiscal year 1975, the Administration request to the Congress provided $788.2 million in new funds for the National Science Foundation. This request included $5 million in excess foreign currencies and was $142.1 million above the budget request submitted for fiscal year 1974. On April 3, 1974, Senator Dominick introduced S. 3299, a bill that incorporated the Administration's FY 75 budget request for the National Science Foundation.

The Special Subcommittee on the National Science Foundation held a hearing on S. 3299 on April 5, 1974. Testifying in support of the Foundation's FY 75 budget request were the following officials of the NSF: Dr. H. Guyford Stever, Director; Dr. Raymond L. Bisplinghoff, Deputy Director; Dr. Alfred Eggers, Assistant Director for Research Applications; Dr. Edward C. Creutz, Assistant Director for Research; Dr. Lowell Paige, Assistant Director for Education; Dr. Thomas B. Owen, Assistant Director for National and International Programs; and Mr. Thomas E. Jenkins, Assistant Director for Administration. The Committee also heard testimony from public witnesses, including: Dr. Philip Handler, President, National Academy of Sciences; Dr. Donald F. Hornig, President, Brown University, representing the Association of American Universities, the National Association of State Universities and Land Grant Colleges, and the American Council on Education; and a panel of science educators, Professor Richard Wright, Biology Department, Gordon College, Wenham, Massachusetts, Professor Jane C. Belcher, Professor of Ecology, Sweetbriar College, Sweetbriar, Virginia, and Mr. Miles Fisher, Executive Secretary, National Association for Equal Opportunity in Higher Education. In addition to the testimony presented during the hearing, the National Science Foundation also supplied references for the Record to a series of questions submitted by the Committee.

Based on the information obtained during this hearing, Senator Edward Kennedy introduced S. 3344 on April 10, 1974. This bill called for an authorization of $855.3 million, including $5 million in excess foreign currencies. This authorization level was $67.1 million greater than the Administration request.

At an Executive Meeting of the Special Subcommittee on the National Science Foundation on May 2, 1974, Senator Dominick offered an amendment in the nature of a substitute to S. 3344. The substitute contained an authorization of $834.8 million for the Foundation's programs in fiscal 1975. The substitute was unanimously accepted by the Subcommittee and S. 3344 as amended was unanmiously reported to the full Committee on Labor and Public Welfare by a roll call vote of all seven members of the Subcommittee. On May 13, 1974, the Committee on Labor and Public Welfare ordered S. 3344 as amended reported favorably to the Senate.

The authorization contained in S. 3344, as amended, will permit the National Science Foundation to continue to provide essential support for basic research in the science disciplines, for research focused on

problems of national concern, for initiatives aimed at solving our energy crisis, and to maintain an adequate level for science education and institutional science support necessary to sustain the science education and research roles of academic institutions. Based upon a careful and thorough review of the hearing record, and recognizing the past accomplishments and achievements of the National Science Foundation, the Committee urges the adoption of S. 3344, as amended.

In formulating S. 3344, the Committee considered the many factors that have and will continue to influence the Foundation during the coming year. One of the single most important elements to be considered is NSF's expanded role in energy research and technology. For fiscal 1975, the Foundation has requested a total of $252.6 million for energy-related research. This request includes $136.5 million that is a part of the President's regular budget request and $116.1 million in additional energy research support that was submitted as part of the President's Budget Amendment for energy. The energy amendment was the result of an Executive Branch Study of the future energy needs of the United States, and it is significant to note that this $116.1 million energy amendment builds, to a large degree, upon existing NSF research programs.

The Foundation's $252.6 million energy request includes $101.8 million for direct energy research and facility support, and an additional $150.8 million in indirect or supporting energy programs. The direct energy research is concentrated in the Research Applied to National Needs (RANN) program, while the vast majority of the indirect or supporting energy research will be undertaken under the Foundation's basic research project support program. Of the $101.8 million requested by the Foundation for direct energy research $93.4 million will be used by the RANN program. RANN's direct energy budget will include $72.3 million for research in renewable energy resources, such as solar and geothermal energy, and $12 million for the exceptionally important area of energy conservation. In the Scientific Research Project Support Program, the Foundation requested $11.1 million for basic research in energy related areas that have the potential for helping to solve the nation's energy problems. Another area that this committee believes to be vital to our energy effort is a carefully coordinated study of the environental effects of energy, and $30.5 million is included in the FY 75 budget request for this purpose.

This committee has long considered energy research to be an important element of the Foundation's total scientific research program. During the Second Session of the 92nd Congress, for example, this committee increased significantly the level of support for the RANN program, saying that "this increase will permit the Foundation to significantly augment its support of energy and related technology, particularly in solar, geothermal and other unconventional energy sources." It is especially important that NSF continue and expand its efforts in the energy area at this time, and the Committee welcomes the substantially increased budget request for the Foundation's FY 75 energy program. The $252.6 million requested for FY 75 compares with the estimated $114.7 million being obligated in fiscal 74. The committee has authorized and strongly endorses the full budget request for energy related research.

The committee notes, however, that more than 50 percent of the increase is for energy related research and virtually all of the remainder is for increased support for basic research in the science disciplines. While the committee agrees with the need for this additional energy related and basic research and is satisfied with the proposed program for these purposes, it also believes that it is in the national interest to provide new authorization for problem focused non-energy related activities of the Foundation that did not receive the benefit of additional funds for fiscal 1975. Therefore, after comparing the line item requests for FY 75 that the Foundation submitted to the Office of Management and Budget, the Committee authorized an additional $46.6 million to meet the urgent requirements of these other NSF programs.

The Foundation had requested $703.45 million from the Office of Management and Budget for FY 75. To meet the energy crisis, the OMB increased the NSF budget request by $84.75 million, primarily in the RANN energy area and in the energy related basic research area. The RANN request increased from $82 million to $148.9 million to handle these energy initiatives; the Scientific Research Project Support request grew by $30.7 million to $363.7 million. To offset some of this increase, the OMB reduced other areas of the Foundation's budget by a total of $19.8 million. To enable the Foundation to maintain an effective program of research, science training, and other science support requirements, the Committee has restored most of these cuts.

The committee is especially concerned that in the area of science education, the budget cuts would be detrimental to the continuation of some of the Foundation's important and widely respected programs. As a result, the Committee increased the authorization in areas generally related to science education by a total of $24.9 million and, in addition, included language in the bill that would require the Foundation to adhere to a stated minimum in certain of these programs.

At the same time, the Committee authorized an additional $11.8 million for the RANN program to be used in non-energy related areas. Concern was expressed by some members of the Committee that these non-energy related RANN programs were barely holding their own when compared with the fiscal 1974 request and in some instances they have been reduced. One area of special concern to the nation, and a subject that this committee has long advocated, is the improvement of the Earthquake Engineering program. Last year, the Committee stipulated that at least $8 million be spent in this program for FY 74. While the Foundation has requested $8 million for earthquake engineering in the FY 75 budget, the Committee has again included a minimum that would require this level of activity for FY 1975. The NSF earthquake engineering program is unique and represents the only Federal program aimed at finding practical engineering methods for constructing earthquake resistant structures that can withstand earthquakes. Solutions of this nature are absolutely essential if this nation hopes to minimize the loss of life and property that accompany earthquakes, especially in light of the recent population increases in earthquake prone sections of the country.

To continue an orderly replacement program for outdated research vessels and to provide authorization for increasing fuel costs, the Committee recommends a $9.9 million increase in the Oceanographic Facilities and Support element of the National and Special Research Programs, including an $8.0 million minimum for ship construction/conversion. Such an increase would provide for the construction of two new oceanographic vessels and $1.9 million to cover the rising cost of fuel for the oceanographic vessel fleet. In view of the significance of the oceanographic program to the world's environmental problems, and the increasing importance of the sea's resources, the Committee believes that the added investment in oceanography will result in future benefits to the nation.

In meeting its statutory responsibilities for maintaining U.S. strength in all fields of Science, the National Science Foundation has supported a range of social science research activities. The responsibilities in this area were clarified by the 1968 amendments to the NSF Act. Since the solution to a growing number of domestic problems depends upon the wise utilization of a combination of social, physical and environmental sciences, this committee urges the National Science Foundation to maintain a strong posture on the social sciences.

In its report on the National Science Foundation Authorization for fiscal 1974, the Committee expressed interest in the development of the Very Large Array (VLA) Telescope for Radio Astronomy. The Committee felt this project should be continued, even if a limited appropriation required a modification of the construction schedule. The FY 74 appropriation amounted to $5 million, exactly half of the budget request, but for fiscal 1975, the Foundation has requested $13 million to place the construction of this telescope back onto an accelerated schedule. The committee still maintains its views on the importance of the VLA and has authorized the full budget request.

As a result of the Reorganization Plan No. 1 of 1973, the Director of the NSF appeared before this committee for the first time in his capacity as the President's Science Advisor. In this role, the Director is responsible to advise and assist the President, and the agencies in the Executive Office of the President, on matters involving science policy and to act as the President's representative in various international scientific and technological activities. To support him in this new capacity, the Director has established two new offices at NSF, the Science and Technology Policy Office (STPO) and the Office of Energy R&D Policy Research. STPO exists to provide the analytical basis for policy formulation for the science Advisor and the FY 75 program will reflect the needs for detailed studies and analyses to support the development of policy options and possible program initiative. The Energy R&D Policy Office, which was established on August 3, 1973, will assemble and mobilize a wide range of information and advice in energy related matters, furnishing the Director with the capacity to respond to requests for policy analysis of energy issues. NSF has requested $1.5 million for FY 75 for STPO and $4.5 million for the Energy R&D Policy Office. In supporting this request, the Committee urges the Director to continue to make his voice heard as Science Advisor in the discussions impacting on national science policy at the highest level of government.

Finally, the Committee continues to be deeply concerned with the effects of inflation on the scientific research community. Inflation has reduced the effective support level of U.S. research efforts. Since FY

1967, there has been a 22% decline in constant dollars in the amount of Federal support for scientific research. This has worked a particular hardship on NSF and academic science and represents an inconsistent posture on the part of the Federal government in its treatment of research and development support. Federal agencies with in-house laboratories have been able to compensate for inflation by means of salary, instrument and facility budget allowances. NSF has not been able to take advantage of this situation since it has no in-house research capability and the Administration has refused to take the escalating costs of operating academic research laboratories into account in the NSF budget. The Committee strongly believes that unless NSF takes inflation into account in the development of its program, the Nation's capacity to produce quality scientific research will be severely hampered.

III—NATIONAL SCIENCE FOUNDATION PROGRAMS

[Fiscal years]

	National Science Foundation request		
	1974 program	1975 appropriation request	Committee recommendation, 1975
Scientific research project support	$291,294,617	$363,700,000	$363,700,000
National and special research programs	91,600,000	84,800,000	94,700,000
National research centers	42,500,000	52,500,000	52,500,000
Science info activities	8,000,000	5,000,000	5,000,000
International cooperative scientific activities	6,400,000	8,000,000	8,000,000
Reasearch applied to national needs	75,100,000	148,900,000	160,700,000
Intergovernmental science and research utilization	1,000,000	1,000,000	3,000,000
Institutional improvement for science	10,000,000	3,000,000	12,000,000
Graduate student support	13,000,000	12,700,000	17,000,000
Science education improvement	67,500,000	61,400,000	71,000,000
Planning and policy studies	2,600,000	2,700,000	2,700,000
Program development and management	31,660,000	39,500,000	39,500,000
Subtotal, science and education appropriation	640,654,617	783,200,000	829,800,000
Special foreign currency appropriation	5,657,879	5,000,000	5,000,000
Total	646,312,496	788,200,000	834,800,000

A brief description of each of the programs set forth in the administration's budget request follows below:

Scientific research project support

Actual, fiscal year 1973	$277,252,364
Estimate, fiscal year 1974	291,294,617
Estimate, fiscal year 1975	363,700,000

This is the core research support activity of the Foundation. It includes research in all fields of science—physical, environmental, biological, materials and social sciences, and engineering. The research is conducted mainly through academic institutions and nonprofit research institutions with a small but increasing participation by industrial firms and other for-profit institutions.

Over one-third of the total or $130,100,000 is for research which now shows potential of making a contribution to long term solutions of energy problems. This includes multidirectional research in the science disciplines to find answers to some fundamental questions already identified as well as research to develop the resource of new basic knowledge that will be needed to help solve unknown barriers to technological progress. This research encompasses the broad areas of research that are related to energy resource development and utilization. It includes, for example, ecological studies dealing with the impacts of energy resource development and utilization, engineering and materials research on matters related to energy technology and chemistry, physics, and a broad spectrum of other research on fundamental processes which must be better understood to make major advances in the energy area over the long term. Energy-related economic studies are also an important element of this total integrated research effort. These efforts complement the research under Research Applied to National Needs which is designed to develop techniques for the practical application of solar and geothermal energy and to explore the feasibility of utilizing other nonconventional energy sources and the science manpower training efforts in energy related fields which are included in education.

National and special research programs

Actual, fiscal year 1973	$103,268,869
Estimate, fiscal year 1974	91,600,000
Estimate, fiscal year 1975	94,700,000

These are major research programs that have as a chief characteristic one or more of the following: they are heavily involved with research dealing with global environmental issues such as air-sea interaction, global weather, ocean circulation patterns; they require coordinated efforts on a national or international scale; or they address special science problem areas. For example, the U.S. Antarctic Research Program, the Arctic Research Program, the Ocean Sediment Coring Program, and the International Decade of Ocean Exploration involve extensive international coordination and cooperation in the planning and conduct of the research, as well as extensive interaction with other U.S. Government agencies.

Two of the programs, Science and Technology Policy Research ($1,500,000) and Energy R&D Policy Research ($4,500,000) directly support the Director of the National Science Foundation in his role as the President's Science Adviser.

Highlights of these programs include:

An amount of $4,000,000 is included for the Global Atmospheric Research Program (GARP). This is an international, interagency, and multidisciplinary research effort designed to improve the capabilities of making long range weather forecasts. The National Oceanographic and Atmospheric Administration is the lead agency for coordination of the program, and NSF has responsibility to insure effective participation by university scientists in the program. The major part of the FY 1975 funds will be used to support studies of the physical processes in the troposphere and stratosphere, in order to gain a better understanding of the transient behavior of the atmosphere.

The budget includes $1,000,000 for the Experimental R&D Incentives program (RDI). Emphasis will be placed upon monitoring, managing, collecting data and evaluating experiments that were fully funded in FY 1973 and FY 1974.

These experiments have a life of 3 to 5 years. They involve tests of various things the Federal government can do to accelerate the application of new scientific and technical results. In FY 1975, the focus will be on evaluations of the results of experiments previously funded and on comparative and evaluative studies of on-going programs of NSF and other agencies that impact on the innovation process.

The National R&D Assessment program is budgeted at $3,000,000 for FY 1975. During its first 2 years it has supported studies that analyzed (1) patterns of R&D technological innovation, (2) the incentives and decisions that underlie those patterns, (3) the implications of alternative options on future patterns of R&D technological innovation. The FY 1975 program will begin to capitalize on these earlier efforts and will attempt to provide a framework of knowledge within which decision-makers may consider various policy options and their likely consequences.

An amount of $15,500,000 is included for the International Decade of Ocean Exploration (IDOE). The U.S. participation in the program is planned, managed, and supported by NSF. The program is the major thrust of the Intergovernmental Oceanographic Commission's Long-term and Expanded Program of Oceanic Exploration and Research. Research projects are designed to improve understanding of the influence of the oceans on man's activities and his impact on the marine environment. Included are major research efforts to provide a scientific basis for improved environmental forecasting and to develop the knowledge applicable to an ocean monitoring system for use in predicting conditions in the oceans and atmosphere.

During FY 1975, drilling and coring of oceanic sediments and rocks will continue under the Foundation's Ocean Sediment Coring Program with drilling sites planned for the Atlantic Ocean and Mediterranean Sea. The sites planned for FY 1975 involve areas not previously drilled as well as those where prior drilling has indicated the potential for particularly significant new knowledge. This is increasing international interest in the program and preliminary negotiations are being explored for increased international participation. The budget includes $11,000,000 for this program.

The Arctice Research Program will give emphasis to the Arctic Ice Dynamics Joint Experiment (AIDJEX). This is a multidisciplinary international effort to investigate the dynamic response of the pack ice and the underlying ocean to the forces exerted by the atmosphere. Other research being stressed is analysis of data gathered as a part of a 5-year Tundra Biome Project, studies on high-latitude solar-terrestrial effects as well as earth sciences and glaciology studies. An amount of $3,500,000 is included for this program.

Support totaling $25,800,000 is included for the U.S. Antarctic Research Program. This amount includes logistic support totaling nearly $17,000,000 which is provided by the U.S. Navy on a reimbursable basis. Research emphasis will be placed on (1) investigations of the physical and biological characteristics of the continent and its surrounding seas; (2) studies directed toward understanding the role of Antarctica in global climate variations and weather prediction; (3) basic scientific investigations such as upper atmospheric physics, tectonics, terrestrial biology, and paleontology, and (4) evaluation of

the renewable and nonrenewable resources in the Antarctic area. These studies will lead to an understanding of the influences of the Antarctic area on the earth's environment. The program is designed to maintain an effective U.S. presence in Antarctica.

Continued emphasis is being provided for Oceanographic Facilities and Support. This program is designed to provide ships and other specialized facilities required for academic oceanographic research activities not only in deep ocean areas but also in continental-shelf, coastal and estuarine regions and in the Great Lakes. These facilities contribute to the Nation's marine program by sustaining an important research and training capability in the Nation's universities. The program also promotes shared use of facilities through the academic community cooperative organization entitled "University National Oceanographic Laboratory System (UNOLS)." The authorization for this program totals $24,900,000, or $7.0 million above the FY 1974 level.

National research centers

Actual, fiscal year 1973	$39,750,000
Estimate, fiscal year 1974	42,500,000
Estimate, fiscal year 1975	52,500,000

The NSF provides support for the development and operation of five National Research Centers which have been established to meet national needs for research in specific areas of science. These areas of research require facilities, equipment, staffing and operational support beyond the capabilities of separate institution and which could not appropriately be provided to a single institution.

These centers are operated and managed by non-profit organizations under contract with the National Science Foundation.

A brief summary of each of these centers follows.

The National Astronomy and Ionosphere Center (NAIC) is budgeted at $3,300,000. The major instrument at this facility which is located in Puerto Rico, is a fixed 1000-foot-diameter radio-radar telescope that is used both for transmitting and receiving radar signals, and for observing the natural radio emissions of distant celestial bodies. Research will include studies of the radio spectrum of molecules, atoms and radicals in interstellar clouds of gas and dust, and of complicated photochemical and dynamical processes of the upper atmosphere. Radar observations will be used to refine the values of the orbital parameters of planets. There will be continued investigations of the radiating mechanisms of pulsars.

Funding in the amount of $7,800,000 is included for the Kitt Peak National Observatory (KPNO) in Arizona. This observatory supports research in stellar, solar, and planetary astronomy by providing optical instrumentation for use by the U.S. scientific community. The instrumentation includes telescopes, auxiliary equipment, and the necessary support services for the conduct of research by visiting scientists. A new 4-meter (aproximately 150″) telescope became operational in FY 1974. Examples of research conducted at this Center include the mapping of magnetic fields and motions of gases in the regions of the sun; studies of the structure, chemical constituents, and radiation characteristics of planetary atmospheres; and studies on the origin and evolution of stars and stellar systems.

The budget includes $3,000,000 for the Cerro Tololo Inter-American Observatory (CTIO) in Chile. This facility provides astronomers with a major optical observatory in the Southern Hemisphere. The new 4-meter telescope, identical to the recently dedicated 4-meter on Kitt Peak, Arizona, will become fully operational in FY 1975. It will be the largest telescope in the Southern Hemisphere and will enable CTIO to carry forward new investigations of nebulae, quasars, pulsars and remote extragalactic objects.

An amount of $20,500,000 is included for the National Radio Astronomy Observatory (NRAO). This observatory provides radio telescopes, auxiliary equipment, and support services to enable qualified scientists to conduct advanced research on celestrial radio sources at various wavelengths throughout the radio spectrum. Of the amount requested, $13,000,000 is included to continue construction of the Very Large Array (VLA) radio telescope which, when completed, will provide radio astronomers with the most advanced instrumentation capable of significantly increasing sensitivity and resolution in radio astronomy.

The Foundation plans to support the National Center for Atmospheric Research (NCAR) in Colorado at a level of $17,900,000 in FY 1975. The mission of the Center is to plan and conduct, in cooperation with universities and other scientific organizations, atmospheric research programs requiring large scale coordinated efforts and facilities beyond the capabilities of single university departments, and to provide facilities and logistic support to the atmospheric sciences program of universities. The major facilities include scientifically instrumented aircraft, field observing equipment, a powerful computer capability to support atmospheric research, and the National Scientific Balloon Facility in Texas. In fiscal year 1975, research will continue on the development of a numerical model of global circulation that takes into account ocean-atmosphere interactions, stratospheric circulation and the effects of major mountain ranges. Emphasis will also continue on a long-term program to produce a three-dimensional model of the sun's outer atmosphere.

Science information activities

Actual, fiscal year 1973	$8,464,408
Estimate, fiscal year 1974	8,000,000
Estimate, fiscal year 1975	5,000,000

The program for fiscal year 1975 includes $5,000,000 for projects to develop and improve information systems and services to promote the dissemination of scientific information and to help scientists and others obtain and use the results of worldwide scientific research. This goal is pursued by supporting activities whose results can be applied to improve and extend science information services provided by Government agencies, scientific societies, colleges and universities, and private organizations. Support is limited to projects of national significance that cannot be successfully conducted by private organizations without Federal support. During fiscal year 1975, increased support will be provided for research to develop improved user-responsive computer information networks and to assess the operational implications of new technology upon individual and organizational users will also be supported.

In fiscal year 1975, final support is planned for that part of the national informations systems program dealing with abstracting and indexing systems as well as for work leading to the adoption of national abstracting standards.

International cooperative scientific activities

Actual, fiscal year 1973	$4,684,113
Estimate, fiscal year 1974	6,400,000
Estimate, fiscal year 1975	8,000,000

The amount of $8,000,000 included for this program in fiscal year 1975 will enable NSF to provide increased support for 17 bilateral research and exchange programs. Expanded programs of science cooperation are planned with various countries including the U.S.S.R., France, and others. In addition, there will be growth in cooperative efforts with Japan and other Pacific nations. Through such agreements and programs, the U.S. and foreign scientists are provided opportunities to do research on scientific problems whose solutions may be accelerated through collaborative efforts. The Foundation has lead agency responsibility for many of the areas approved under United States-U.S.S.R. Agreement for Science and Technology.

Increased funding for fiscal year 1975 will be used to support a special program in international cooperation in the field of energy research and development. The Foundation will also provide support to the National Academy of Sciences for operation of selected U.S. National Committees that are important for effective U.S. participation in non-governmental international scientific activities. Included in this program is $1,000,000 for the annual U.S. share of support for the International Institute for Applied Systems Analysis.

Research applied to national needs

Actual, fiscal year 1973	$69,887,314
Estimate, fiscal year 1974	75,100,000
Estimate, fiscal year 1975	160,700,000

An amount of $160,700,000 is included for the Research Applied to National Needs (RANN) program, to support five major program areas: Energy Research and Technology; Environmental Systems and Resources; Advanced Technology Applications; Social Systems and Human Resources; and Exploratory Research and Problem Assessment.

The RANN program is designed to focus U.S. scientific and technical resources on selected problems of national importance, with the objective of contributing to their practical solution. An important purpose of RANN is to shorten the lead time between the discoveries of science and their application in meeting the Nation's needs. RANN provides a key bridge between the Foundation's basic research and education programs and the development and operations programs of the Federal mission agencies and other elements of the user community, including State and local governments and private industry. A major emphasis in all program areas of RANN is research utilization, and special emphasis is being placed on efforts to move RANN results into the public and private sectors in FY 1975.

The principle emphasis of the RANN program currently is placed upon three major problem areas. These are Energy, the Environment,

and Productivity. Applied research in each of these areas builds upon the results of exploratory research and problem assessments undertaken to determine the need for more intensive study and the applicability of science and technology in meeting national needs.

Energy Research and Technology—The National Science Foundation's program for FY 1975 includes a major research effort to find ways to make practical application of solar and geothermal energy. It also includes studies designed to explore the use of other nonconventional energy sources, such as wind energy, ocean thermal gradients, and others. A major thrust is focused on the application of solar energy to the heating and cooling of buildings. Other highlights include efforts to find more efficient ways to utilize conventional energy resources such as coal, shale deposits, and others; systems analysis studies to access alternative energy systems and public policy options; and a variety of studies dealing with energy conversion and storage, energy and fuel transportation and energy systems. Another area of emphasis is research to increase engine fuel economy and cycle efficiency.

Environment—RANN environmental research activities are focused on four major areas:

A concerted research effort to determine the environmental effects of energy utilization;

Efforts to improve the Nation's overall ability to effectively manage the environment;

Research focussed on alleviating threats to the natural environment; and

Research to mitigate threats to the man-made environment.

In fiscal year 1975, research will focus on determining the effect of energy extraction, conversion, and use on the natural environment. This program, based on previous RANN research, is also an important element of the total Federal energy effort. Research will focus on strengthening the scientific basis for implementing emerging Federal and State land use legislation, understanding and correcting the effects of waste discharges in estuarine areas and on studies that can provide information to local decision-makers concerned with the impact on the environment of various urbanizing activities. Weather modification research will continue to develop improved understanding of extreme weather phenomena and studies of the social and economic aspects of weather modification will be stressed.

Research in trace contaminants will provide important data on the environmental and human consequences stemming from mining, manufacturing, use and disposal of selected potentially or overtly toxic metals and synthetic organic compounds.

Productivity—The RANN program for FY 1975 gives continuing strong support for various studies related to productivity. This includes research efforts aimed at improving advanced industrial processing technology, including enzyme technology; finding ways to increase the speed and cost effectiveness of underground excavation technology; and developing earthquake engineering technology to make it possible to design and construct earthquake resistant structures at reasonable costs. Another major objective is improvement in productivity in the delivery of public services through the application of technology to the operations of local government.

Intergovernmental science and research utilization

Actual, fiscal year 1973	$997,733
Estimate, fiscal year 1974	1,000,000
Estimate, fiscal year 1975	3,000,000

The sum of $3,000,000 is included for this program to provide support for efforts designed (1) to aid State and local governments to increase their capability to employ science and technology effectively; and (2) to formulate policies, procedures and programs for the dissemination and utilization of research results from the Foundation's RANN program. The program plays a significant role in understanding and analyzing the implications of various science and technology policies.

Institutional improvement for science

Actual, fiscal year 1973	$9,101,767
Estimate, fiscal year 1974	10,000,000
Estimate, fiscal year 1975	12,000,000

The $12 million is included for this program. This will provide for a continuation of the Institutional Grants for Science Program and Institutional Grants for Research Management Improvement.

Graduate student support

Actual, fiscal year 1973	$15,308,895
Estimate, fiscal year 1974	13,000,000
Estimate, fiscal year 1975	17,000,000

The authorization provides $17 million for Graduate Student support for FY 1975. These competitive 3-year fellowships are designed to insure that the Nation's most talented science students will have an opportunity to pursue science careers in disciplines of their choice. It also makes provision for postdoctoral fellowships and science manpower training.

Science education improvement

Actual, fiscal year 1973	$46,924,510
Estimate, fiscal year 1974	67,500,000
Estimate, fiscal year 1975	71,000,000

Funds in the amount of $71,000,000 are included for the Science Education Improvement activity. This activity provides support for programs that are designed to increase educational efficiency, help provide the essential number and variety of trained scientists and engineers, and provide science training that will enable the non-scientist to function confidently both as a worker and as a citizen in our science and technology-intensive society. The NSF programs for fiscal year 1975 aim directly at the achievement of these goals.

In addition to continuation of previous energy related efforts, $1,400,000 has been added in FY 1975 specifically for two types of energy related projects, one involving technician education and the other visiting foreign scholars.

Within the FY 1975 total, special attention has been given to the specific programs within the Science Education Improvement activity for which increases were mandated by the Congress for FY 1974. The balance of the activity remains in an experimental stage, FY 1974 being the first full year of operation under the new goal-oriented structure.

The FY 1975 program gives emphasis to:

The development of courses that will provide science training for careers as practioners as well as researchers;

Projects aimed at providing to a broader range of students a basic understanding of how science works and gives special emphasis to efforts to improving the problem solving skills of students at the elementary and secondary levels.

Experiments to improve the structure of education through the application of advanced technology.

Activities to improve the understanding by the public of the roles, potentials and limitations of science and technology.

The Problem Assessment and Experimental Project subactivity is expected to identify new areas of concern for Science Education Improvement. In addition to the above, the authorization provides for an increased emphasis for the Ethnic Minorities and Women Program. It also provides for a Faculty Fellowships Program and continued strong support science teacher programs at the elementary and secondary school levels, a secondary school student training program and various student originated studies and research participation activities.

Planning and policy studies

Actual, fiscal year 1973	$1,689,870
Estimate, fiscal year 1974	2,600,000
Estimate, fiscal year 1975	2,700,000

An amount of $2,700,000 is budgeted for NSF Planning and Policy Studies. The objective of NSF's planning and policy studies activity is to provide the factual data and analytical basis for sound decisions leading to the development of improved policies and plans for the advancement and utilization of science. The major elements of the program are: (1) studies of science resources; (2) science planning and policy analysis; and, (3) program evaluation studies.

Program development and management

Actual, fiscal year 1973	$28,619,198
Estimate, fiscal year 1974	31,660,000
Estimate, fiscal year 1975	39,500,000

All operating costs of the National Science Foundation, including the management of the various program activities and the executive direction and administrative management of the Foundation, are included in this activity. The amount requested, $39,500,000 is about 4.5 percent of the total fiscal year 1975 authorization of $834.8 million. Funds requested will provide for 1,370 positions, an increase of 180 over fiscal year 1974, primarily to manage a large increase in energy related research activities. A major part of the increase for this activity are funds to provide reimbursement of $2,618,000 to GSA for National Science Foundation occupied space. This is the first year that agencies, by law, must reimburse GSA for office space.

Special foreign currency program

Actual, fiscal year 1973	$4,342,121
Estimate, fiscal year 1974	5,657,879
Estimate, fiscal year 1975	5,000,000

A separate appropriation request of $5,000,000 for payment in foreign currencies which are excess to the normal requirements of the United States is included. The activities supported in designated countries under this program include cooperative scientific research projects, seminars, and the travel of U.S. foreign scientists involved in mutually beneficial efforts. It also provides for the procurement of translated foreign scientific literature, and related science activities.

IV. Action by the Committee on Labor and Public Welfare

A. SUMMARY

The purpose of S. 3344, as amended by the committee, is to authorize appropriations to the National Science Foundation for FY 1975 in the amount of $834.8 million including $829.8 million for the Salaries and Expenses Appropriation and $5.0 million in the Foreign Currencies which the Treasury determines to be excess to the normal requirements of the United States.

B. ADDITIONS TO AUTHORIZATIONS AMOUNT REQUESTED ($46.6 MILLION)

The Foundation's authorization request for FY 1975 totaled $788.2 million including $783.2 million for its Salaries and Expenses Appropriation and $5.0 million for its Special Foreign Currency program. This represents an increase of $142.1 million over the amount of $646.1 million that was authorized for the FY 1974 program. More than 80 percent of this increase is for an accelerated energy research and technology effort and the remainder is almost entirely directed to support of basic research in the science disciplines. While the committee recognizes the importance of accelerating energy research and technology efforts in FY 1976 and the need to maintain strong support for basic sciences, it is convinced that the Foundation's request fails to assign proper priority to important nonenergy research areas. As a consequence, the uneven growth pattern proposed by NSF will result in severe constraints and downward adjustments in programs which have repeatedly been assigned high priority by the Congress.

The Foundation's request makes no provision for Institutional Grants for Science which was covered by a $10.0 million authorization minimum last year. This program is vitally important to more than 600 colleges and universities in all parts of the United States, helping them maintain flexibility and balance in their federally supported science activities. Science Education Improvement and Graduate Student Support, which were also activities covered by legislation minima last year, were budgeted for FY 1975 at levels below the FY 1974 minima established by the Congress for these activities. The testimony of public witnesses before the committee confirmed the importance and essential nature of NSF activities proposed for reduction or curtailment by the Administration in FY 1975 and the committee believes that, if sustained, the Foundation's request would aggrevate an already serious problem brought about by abrupt changes in federal institutional and science education support. Moreover, the program, by not addressing nonenergy research needs, would slow the programs in many important areas of research, especially in the nonenergy areas of the Foundation's programs of Research Applied

to National Needs, Institutional Science Support, and Science Education Improvement activities.

After careful review of the Foundation's authorization request and evaluation of the statements made by the witnesses, who are recognized leaders in U.S. science, the committee recommends a FY 1975 authorization of $834.8 million including $829.8 million for Salaries and Expenses and $5.0 million for Special Foreign Currency. The specific increases above the NSF request are discussed in the following paragraphs.

1. National and special research programs

The Foundation requested $24.8 million for the 10 programs that constitute the National and Special Research program activity. The requested amount is $6.8 million below the FY 1974 program and is representative of the imbalance in the nonenergy research portion of the Foundation's proposed program for FY 1975. The committee recommends an authorized amount of $94.7 million or $9.9 million more than the NSF authorization request for this activity.

The committee has repeatedly called attention to the importance of updating the academic research fleet needed for oceanography research. Of the 31 research ships in the fleet, 10 are more than 24 years old. Two of these ships will be replaced by ships now under construction as the result of mandatory language included in the FY 1974 Authorization Act. In spite of the urgency assigned to the task by the Congress, the Foundation's program for FY 1975 did not make provisions for the construction of replacement ships. High maintenance costs of the old vessels remaining in the fleet are further aggravating a situation already made critical by rising fuel costs. The following chart lists the ships in the research fleet which are candidates for replacement:

REPLACEMENT OUTLOOK FOR ACADEMIC SHIPS, 20 PLUS YEARS OLD

Ship	Length (feet)	Age	Planned replacement
Chain, Woods Hole	214	33	Oceanus, 1975.
Trident, Rhode Island	180	30	
Yaquina, Oregon State	180	30	Prime candidates for replacement by unnamed Oceanus sister ship, 1975/76.
Agassiz, Scripps	180	30	
Vema, Columbia	197	51	
Velero IV, Southern California	110	26	
Oconostota, Scripps	101	30	May be replaced in 1975 by Dolphin, a private donation to Scripps.
Kit Jones, Georgia	65	36	
Hoh, Washington	65	31	
Maury, Johns Hopkins	65	24	

The $9.9 million increase for the National and Special Research Programs includes an $8.0 million minimum for ship construction/conversion. The committee also finds that unless provision is made for added fuel costs which have increased by approximately $0.15 per gallon to more than $0.35 per gallon in the past few months, there will be a sharp reduction in the number of ship-days at sea in FY 1975. Such a reduction would seriously curtail oceanography research activities. The remaining increase of $1.9 million in the authorization recommended by the committee is to provide for the additional fuel costs and the needed shore facility requirements. The

growing importance of the sea and its resources require a strong research and technology effort in oceanography. A modern cost-effective research fleet is an important element in this overall national effort and the authorization recommended by the committee provides for a continual, orderly replacement program for outdated research ships and shipboard equipment.

2. Research applied to national needs (RANN)

The Foundation requested an authorization totalling $148.9 million for the RANN program. This total included $93.4 for direct energy research and technology activities. The RANN program has brought U.S. scientific resources to bear on a number of nationally important problems including energy, productivity, environment, and a range of technology assessment activities which have important implications for national policy.

The Committee recommends an authorization of $160.7 million, $11.8 million above the amount requested by the NSF for this activity.

The Committee believes that sufficient amounts are included in the RANN budget request for an energy research effort which focuses on conservation, conversion, production, and transmission, as well as on the impact of energy production on the ecology and economies of various regions. The Foundation's direct energy research and technology support is concentrated in the RANN program. In view of the importance of this segment of the RANN program in terms of national policy and the achievement of energy goals, the committee concurs with the Foundation's recommendations for a substantial expansion of its research and technology support for non-conventional energy sources. The amount of $93.4 million included in the Foundation's RANN program for direct energy support is fully covered by the authorization recommended by the committee, and the committee believes that this will provide for an effective level of support for FY 1975.

Particular interest with expressed by Senator Dominick in the support being given through the RANN program to research on shale oil, both in terms of the technology used in the retorting and refining process and in connection with the waste disposal problems involved. The committee expects the NSF to participate fully in the development of adequate information on shale oil development, which is of such critical concern to the states of Colorado, Utah and Wyoming, and which may prove to be of great benefit throughout the nation.

In other promising energy research areas, the committee believes the Foundation should increase its focus on wind energy, and on other non-conventional energy sources such as ocean thermal gradients and ocean tides and waves as potential long term possibilities in this connection, the committee urges the Foundation to use fully the resources of academic and other institutions engaged in the National Sea Grant Program of the Department of Commerce.

The committee is concerned, however, that the nonenergy areas of RANN are given insufficient attention in the fiscal 1975 budget request. The lack of an aggressive program on environmental problems, advanced technology applications, and a constrained technology assessment effort may seriously weaken the overall effectiveness of the

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Foundation. The RANN program, over the past several years, has demonstrated that science and technology can—through focused efforts—lead to improvements in municipal services, industrial processing techniques, and environmental measurement and control systems. It is important that research in nonenergy areas such as these goes forward at a rapid pace, and it is the committee's intent that the increased authorization for the RANN program be made available for use in these important domestic problem areas.

In a time of inflation, the levelling out of funding of research in the Social Systems and Human Resources program is unwise. We urge the Foundation to continue a vigorous and expanded program in this area to enable the nation to increase its understanding of an ability to deal with the growing alienation that has characterized much of recent American experience.

Furthermore, though the budget request does provide increasing funding for the Environmental Systems and Resources program, it should be noted that almost all of the increase is directed to energy related problems. Our national commitment to dealing with the challenge of environmental problems must remain strong, and vogues in national problems which cause us to sporadically redirect our efforts and attention to meet the latest crisis do not imply that we have solved the last one. Environmental problems cannot be dealt with in this way. They are not readily or easily solved, and can be expected to be with us for some time. A continuing national effort is essential and we therefore recommend increased funding for this aspect of the RANN program .

A third aspect of RANN's efforts, which we feel has been unjustifiably shortchanged in the NSF's fiscal 1975 budget request is Exploratory Research and Problem Assessment, with particular reference to the area of technology assessment. The budget request does not give sufficient emphasis to the need for supporting the development of the concept of technology assessment and the technology assessments themselves. The requested $1.4 million is inadequate at a time when the Congress has recognized the national need for the assessment of technologies as vital to its own decision making process by creating a Congressional Office of Technology Assessment.

The Foundation should be significantly expanding its own effort in this area to assist and supplement OTA's efforts. We recommend a significant increase in funding for technology assessment in fiscal 1975, and in subsequent years as well. This is vital to the long-range assessment of national needs and is clearly in the national interest.

For fiscal 1975, the Foundation requested $8.0 million for earthquake engineering to find ways to design and construct earthquake resistant structures. The committee believes that it is essential that this level of funding be committed for this purpose in FY 1975, and therefore has established a minimum level for this effort in the full amount of $8.0 million.

3. Intergovernmental science and research utilization

The Foundation's Intergovernmental Science and Research Utilization Program has resulted in the implementation of a wide range of innovative coordination mechanisms among Federal, State, and local government agencies and is proving to be an effective instrument for

moving the designated scientific research results to user groups. Because this program shows great promise, the committee believes that it's time to move it out of the experimental phase. For the past several years, the funding level has remained constant at the FY 1975 request of $1.0 million. This year the committee recommends increasing the authorization level for FY 1975 to $3.0 million.

4. Institutional improvement for science

The Foundation's authorization request for Institutional Improvement for Science was $3.0 million or $7.0 million below the FY 1974 legislative minimum established for this activity. The reduction reflects the elimination by the Administration of the institutional grants for science program. This program has provided flexible funds for more than 600 colleges and universities in all regions of the U.S. so that they might maintain an effective balance in their total scientific activities. In testimony presented to the committee by the Foundation, it was learned that in its budget submission, NSF had requested $7.0 million for this program. OMB, however, denied the Foundation funds for this activity. The committee disagrees with this action and concurs with the statement of Dr. Donald F. Hornig, of Brown University, when he said that the elimination of this program would be a "serious error in public policy." The committee acknowledges that this small amount of money is extraordinarily productive to a college or university because of the flexibility it provides. This program is directly responsive to language in the NSF Act of 1950 as amended which requires the Foundation to avoid undue concentration of its support and, over the years, the institutional support program has provided assistance to many small colleges and universities that would otherwise not receive NSF funding. In view of the importance of this program to the nation's universities and colleges and its relevance to its achievements of stated NSF objectives, the committee has established a minimum of $12.0 million for the Institutional Improvement for Science Program.

5. Graduate Student Support

The Foundation requested $12.7 million for Graduate Student Support or $300,000 less than the amount authorized for this program in FY 1974. There has been a sharp reduction in the level of Graduate Student Support since FY 1971, when the Foundation's budget included $30.0 million for this program. This year the budget request is less than $13.0 million. The committee believes that the Foundation's cutback may be an overreaction to temporary imbalances in the supply demand ratio for scientists and engineers. For example, according to the testimony of Dr. Philip Handler, President of the National Academy of Sciences, "there is no significant unemployment of Ph.D. scientists in the U.S. today, in any discipline." In addition, in the field of engineering there is a growing shortage with current unemployment levels estimated at about one-half percent on a scale where three percent is considered full employment. This further demonstrates the need to establish Graduate Student Support policy on the basis of long term national needs. It is essential that bright, young people continue to flow into scientific and technological careers in order to maintain the vitality and strength of U.S. science. The committee believes that

Graduate Student Support should be based on the quality of the student and not on the temporary needs of the particular science discipline. However, the committee believes that it is important to insure a continuing pool of highly qualified scientists and engineers. It does not believe that the Foundation's FY 1975 request meets this objective. To achieve this goal, the committee directs that not less than $17.0 million be devoted to Graduate Student Support by the Foundation in FY 1975.

6. Science Education Improvement

The Foundation requested $61.4 million for Science Education Improvement for FY 1975. This is a reduction of $6.1 million below the legislative minimum established for this program in FY 1974. However, the effective reduction of the program on a comparable basis with FY 1974 is $11.1 million since $5.0 million of the FY 1975 request represents a new effort for energy manpower resources.

This decrease in science education support again reflects the imbalance in the Foundation's nonenergy support activities. To correct this imbalance, the committee has established a $71.0 million minimum for Science Education Improvement activities. The $8.6 million increase is based on the committee's belief that certain programs should receive special attention by the Foundation.

The committee strongly urges the Foundation to expand its science education program for Ethnic Minorities and Women to a level of $8.1 million in FY 1975. Ethnic Minorities and Women represent a relatively untapped science and technology manpower resource. The committee heard testimony from Mr. Miles Fisher, Executive Secretary, National Association for Equal Opportunity in Higher Education, in which he noted the serious decrease in the amount of funds requested for the minority college program at the same time the pool was being expanded to include minority institutions other than the historically black colleges. The committee concurs with the Foundation's action to insure that all minorities receive fair and equal treatment under this program. This expansion, however, will necessarily require an increased level of authorization and funding in FY 1975. Therefore, the committee strongly recommends that $8.1 million of the Foundation's Science Education Improvement program for FY 1975 be devoted to this purpose.

The committee also urges the NSF to maintain strong support for programs designed to improve the quality and effectiveness of science teachers at the elementary and secondary school levels. The committee does not agree with the position taken by the Foundation that summer institutes aimed at upgrading the science subject-matter proficiency of teachers can now be phased out. Correspondence received by the committee indicates the opposite is true. Therefore, the Foundation should take the necessary steps to reestablish and maintain summer institutes specifically designed to enhance the subject matter competence of the teachers.

The Foundation's budget request for FY 1975 discontinues the Faculty Fellowships Program which was funded at a level of $1.0 million in FY 1974. Information provided the committee by outside witnesses and correspondence received by committee indicates that there is a clear need for a postdoctoral fellowship program. The committee recommends that the Foundation provide for a faculty fellowships program in FY 1975 which is to be separate and apart from the proposed faculty research participation program.

The Nation's small colleges and junior colleges have contributed significantly to the develoment of high quality science and engineering manpower. It is estimated that as much as 40 to 45 percent of the graduate student enrollment in science and engineering is made up of students who have received all or part of their undergraduate training in small academic institutions. These institutions have an important role to play in science education and the committee urges the NSF to give these institutions careful consideration in implementing its science education programs in FY 1975.

The committee has strongly endorsed the Foundation's program, designed to stimulate outstanding high school students to pursue careers in science and to provide opportunities for undergraduate students to participate in productive research. It has also encouraged NSF to maintain strong support for student originated studies. All these programs are scheduled for reductions in the program presented to Congress. The recommended authorization which establishes a minimum of $71.0 million for Science Education Improvement activities will insure that these programs and a range of these activities can be maintained at least at the FY 1974 level.

7. NSF solar energy coordinating responsibility

The committee has charged the Director of the NSF with the responsibility for the planning, coordinating, and directing the Federal Government's solar energy research programs. The Foundation is uniquely qualified to carry out these responsibilities because of its current lead agency role in this field and because of the perspective that the Director of the Foundation has as the President's Science Advisor.

In testimony presented to this committee, the Foundation demonstrated the rapid progress that is being achieved, under its direction, by university and industry teams to make widespread application of solar energy a reality in the shortest feasible time. For example, solar energy heat augmentation systems have been installed in four schools located in different regions of the country: Massachusetts, Minnesota, Maryland, and Virginia. A transportable laboratory has been developed jointly with industry to collect solar energy data from all regions of the nation. This transportable laboratory will negate the need for developing individual research facilities at different locations. Another major element of the Foundation's effort in the solar heating and cooling of buildings area is the design and construction of an experimental solar home laboratory by researchers at the Colorado State University.

Rapid progress is also being made in wind energy systems, another element of the Foundation's solar energy program. The Foundation is in the process of bringing wind energy systems through the proof-of-concept stage. These areas of the Foundation's solar energy program include bioconversion to fuel, photovoltaic conversion, solar thermal conversion, and ocean thermal conversion. The social, economic, and environmental aspects of this approach represent another major feature of the Foundation's comprehensive and systems ap-

proach to solar energy research and technology. This system's approach, coupled with the Foundation's technology assessment effort and the rapid advances being realized under NSF leadership, are the motivating factors in the committee's determination to place the total federal responsibility in the hands of the NSF Director.

Another important consideration in assigning this total federal coordinating responsibility to the Director of NSF is the success that has already been achieved under NSF leadership in the solar energy research field. The Foundation's operating mode, which requires that it utilize the capabilities of other Federal agencies, the academic community, and industry to carry out its programs, makes it uniquely well qualified for this coordinating role. It has already established an effective means for coordinating these activities through the Interagency Panel on Terrestrial Applications of Solar Energy. The AEC, NASA, and the NBS, HUD, Department of Interior, and other involved Federal agencies are members of the Panel, which is chaired by NSF.

The committee believes that the Foundation should continue its effort in this area and concentrate especially on solar heating and cooling of buildings, on wind energy, and on other systems which have the potential for near term application. In addition, the committee encourages the Foundation to continue to investigate the possibility of using ocean thermal gradients and to explore ocean waves and tides as potential long term possibilities.

V—Committee Views

APPLIED RESEARCH

It is the Committee's view that the NSF's applied research program presents an unusual opportunity for Federal funding of interdisciplinary applied research directed toward national needs. These needs, in our view, have been shortchanged for too long.

We have examined closely the links that have been established with potential users of the results of projects funded by the Research Applied to National Needs program, and feel that much more must be done in this area. We feel that RANN has, thus far, made but a bare beginning, and we call on the Foundation to strengthen these links between research and the users of research.

In addition, very few state and local governments and industries, particularly smaller industries, have been brought into the planning and advisory phases of the RANN program. We recommend the expansion and strengthening of this aspect of the RANN program as essential to the identification, design and development of applied research, and to its ultimate responsiveness to the needs of the Nation.

Equipment and instrumentation

Over the past decade funds available for the acquisition of instrumentation and equipment have failed to keep pace with other aspects of funding for scientific research. In the period since 1967, available funds have been utilized largely to retain the scientific labor force, while making do with existing instruments. This is a situation of great concern to the Committee, or advances in scientific research derive

from a combination of the growing skill of researchers and the increasing sophistication of research tools.

Two years ago the National Academy of Sciences conducted a survey of instrumentation needs in all scientific disciplines in a sample of large and medium-size universities. The accumulated backlog of instrumentation requirements was estimated in the hundreds of millions of dollars. Failure to make provision for this need places an all-too-real ceiling on the potential quality and quantity of the national scientific research endeavor, and the Committee urges the Foundation to take this situation into account in preparing its budget for fiscal 1976.

Science information

The Committee took careful note of the reduction in funding for Science Information Activities included in the NSF's budget request. In testimony before the Committee, the NSF took the position that the information systems supported by the Foundation in the past should be able to operate effectively without continued federal support and that selected dissemination activities should be supported by other Federal programs, rather than by the NSF.

Nevertheless, the Committee is concerned that this reduction may have serious implications for the continuing effectiveness of science and technology in this country, for it is self-evident that the rate of advance in any discipline is dependent in part on the ease and efficiency of exchange of information and data among practitioners of the discipline.

Therefore, while the Committee did not authorize additional funds over the NSF's budget request, it is our intention to monitor closely the effects of a curtailed science information program within the Foundation, and to consider significant increases in this program in the authorization for FY 1976.

The Committee is also considering action to incorporate the provisions of Title IX of the National Defense Education Act, dealing exclusively with the science information activities of the Foundation, into the National Science Foundation Act. However, since it is our intention, in the near future, to study further the science information program, the Committee has decided to postpone this contemplated legislative change until this study has been completed.

Program development and management

The Committee has approved the full request of the NSF for Program Development and Management. The authorization will provide for an additional 180 positions in the NSF, to meet the program and management requirements growing out of an expanded energy related research effort.

The Committee expects the Foundation to bring into these programs highly qualified persons from the academic, industrial and technical communities. And because this expansion represents a 15 percent increase in the total NSF staff, considerable top level management attention will be required to assure that it is carried out effectively.

The committee will follow closely the Foundation's implementation of its enlarged energy research program and expects the funding pro-

vided for Program Development and Management to permit the NSF to carry out these responsibilities smoothly and efficiently.

Allocation of appropriated funds

The Committee notes that the Foundation has complied with Congressional intent and allocated all of the funds authorized and appropriated to it for FY 1974. In the past, the Committee has expressed concern about the impoundment of funds, especially in the science education area. In fiscal 1973, for example, $58.9 million was impounded, athough all of this money was finally released for use by the Foundation in FY 1974.

The Committee considers it essential that all money should be allocated in the fiscal year for which it is authorized and appropriated.

VI—Section-by-Section Analysis

Section 1. This section authorizes an appropriation for the National Science Foundation in the amount of $829,800,000 for the fiscal year ending June 30, 1975. The amount authorized to be appropriated is distributed in specific amounts to twelve program categories.

Section 2. This section stipulates that minima or floors shall be placed under the amount authorized to be appropriated in certain categories of Section 1.

Subsection (a) provides that not less than $12,000,000 authorized to be appropriated for the "Institutional Improvement for Science" Category (8) of Section 1 shall be available for that program;

Subsection (b) provides that not less than $17,000,000 authorized to be appropriated for the "Graduate Student Support" Category (9) of Section 1 shall be available for that program;

Subsection (c) provides that not less than $71,000,000 authorized to be appropriated for the "Science Education Improvement" Category (10) of Section 1 shall be available for that program;

Subsection (d) provides that of the amount authorized to be appropriated for National and Special Research Programs in Category (2) of Section 1, not less than $8,000,000 shall be made available for the "Ship Construction/Conversion Program";

Subsection (e) provides that of the amount authorized to be appropriated for Research Applied to National Needs in Category (6) of Section 1, not less than $8,000,000 shall be made available for the "Earthquake Research and Engineering" program.

Section 3. This section gives the full responsibility for the planning, coordinating and directing the Federal Government's solar energy research program to the Director of the National Science Foundation.

Section 4. This section authorizes, in addition to the amount authorized to be appropriated in Section 1, an appropriation of up to $5,000,000 for expenses of the National Science Foundation outside the United States to be financed from foreign currencies which the Treasury Department determines to be excess to the normal requirements of the United States.

Section 5. This section provides $5,000 for use by the Director of the National Science Foundation at his discretion. This money may be used for official consultation and other unusual expenses.

Section 6. This section provides that appropriations made pursuant to Sections 1 and 4 of the Act shall remain available for obligation and expenditure for the period of time specified in the appropriations act.

Section 7. This section prohibits the Foundation from transferring funds to or from a particular category in section 1 if the amount to be transferred exceeds 10 per centum of the total funds in that particular category, unless the appropriate House and Senate Committees are notified in writing and the Director waits thirty legislative days before taking final action, or these committees notify the Director of the Foundation in writing that they have no objection to such transfer.

Section 8. This section requires that the Director of the Foundation keep the House Committee on Science and Astronautics and the Senate Committee on Labor and Public Welfare fully and currently informed on all activities of the Foundation.

Section 9. This section cites the title of the Act: "National Science Foundation Authorization Act of 1975."

VII.—Cost Estimates Pursuant to Section 252(b) of the Legislative Reorganization Act of 1970

S. 3344, as amended, authorizes appropriations to the National Science Foundation for fiscal year 1975 in the amount of $834.8 million, including $5 million in foreign currencies which the Treasury Department determines to be excess to the normal requirement of the United States.

VIII.—Vote in Committee

The committee ordered the bill favorably reported by unanimous vote, the following Senators voting in the affirmative: Williams, Randolph, Pell, Kennedy, Nelson, Mondale, Eagleton, Cranston, Hughes, Hathaway, Javits, Dominick, Schweiker, Taft, Beall, and Stafford.

National Science Foundation

WASHINGTON, D. C. 20550

APPENDIX A

Justification of Estimates of Appropriations

Salaries and Expenses

Special Foreign Currency Program

Fiscal Year 1975

TO

THE CONGRESS

NATIONAL SCIENCE FOUNDATION
GRANTS AND CONTRACTS AWARDED
FISCAL YEAR 1973

EXPLANATORY NOTES

The following explanatory material is provided to facilitate use of the data contained in the listing:

1. Data shown under the Fellowships column represent the following:

   a. No. The number of Fellowship awards accepted as of June 30, 1973.

   b. Amount-Institution. Tuition, fees or cost of education allowances payable to an institution on behalf of an NSF fellow.

   c. Amount-Individual. Stipends or other allowances payable to an NSF fellow for his personal use.

2. Grants and Contracts awarded from the NSF Appropriation 49X0100, Salaries and Expenses, are listed on pages 2 through 75. Awards made from the NSF Special Foreign Currency Program Appropriation 493/40102, are listed on pages 76 through 87.

Grants and Contracts Awarded from Appropriation 49X0100, Salaries and Expenses

SUMMARY (Amounts in Thousands of Dollars)	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NATL NEEDS INT GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
ALABAMA	63	1,524	20	485	1	28	5	325	16	126	21	560	1	3	4
ALASKA	56	3,757	32	2,719	12	1,431	3	25	5	54	3	25	2	6	8
ARIZONA	121	14,284	74	2,848	11	10,593	4	333	17	168	15	352	7	21	27
ARKANSAS	32	512	8	230					12	108	12	174			
CALIFORNIA	1,320	81,728	905	47,554	67	15,414	94	12,011	39	2,173	105	3,575	378	1,134	1,452
COLORADO	234	38,459	129	7,321	23	23,751	19	5,348	22	214	41	1,825	14	42	54
CONNECTICUT	234	8,486	166	6,436	7	346	15	1,153	23	162	23	389	86	258	330
DELAWARE	32	1,142	21	630	1	49	1	10	4	30	5	423	1	3	4
DISTRICT OF COLUMBIA	483	24,631	110	3,028	89	6,161	96	3,203	122	8,995	66	3,243	2	6	8
FLORIDA	246	11,869	156	5,813	23	3,034	7	1,494	30	239	33	1,290	11	33	42
GEORGIA	137	4,802	66	1,783	12	1,149	4	266	23	380	32	1,224	4	12	15
HAWAII	84	4,220	61	2,256	6	1,379	3	423	8	78	6	85	4	12	15
IDAHO	19	437	5	198					5	47	9	192	1	3	4
ILLINOIS	553	28,739	382	19,747	19	680	31	4,426	55	514	66	3,372	94	282	361
INDIANA	253	11,728	158	7,396	3	69	17	1,836	27	237	48	2,191	29	87	111
IOWA	114	3,822	58	1,708			3	254	27	164	34	896	4	12	15
KANSAS	86	2,049	49	1,391					15	96	22	562			
KENTUCKY	53	783	18	283			4	89	11	92	20	318	1	3	4
LOUISIANA	92	2,269	47	1,107	2	5	4	496	15	124	24	538	6	18	23
MAINE	36	813	12	361	1	5	2	24	6	34	15	389			
MARYLAND	279	12,159	162	6,899	20	1,121	32	2,969	36	405	29	765	9	27	35
MASSACHUSETTS	805	44,901	559	27,376	34	6,443	55	6,867	81	1,263	76	2,951	367	1,101	1,489
MICHIGAN	329	13,832	207	9,383	9	535	12	2,076	37	243	64	1,595	77	231	296
MINNESOTA	133	4,457	74	2,410	5	219	9	1,058	22	134	23	627	16	48	61
MISSISSIPPI	57	1,339	10	188			3	135	9	79	35	937			
MISSOURI	172	5,935	105	3,420	3	145	15	1,535	22	205	27	630	5	15	19
MONTANA	29	647	10	128			3	227	5	73	11	220	3	9	12
NEBRASKA	36	690	14	337	2	75	1	33	10	48	9	180	1	3	4

SUMMARY (Amounts in Thousands of Dollars)	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NEVADA	24	1,091	11	716			2	151	6	46	5	188			
NEW HAMPSHIRE	56	1,437	28	847	1	21	2	213	7	62	18	254	4	12	15
NEW JERSEY	249	10,126	177	7,971	4	124	7	755	10	438	31	868	77	231	296
NEW MEXICO	60	3,393	35	1,103			5	1,950	10	121	10	220	1	3	4
NEW YORK	1,058	50,990	693	38,015	37	3,432	43	4,170	150	1,693	135	3,480	95	285	365
NORTH CAROLINA	193	8,589	105	4,248	7	1,282	10	586	32	360	39	2,012	20	60	77
NORTH DAKOTA	17	316	2	72					3	33	12	210			
OHIO	334	11,424	197	7,215	13	362	6	582	54	1,012	74	2,253	9	27	35
OKLAHOMA	85	2,425	36	1,091	2	55	5	263	12	127	30	889	4	12	15
OREGON	158	7,866	90	3,408	15	2,824	2	195	17	189	34	1,250	1	3	4
PENNSYLVANIA	519	22,587	324	14,727	9	1,539	29	2,328	88	1,344	69	2,570	21	63	81
RHODE ISLAND	128	5,421	80	3,437	14	1,429	3	140	16	135	15	309	8	24	31
SOUTH CAROLINA	43	1,224	12	396	1	11	1	31	9	64	20	723	1	3	4
SOUTH DAKOTA	24	515	3	143	1	34	1	52	11	71	8	215			
TENNESSEE	136	7,558	57	3,780	1	70	13	2,107	25	152	40	1,442	5	15	19
TEXAS	365	13,298	206	7,432	28	1,331	11	1,485	69	540	59	2,511	20	60	77
UTAH	93	4,107	60	3,116	3	51	4	431	10	128	16	381	3	9	12
VERMONT	14	138	4	67					5	35	5	35			
VIRGINIA	207	7,508	79	2,818	24	621	15	566	50	279	39	3,215	4	12	15
WASHINGTON	224	13,699	147	7,443	13	3,851	11	1,179	22	177	31	1,049	16	48	61
WEST VIRGINIA	26	18,291	7	144	3	9,785	1	125	6	50	9	193			
WISCONSIN	269	9,393	162	6,563	13	660	8	759	39	231	47	1,180	56	168	215
WYOMING	27	1,004	14	470	2	58	2	131	3	26	6	319	1	3	4
UNITED STATES TOTAL	10,396	523,526	6,129	278,186	533	101,363	633	64,942	1,478	23,736	1,623	55,299	1,469	4,407	5,643
FEDERAL GOVERNMENT TOTAL	119	52,609	14	1,043	51	44,546	37	6,269	14	712	3	39			
U.S. POSSESSIONS TOTAL	15	3,472	5	202	3	3,144			4	61	3	65			
FOREIGN COUNTRIES TOTAL	31	831	8	432	6	248			14	106	1	50	19	10	73
GRAND TOTAL	10,561	580,443	6,156	279,863	595	149,301	670	71,211	1,510	24,615	1,630	55,453	1,488	4,417	5,716

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
ALABAMA															
ALA SCI ENGR & TECHN S C	1	12,000					1	12,000							
ALABAMA A & M UNIVERSITY	3	37,186	1	14,000					1	7,186	1	15,200			
AUBURN UNIV	12	478,865	2	28,200	1	28,400	4	312,563	1	34,419	4	75,283	1	3,000	3,842
BIRMINGHAM-SOUTHERN COL	1	1,090							1	1,090					
FLORENCE STATE UNIVERSITY	2	12,435							1	1,090	1	11,345			
JACKSONVILLE ST UNIV	1	1,090							1	1,090					
JEFFERSON ST JR COL	1	2,500									1	2,500			
LAWSON STATE JUNIOR COL	1	8,400									1	8,400			
MILES COL	3	156,788	1	7,500							2	149,288			
TALLADEGA COL	2	21,614	1	15,600					1	6,014					
TUSKEGEE INST	6	98,795	3	58,500					1	8,222	2	40,033			
U OF ALA IN BIRMINGHAM	5	146,354	2	118,000					1	16,374	2	19,980			
U OF ALA-BIRM MED COL ALA	3	129,288	3	129,288											
INSTITUTION TOTAL	8	275,554	5	239,288					1	16,374	2	19,980			
U OF ALA IN HUNTSVILLE	1	16,787							1	16,787					
UNIV OF MONTEVALLO	2	45,190							1	5,462	1	39,728			
UNIV OF SOUTH ALA	1	13,792							1	13,792					
UNIVERSITY OF ALABAMA	13	348,388	6	137,288					1	12,375	6	198,733			
OTHER GRANTS & CONTRACTS	5	2,865	1	250					4	1,815					
STATE TOTAL		1,524,251		485,258		28,488		324,563		125,636		560,482		3,000	3,842
	63		20		1		5		16		21		1		
ALASKA															
ALAS DEPT ENVTL CONSRVTN	1	3,000			1	3,000									
UNIV OF ALASKA	16	1,482,548	8	713,688	2	684,500	1	7,500	2	51,948	3	25,000	2	6,000	7,683
U OF ALAS-GEOPHYS INST	21	1,358,488	17	1,227,888	3	113,000	1	17,600							

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
ALASKA															
U OF ALAS-INST MARINE SCI	12	868,700	7	277,300	5	591,400									
INSTITUTION TOTAL	49	3,709,648	32	2,218,700	10	1,388,900	2	25,100	2	51,948	3	25,000	2	6,000	7,683
OTHER GRANTS & CONTRACTS	5	44,596			1	39,565	1	2,500	3	2,531					
STATE TOTAL		3,757,244		2,218,700		1,431,465		27,600		54,479		25,000		6,000	7,683
	55		32		12		3		5		3		2		
ARIZONA															
ARIZ WESTERN COL	1	1,090							1	1,090					
ARIZONA STATE UNIV	21	516,520	14	444,700					3	24,752	4	49,064			
CERRO TOLOLO INT-AM OBSER	4	2,700,800			4	2,700,800									
DESERT BOTANICAL GARDEN	1	10,600	1	10,600											
GLENDALE COMM COL	1	1,090							1	1,090					
KITT PEAK NAT OBSERVATORY	4	7,847,500			4	7,847,500									
LOWELL OBSERVATORY	3	83,500	3	83,500											
MUSEUM OF NORTHERN ARIZ	1	42,400	1	42,400											
N ARIZ SOC OF SCI & ART	1	46,300					1	46,300							
NAVAJO COMMUNITY COLLEGE	1	12,004							1	12,004					
NORTHERN ARIZ UNIV	3	21,018							1	5,442	2	15,176			
PHOENIX COL	1	1,090							1	1,090					
PRESCOTT COL	1	5,573							1	5,573					
UNIV OF ARIZONA	66	2,836,089	52	2,134,340	1	35,000	3	286,400	2	112,200	8	268,149	7	21,000	26,893
U OF ARIZ-COL OF MED	2	127,000	2	127,000											
INSTITUTION TOTAL	68	2,963,089	54	2,261,340	1	35,000	3	286,400	2	112,200	8	268,149	7	21,000	26,893
OTHER GRANTS & CONTRACTS	10	38,072	1	5,386	2	400			6	4,410	1	19,876			
STATE TOTAL		14,283,846		2,847,926		10,582,900		332,700		168,051		352,269		21,000	26,893
	121		74		11		4		17		15		7		

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
ARKANSAS															
ARK ARCHEOLOGICAL SURVEY	1	70,388		26,788					1	43,600					
ARK POLYTECHNIC COL	1	3,815							1	3,815					
ARK ST UNIV	1	11,020									1	11,020			
HARDING COL	1	5,879							1	5,879					
HENDRIX COL	1	1,090							1	1,090					
JOHN BROWN UNIV	1	1,090							1	1,090					
OUACHITA BAPTIST UNIV	1	1,090							1	1,090					
PHILANDER SMITH COL	1	4,905							1	4,905					
SOUTHERN ST COL	1	3,000									1	3,000			
STATE COLLEGE OF ARKANSAS	1	1,090							1	1,090					
UNIV OF ARK															
U OF ARK-LITTLE ROCK-MED	2	45,000	2	45,000											
UNIV OF ARK FAYETTEVILLE	14	291,855	5	117,000					1	28,909	8	144,346			
UNIV OF ARK LITTLE ROCK	1	5,487							1	5,487					
UNIV OF ARK MEDICAL CTR	2	58,306	1	48,000							1	10,306			
UNIV OF ARK MONTICELLO	1	5,200									1	5,200			
UNIV OF ARK PINE BLUFF	1	5,597							1	5,597					
UNIV OF ARK SYS OFF	1	5,671							1	5,671					
STATE TOTAL		511,569		229,588						108,223		173,866			
	32		8						12		12				
CALIFORNIA															
AEROSPACE CORPORATION	5	253,603	3	115,600			2	138,003							
AMER SOC OF ZOOLOGISTS	1	3,100	1	3,100											
ASIA FDN	1	11,000									1	11,000			
CAL ACAD OF SCIENCES	4	151,300	4	151,300											
CAL COMM REGNL MED PROG	4	255,110									4	255,110			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
CALIFORNIA															
CAL DEPT OF PUBLIC HEALTH	1	92,200					1	92,200							
CAL INST OF TECH	74	5,812,610	57	4,480,200	4	289,000	8	805,530	2	148,000	3	89,910	45	144,000	184,406
CAL INST OF TECH-DIV ENG	1	171,300					1	171,300							
INSTITUTION TOTAL	75	5,983,910	57	4,480,200	4	289,000	9	976,800	2	148,000	3	89,910	45	144,000	184,406
CAL INST OF THE ARTS	2	100,000	2	100,000											
CAL ST COL AT BAKERSFIELD	1	85,741									1	85,741			
CALIF ST COL STANISLAUS	1	5,560							1	5,560					
CALIF ST COLLEGE SONOMA	3	71,749							1	5,462	2	66,287			
CALIF ST POLY UNIV POMONA	2	60,753							1	5,830	1	54,923			
CALIF ST U SAN LU OBIS PO	1	5,584							1	5,584					
CALIF ST UNIV CHICO	2	13,744	1	8,000					1	5,744					
CALIF ST UNIV FRESNO	4	73,169	1	6,400					1	10,140	2	56,629			
CALIF ST UNIV FULLERTON	8	157,968	4	84,880					3	25,784	1	47,384			
CALIF ST UNIV HAYWARD	2	70,190							1	1,090	1	69,100			
CALIF ST UNIV HUMBOLDT	4	184,110	2	68,000					1	7,186	1	28,924			
CALIF ST UNIV LONG BEACH	4	41,303	2	31,900					1	6,903	1	2,500			
CALIF ST UNIV LOS ANGELES	5	78,429	2	55,800					1	6,619	2	15,811			
CALIF ST UNIV NORTHRIDGE	4	106,088	2	55,300					1	5,450	1	45,338			
CALIF ST UNIV S FRANCISCO	3	23,149	1	12,100					1	6,149	1	4,900			
CALIF ST UNIV SACRAMENTO	3	14,154							1	6,014	2	8,140			
CALIF ST UNIV SAN DIEGO	14	507,561	5	292,800	1	12,300			1	20,389	7	182,872			
CALIF ST UNIV SAN JOSE	4	97,221	1	4,500					1	8,734	2	83,987			
CALIF-OFFICE OF THE GOV	2	42,000					2	42,000							
CHAFFEY COL	1	1,090							1	1,090					
CHAPMAN COL	1	3,000									1	3,000			
CITY OF HOPE MEDICAL CTR	3	74,660	3	74,660											
CLAREMONT GRADUATE SCHOOL	7	168,421	4	85,000					1	8,843	2	6,578			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
CALIFORNIA															
COL OF MARIN	1	5,499							1	5,499					
COMM FOR ADV SCI TRAINING	1	9,204									1	9,204			
COUNCIL OF MONTEREY BAY	1	85,000					1	85,000							
CT-S DIEGO, ENV DEV AGCY	1	130,800					1	130,800							
CTR ADV STUDY BEHAV SCI	2	263,600	2	263,600											
CTR FOR STUDY OF DEM INST	1	86,900					1	86,900							
DE ANZA COLLEGE	1	800									1	800			
EARTHQUAKE ENG RES INST	2	204,800					2	204,800							
HARVEY MUDD COL	4	35,245							1	5,573	3	29,672			
HOLMES & NARVER INC	2	682,500			2	682,500									
HUMAN INTRACTION RES INST	1	285,600				211,400	1	74,200							
INST OF MEDICAL SCIENCES	2	42,700					2	42,700							
JOHN A. BLUME & ASSOCIATES	1	4,100					1	4,100							
JOHN F KENNEDY UNIVERSITY	1	7,644							1	7,644					
JOHN MUIR INSTITUTE INC	2	125,600					2	125,600							
L A CNTY MUS NAT HIST	5	180,700	5	180,700											
LAWRENCE BERKLEY LAB	1	99,600					1	99,600							
LOCKHEED AIRCRAFT CORP															
LOCKHEED AIR-RESEARCH LAB	2	93,800	1	43,900	1	49,900									
LONE MOUNTAIN COLLEGE	1	1,090							1	1,090					
LOS ANGELES PIERCE COL	1	10,000									1	10,000			
MARCOM APPLIED SYS INC	2	115,447					2	115,447							
MILLS COL	1	5,511							1	5,511					
MONTEREY PENINSULA COL	2	7,771							1	5,671	1	2,100			
MT ST MARYS COL	1	3,100									1	3,100			
MT ZION HOSP & MED CENTER	1	35,000	1	35,000											
NEW ENT UTILIZING SCI INC	3	78,400					3	78,400							

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' YSTDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
CALIFORNIA															
OCCIDENTAL COL	3	13,138							1	6,308	2	6,830			
OPTICS TECHNOLOGY INC	3	160,880									3	160,880			
PEPPERDINE UNIVERSITY	1	6,223							1	6,223					
POMONA COL	3	22,666	1	10,600					1	5,646	1	6,420			
QUANTUM SCIENCE CORP	1	48,000			1	48,000									
RAND CORPORATION	8	1,257,473					8	1,257,473							
RIVERSIDE CITY COL	2	7,887							1	5,487	1	2,400			
ROCKWELL INTERNATIONAL	2	11,500	2	11,500											
SACRAMENTO CITY COL	1	14,000	1	14,000											
SALK INST FOR BIOL STUD	3	199,000	3	199,000											
SAN DIEGO COMPRH PLAN ORG	1	28,400	1	28,400											
SAN DIEGO JR COL SYS OFF	1	5,597							1	5,597					
SAN FRAN BAY AAP CTL DIST	1	100,000					1	100,000							
SAN JOSE CITY COL	1	126,000	1	126,000											
SCIENTIFIC ANALYSIS CORP	1	15,100					1	15,100							
SCRIPPS CLINIC & RES FDN	1	38,000	1	38,000											
SOCIETY OF RESEARCH ADMIN	1	18,400							1	18,400					
ST MARYS COL CALIFORNIA	1	1,090							1	1,090					
STANFORD RESEARCH INST	24	1,925,386	12	858,886	5	272,500	7	780,100		14,708					
STANFORD UNIV	142	12,279,810	122	9,978,098	3	378,400	7	1,124,900	3	230,473	7	567,947	143	447,000	572,427
STANFORD UNIV-PRESS		28,000		28,000											
STANFORD UNIV-SCH OF MED	8	542,800	7	348,000			1	194,000							
INSTITUTION TOTAL	150	12,841,810	129	10,346,098	3	378,400	8	1,318,900	3	230,473	7	567,947	143	447,000	572,427
STD RESEARCH CORPORATION	1	74,983	1	74,983											
SYSTEM CONTROL INC	1	149,638					1	149,638							
SYSTEMS, SCI & SOFTWARE	1	81,100					1	81,100							
TAHOE REG PLANNING AGENCY	1	50,000					1	50,000							

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' YSTDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
CALIFORNIA															
TEKNEKRON INC	1	75,900			1	75,900									
TETRA TECH INC	1	91,700					1	91,700							
U S INTERNATIONAL UNIV	3	45,555							1	9,813	2	35,742			
UNIV OF CAL BERKELEY	204	12,565,161	175	9,873,120	5	167,800	12	1,725,000	5	270,921	7	528,320	111	333,000	425,439
U OF CAL-RICHMONT FLD STA	1	785,100					1	785,100							
INSTITUTION TOTAL	205	13,350,261	175	9,873,120	5	167,800	13	2,510,100	5	270,921	7	528,320	111	333,000	426,439
UNIV OF CAL DAVIS	58	2,925,477	38	1,390,250	3	72,800	4	1,330,300	1	42,158	4	89,969	7	21,000	26,893
U OF CAL-SCH OF MED	1	1,800	1	1,800											
INSTITUTION TOTAL	51	2,927,277	39	1,392,050	3	72,800	4	1,330,300	1	42,158	4	89,969	7	21,000	26,893
UNIV OF CAL IRVINE	31	1,262,549	28	1,093,200			1	129,100	1	24,499	1	15,750	4	12,000	15,367
U OF CAL-CAL COL OF MED	1	35,000	1	35,000											
INSTITUTION TOTAL	32	1,297,549	29	1,128,200			1	129,100	1	24,499	1	15,750	4	12,000	15,367
UNIV OF CAL LOS ANGELES	141	6,802,894	122	5,001,000	3	359,500	9	863,400	3	315,144	4	263,050	13	39,000	49,943
U OF CAL-SCH OF MED	6	224,800	6	224,800											
INSTITUTION TOTAL	147	7,826,894	128	5,225,800	3	359,500	9	863,400	3	315,144	4	263,050	13	39,000	49,943
UNIV OF CAL RIVERSIDE	21	669,527	15	410,800			2	187,100	1	27,471	3	44,156	4	12,000	15,367
U OF CAL-AIR POLL RES CTR	2	125,000	1	80,000			1	45,000							
INSTITUTION TOTAL	23	794,527	16	490,800			3	232,100	1	27,471	3	44,156	4	12,000	15,367
UNIV OF CAL SAN DIEGO	95	5,249,443	84	4,687,200	6	329,600	1	107,200	1	63,113	3	62,330	36	108,000	138,304
U OF CAL-REVELLE COL	8	415,700	8	415,700											
U OF CAL-SCRIPPS INST	64	14,947,912	48	1,926,700	21	12,790,220			3	230,992					
INSTITUTION TOTAL	167	28,613,855	132	7,029,600	27	13,119,820	1	107,200	4	294,105	3	62,330	36	108,000	138,304
UNIV OF CAL SANTA CRUZ	24	614,799	21	573,000					1	16,517	2	25,282	4	12,000	15,367
U OF CAL-LICK OBSERV	6	263,800	6	263,800											
INSTITUTION TOTAL	30	878,599	27	836,800					1	16,517	2	25,282	4	12,000	15,367
UNIV OF CAL SAN FRANCISCO	8	301,150	6	174,500			1	121,400			1	5,250			
U OF CAL-SCH OF MED	5	165,000	5	165,000											

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
CALIFORNIA															
INSTITUTION TOTAL	13	466,150	11	339,500			1	121,400			1	5,250			
UNIV OF CAL SANTA BARBARA	55	2,199,314	49	1,969,500					1	29,547	5	200,267	2	6,000	7,683
UNIV OF CAL SYS OFF	2	321,905							2	321,905					
UNIV OF REDLANDS	3	19,651							1	5,671	2	13,980			
UNIV OF SAN FRANCISCO	3	56,301							1	7,186	2	49,115			
UNIV OF SANTA CLARA	6	134,927	1	26,600					1	7,622	4	100,705			
UNIV OF SOUTHERN CAL	51	2,324,220	35	1,171,800	4	474,000	4	349,000	3	118,048	5	211,372			
U OF SOUTHERN CAL-SCH MED	4	169,200	4	169,200											
INSTITUTION TOTAL	55	2,493,420	39	1,341,000	4	474,000	4	349,000	3	118,048	5	211,372			
UNIV OF THE PACIFIC	3	10,769							1	9,061	2	1,708			
UNIV S D COORDINATE COLL	1	5,990							1	5,990					
US INTERNATIONAL UNIV															
US INTERNATIONAL UNIV	1	3,200	1	3,200											
OTHER GRANTS & CONTRACTS	90	520,483	2	40,000	7	199,840	8	228,990	23	51,653					
STATE TOTAL		81,727,750		47,554,463		16,413,660		12,011,351		2,172,802		3,575,474		1,134,030	1,452,196
	1,320		985		67		104		139		105		378		
COLORADO															
ASPEN INST HUMAN STUDIES															
ASPEN-ASPEN CTR PHYSICS	1	36,400	1	36,400											
BIOL SCI CURICULM STDY CO	3	395,000									3	395,000			
COLORADO COL	2	18,723							1	2,725	1	15,998			
COLORADO SCH OF MINES	10	408,285	4	121,800			2	230,800	1	14,064	3	41,621			
COLORADO STATE UNIV	59	5,599,429	36	3,281,100	7	423,700	9	1,524,800	1	51,690	6	318,139	1	3,000	3,942
FED ROCKY MT STATES INC	1	81,500			1	81,500									
FORT LEWIS COL	1	17,547									1	17,547			
LORETTO HEIGHTS COL	1	4,905							1	4,905					

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
COLORADO															
NAT CTR FOR ATMOS RES	10	25,656,675			8	22,823,342	2	2,833,333							
NAT JEWISH HOSP & RES CTR	1	44,000	1	44,000											
REGIS COL	1	5,450							1	5,450					
SOC SCI EDUC CONSORTIUM	5	225,233									5	225,233			
SOUTHERN COLORADO ST COL	1	4,905							1	4,905					
UNIV OF COLORADO	83	4,125,759	65	2,976,520	3	113,100	3	576,200	1	51,671	11	408,268	13	39,000	49,943
U COLO-DEN MED CTR-MED	3	115,000	3	115,000											
U OF COLO-COLO SPGS CTR	1	18,974									1	18,974			
U OF COLO-DENVER CTR	1	7,400									1	7,400			
U OF COLO-DENVER MED CTR	6	230,100	6	230,100											
INSTITUTION TOTAL	94	4,497,233	74	3,321,620	3	113,100	3	576,200	1	51,671	13	434,642	13	39,000	49,943
UNIV OF DENVER	17	699,262	9	351,200			1	44,400	1	33,722	6	269,940			
U OF DENVER-RES INST	9	613,100	3	163,000	4	309,800	2	138,300							
INSTITUTION TOTAL	26	1,310,362	12	514,200	4	309,800	3	182,700	1	33,722	6	269,940			
UNIV OF NORTHERN COLORADO	4	69,308	1	1,900					1	6,308	2	61,100			
WEST INTERST COMM HIGH ED	1	46,080									1	46,080			
OTHER GRANTS & CONTRACTS	13	38,433							13	38,433					
STATE TOTAL		38,459,468		7,321,020		23,751,442		5,347,833		213,873		1,825,300		42,030	53,785
	234		129		23		19		22		41		14		
CONNECTICUT															
AMERICAN CYANAMID CORP	1	151,500					1	151,500							
BURNDY LIBRARY, INC	1	4,500	1	4,500											
CBS LABORATORIES	1	79,810			1	79,810									
CENTRAL CONN ST COL	1	1,090							1	1,090					
COGEN,HOLT & ASSOC	1	79,400					1	79,400							
CONN AGR EXP STATION	1	25,000	1	25,000											

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT		Amount		
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
CONNECTICUT															
CONNECTICUT COL	1	6,026							1	6,026					
CTR FOR ENVIRNMENT & MAN	10	589,271	1	40,500	4	229,772	5	318,999							
EASTERN CONN STATE COL	1	18,373									1	18,373			
FAIRFIELD UNIV	4	59,812	1	16,800					1	5,904	2	37,108			
FUTURES GROUP	4	384,513					4	384,513							
HASKINS LABORATORIES INC	1	100,000	1	100,000											
HUMAN RELAT AREA FILES	1	48,000		28,000					1	20,000					
INSTITUTE FOR THE FUTURE	3	283,000	3	283,000											
NEW ENGLAND INST	2	18,160							1	6,198	1	3,971			
RENSSELAER POLYTECH INST															
RENSSELAER POLY INST CONN	3	53,273	1	18,300			1	29,408	1	5,573					
SOUTHERN CONN STATE COL	1	33,901									1	33,901			
ST JOSEPH COL	3	17,550							1	5,536	2	12,014			
TRINITY COL	1	2,725							1	2,725					
U S-S AFR LEADER EX PROG	1	5,500									1	5,500			
UNIV OF BRIDGEPORT	1	5,806							1	5,806					
UNIV OF CONNECTICUT	42	1,462,556	35	1,315,750	2	36,900			1	28,288	4	81,618	2	6,000	7,681
U CONN-HEALTH CENTER	2	72,000	2	72,000											
INSTITUTION TOTAL	44	1,534,556	37	1,387,750	2	36,900			1	28,288	4	81,618	2	6,000	7,681
UNIV OF HARTFORD	1	18,000	1	18,000											
UNIV OF NEW HAVEN	1	1,098							1	1,098					
WESLEYAN UNIV	11	298,763	6	228,000					1	10,151	4	60,612			
WESTERN CONN STATE COL	1	545							1	545					
YALE UNIV	110	4,388,084	108	4,000,100			2	188,100	1	55,908	7	135,896	84	252,000	322,711
YALE UNIV-PEABODY MUSEUM	2	66,388	2	66,388											
YALE UNIV-SCH OF MEDICINE	7	341,388	6	268,700			1	80,600							
INSTITUTION TOTAL	119	4,787,684	108	4,327,188			3	268,700	1	55,908	7	135,896	84	252,000	322,711

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT		Amount		
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
CONNECTICUT															
YALE-COL SOUTHERN OBSERV	1	54,900	1	54,900											
OTHER GRANTS & CONTRACTS	13	7,624	4	137					9	7,487					
STATE TOTAL		8,486,388		6,435,987		346,482		1,152,512		162,327		388,992		258,000	330,394
	234		166		7		15		23		23		86		
DELAWARE															
DELAWARE STATE COL	1	5,658							1	5,658					
INTER-UNIV RES CENTER INC	1	48,700			1	48,700									
UNIV OF DELAWARE	28	1,086,764	21	638,488			1	10,000	1	22,935	5	423,429	1	3,000	3,842
OTHER GRANTS & CONTRACTS	2	1,015							2	1,015					
STATE TOTAL		1,142,137		638,488		48,700		10,000		29,688		423,429		3,000	3,842
	32		21		1		1		4		5		1		
DISTRICT OF COLUMBIA															
AMER ASSOC FOR ADVT SCI	6	1,463,178					1	9,900			5	1,453,278			
AMER CHEMICAL SOC	2	3,529,688							2	3,529,688					
AMER COUNCIL ON EDUCATION	2	178,061							2	178,061					
AMER EXPRESS COMPANY	1	100,000			1	100,000									
AMER GEOLOGICAL INST	4	453,388							2	152,488	2	300,900			
AMER GEOPHYSICAL UNION	4	71,232	1	6,000	1	38,000			2	27,232					
AMER INST OF BIOL SCI	4	186,765	2	104,100							2	82,665			
AMER POLITICAL SCI ASSOC	1	150,000									1	150,000			
AMER SOC FOR INFOR SCI	1	15,000							1	15,000					
AMER SOC FOR MICROBIOLOGY	2	9,377							2	9,377					
AMER SOCIOLOGICAL ASSOC	1	5,900	1	2,950						2,950					
AMER STATISTICAL ASSOC	1	7,500	1	7,500											
AMERICAN BAR ASSOCIATION	1	20,300	1	20,300											

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NATL NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
DISTRICT OF COLUMBIA															
ABA COMM OF CORR FACILSERV	1	37,200					1	37,200							
INSTITUTION TOTAL	2	57,500	1	20,300			1	37,200							
AMERICAN SOC OF INTL LAW	1	160,000					1	160,000							
AMERICAN UNIVERSITY	10	226,466	4	104,300					1	25,301	5	96,865	1	7,000	3,842
ARCTIC INST OF NORTH AMER	2	83,700			2	83,700									
ASSOC OF AMER GEOGRAPHERS	3	103,450	1	32,500							2	70,950			
ASSOC OF RES LIBRARIES	1	198,200							1	198,200					
ASSOC SUPV&CURRICULUM DEV	1	22,450									1	22,450			
BROOKINGS INSTITUTION	2	440,300					1	315,300	1	125,000					
CARNEGIE INST OF WASH	9	322,100	9	322,100											
CATHOLIC UNIV OF AMERICA	17	687,244	11	448,100					1	20,847	5	138,297			
CENTER FOR A VOLUNTRY SOC	1	50,500					1	50,500							
CONF BD OF THE MATH SCI	2	129,600	1	128,300							1	1,300			
COURTESY TRAVEL SERVICE	2	450,000							2	450,000					
CTR-CYBERNETIC STUD INC	1	11,254					1	11,254							
EDUCATION & PUB AFFAIRS	1	115,486									1	115,486			
ENVIRONMENTAL LAW INST	1	138,900					1	138,900							
ERNST & ERNST	1	99,739					1	99,739							
FEDERAL CITY COL	1	6,456							1	6,456					
GALLAUDET COL	1	7,393							1	7,393					
GEORGE WASHINGTON UNIV	16	496,742	5	61,250	2	259,247	4	34,339	1	36,965	4	104,941			
GEO WASH UNIV-SCH OF MED	2	75,879							2	75,879					
INSTITUTION TOTAL	18	572,621	5	61,250	2	259,247	4	34,339	3	112,844	4	104,941			
GEORGETOWN UNIV	12	429,947	8	267,100			1	124,200	1	17,108	2	21,539	1	3,000	3,842
GEORGETOWN UNIV-SCH MED	1	43,700	1	43,700											
INSTITUTION TOTAL	13	473,647	9	310,800			1	124,200	1	17,108	2	21,539	1	3,000	3,842
HARBRIDGE HOUSE, INC															

GRANTEE OR CONTRACTOR	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NATL NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT		FELLOWSHIPS		
														Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
DISTRICT OF COLUMBIA															
HOWARD UNIV	14	311,515	10	253,200					1	10,184	3	48,131			
IMAGE ASSOCIATES	2	68,826			2	68,826									
INST FOR SERVICES TO ED	1	57,100									1	57,100			
INTL RES&TECHNOLOGY CORP	2	67,678					2	67,678							
INTRNATL SOC F TECHN ASMT	1	11,000					1	11,000							
JOHNS HOPKINS UNIV															
JOHNS HOPKINS UNIV-ADV	2	188,788				25,000	1	145,788	1	20,000					
JOSEPH FROOMKIN INC	1	44,854							1	44,854					
MATH ASSOC OF AMER	1	77,571									1	77,571			
METROPOLITAN AFFAIR NON-P	1	98,288			1	98,288									
N L CITIES/US CONF-MAYORS	2	60,600					2	60,600							
NAT ACAD OF ENGINEERING	14	738,495	4	122,388	3	147,388	5	388,758	2	152,145					
NAT ACAD OF SCIENCES	22	893,418	7	386,688	6	314,288	2	50,888	7	221,810					
NAT ACAD SCI-NAT RES CNL	32	4,175,426	11	310,888	4	119,688	3	88,588	13	3,332,586	1	332,820			
INSTITUTION TOTAL	54	5,068,844	18	616,688	10	433,888	5	131,388	20	3,554,316	1	332,820			
NAT PLANNING ASSOC	3	162,233			1	49,233	1	47,988	1	65,100					
NAT SCIENCE TCHRS ASSOC	1	31,691									1	31,691			
NATIONAL ACADEMY OF ENG															
COMMISSION ON ENG ED	1	94,814									1	94,814			
NATIONAL CENTER FOR ST CT	1	74,288					1	74,288							
NATL RECREATION&PARK ASSN	1	93,488					1	93,488							
OTHER CONTRACTS	2	196,217							2	196,217					
ORG AMER ST-PAN AM UNION	1	4,719									1	4,719			
PATTERN RECOGNITION SOC	1	7,988	1	7,988											
PEAT,MARWICK,MITCHELL, NY															
PEAT,MARWICK,MITCHELL, DC	1	98,691			1	98,691									
POLICY CENTER INC	2	283,288					2	283,288							

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
DISTRICT OF COLUMBIA															
POTOMAC INSTITUTE INC	1	74,900					1	74,900							
PRACTICAL CONCEPTS, INC	1	39,900			1	39,900									
PUBLIC TECHNOLOGY INC	5	4,307,679	1	20,263	3	4,213,616	1	73,800							
RESOURCES FOR FUTURE INC	3	309,800	1	104,100			2	205,700							
SPERRY URBAN SCIENCE CTR	1	68,000			1	68,000									
URBAN INSTITUTE	8	1,001,300	3	300,500	1	32,000	4	668,800							
WASHINGTON TECHNICAL INST	1	5,769							1	5,769					
OTHER GRANTS & CONTRACTS	234	637,149	26	55,820	58	412,125	54	52,720	78	78,413	26	38,071			
STATE TOTAL		24,630,556		3,028,483		6,161,096		3,283,430		8,994,767		3,242,780		6,000	7,684
	483		110		89		96		122		66		2		
FLORIDA															
BARRY COL	1	28,061	1	28,061											
CHIPOLA JR COL	1	1,090							1	1,090					
FAIRCHILD TROPICAL GARDEN	3	131,100	3	131,100											
FLA INTERNATIONAL UNIV	1	10,700									1	10,700			
FLORIDA AGR & MECH UNIV	5	346,081	1	35,600			1	96,800	1	5,781	2	207,900			
FLORIDA ATLANTIC UNIV	6	146,676	3	58,200					1	6,816	2	81,660			
FLORIDA INST OF TECH	2	39,266							1	6,161	1	33,105			
FLORIDA PRESBYTERIAN COL	1	5,769							1	5,769					
FLORIDA STATE UNIV	47	2,274,604	25	1,020,700	11	584,858			1	40,600	10	708,446	1	3,000	3,842
FLORIDA TECHNOLOGICL UNIV	6	129,254	4	105,600					1	6,394	1	17,260			
JACKSONVILLE UNIV	1	5,462							1	5,462					
MIAMI-DADE JR COL	1	5,584							1	5,584					
NEW COL	1	5,462							1	5,462					
NOVA UNIV	9	603,283	3	291,400	4	299,600			1	11,993	1	290			
PALM BEACH JR COL	1	1,090							1	1,090					

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
FLORIDA															
SOC OF PROTOZOOLOGISTS	1	10,000							1	10,000					
STATE UNIV SYS OF FLA OFF	1	5,658							1	5,658					
STETSON UNIV	1	3,270							1	3,270					
UNIV OF FLORIDA	42	1,450,167	35	968,000			1	324,700	1	44,393	5	113,074	5	14,300	21,051
U OF FLA-COL OF MED	3	135,100	3	135,100											
U OF FLA-ENG EXP STA	12	591,100	10	493,800			2	97,300							
U OF FLA-FLA ST MUSEUM	2	113,400	2	113,400											
INSTITUTION TOTAL	59	2,289,767	50	1,710,300			3	422,000	1	44,393	5	113,074	5	18,000	23,051
UNIV OF MIAMI	18	634,756	15	555,700					1	45,456	2	33,600	4	12,000	15,767
U OF MIAMI-INST MAR SCI	36	3,522,500	28	1,292,700	8	2,229,800									
U OF MIAMI-SCH OF MED	6	1,102,900	5	196,200			1	906,300							
INSTITUTION TOTAL	60	5,259,756	48	2,044,600	8	2,229,800	1	906,300	1	45,456	2	33,600	4	12,000	15,367
UNIV OF SOUTH FLORIDA	24	484,899	17	341,148			2	68,490	1	9,388	4	65,873			
UNIV OF TAMPA	1	5,781							1	5,781					
UNIV OF WEST FLORIDA	2	23,718							1	5,818	1	17,900			
OTHER GRANTS & CONTRACTS	11	52,955	1	46,200					10	6,755					
STATE TOTAL		11,869,286		5,812,909		3,034,258		1,493,590		238,721		1,289,804		37,000	42,751
	246		156		23		7		30		30		11		
GEORGIA															
ALBANY STATE COL	1	17,200	1	17,200											
ATLANTA UNIV	3	165,044	1	27,400							2	137,644			
ATLANTA UNIVERSITY CENTER	1	5,400	1	5,400											
CLARK COL	1	222,600									1	222,600			
COLUMBUS COL	1	5,700									1	5,700			
EMORY UNIV	9	207,531	4	100,700					1	17,070	4	89,761			
FERNBANK SCIENCE CENTER	1	5,828									1	5,828			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NATL NEEDS INT GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
GEORGIA															
FORT VALLEY STATE COL	1	5,634							1	5,634					
GEORGIA COLLEGE	3	15,450							1	5,450	2	10,000			
GEORGIA INST OF TECH	29	1,268,893	17	459,600	1	166,666	2	134,000	3	256,947	6	250,946			
GEORGIA SOUTHERN COL	1	5,462							1	5,462					
GEORGIA STATE UNIVERSITY	5	65,075	1	15,000					1	5,928	3	44,147			
LA GRANGE COL	1	11,983									1	11,983			
MEDICAL COL OF GEORGIA	2	37,699	1	30,000					1	7,699					
MERCER UNIV	1	2,188							1	2,188					
MOREHOUSE COL	2	39,300	2	39,300											
MORRIS BROWN COL	1	14,000									1	14,000			
NORTH GEORGIA COL	1	1,090							1	1,090					
SAVANNAH STATE COL	4	271,915	2	28,100					1	3,815	1	240,000			
SKIDAWAY INST OF OCEANGRY	18	988,188			18	988,188									
SOUTHN REG ED BOARD	1	130,000					1	130,000							
SPELMAN COL	2	16,930							1	1,090	1	15,840			
UNIV OF GEORGIA	44	1,266,195	34	1,032,700					2	57,698	8	175,797	4	12,000	15,357
U OF GA-MARINE INST	2	27,288	2	27,288											
INSTITUTION TOTAL	46	1,293,395	36	1,059,988					2	57,698	8	175,797	4	12,000	15,357
WEST GEORGIA COL	1	4,985							1	4,985					
OTHER GRANTS & CONTRACTS	9	18,575			1	2,498	1	2,475	7	5,618					
STATE TOTAL		4,882,489		1,782,688		1,149,198		266,475		379,978		1,224,246		12,000	15,357
	137		66		12		4		23		32		4		
HAWAII															
BERNICE P BISHOP MUSEUM	2	154,888	2	154,888											
CHAMINADE COL OF HONOLULU	1	17,775									1	17,775			
HAWA DEPT PLAN & ECON DEV	1	21,688					1	21,688							

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GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NATL NEEDS INT GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
HAWAII															
UNIV OF HAWAII	73	3,969,151	58	2,066,150	6	1,378,700	2	400,900	2	56,211	5	67,190	4	12,000	15,357
U OF HAWA-COL TROP AGR	1	35,900	1	35,900											
INSTITUTION TOTAL	74	4,005,051	59	2,102,050	6	1,378,700	2	400,900	2	56,211	5	67,190	4	12,000	15,357
OTHER GRANTS & CONTRACTS	6	21,695							6	21,695					
STATE TOTAL		4,220,121		2,256,050		1,378,700		422,500		77,906		84,965		12,000	15,357
	84		61		6		3		8		6		4		
IDAHO															
BOISE STATE COLLEGE	1	4,200									1	4,200			
COL OF IDAHO	2	7,482							1	1,635	1	5,847			
IDAHO STATE UNIV	2	60,180	1	53,700					1	6,480			1	3,000	3,842
NORTHWEST NAZARENE COL	1	5,584							1	5,584					
UNIV OF IDAHO	13	359,364	4	144,500					2	33,161	7	181,703			
STATE TOTAL		436,810		198,200						46,860		191,750		3,000	3,842
	19		5						5		9		1		
ILLINOIS															
AMERICAN COL OF RADIOLOGY	1	8,700					1	8,700							
ARGONNE NATIONAL LAB	6	655,150	1	22,700			3	608,450			2	24,000			
AUGUSTANA COL	1	1,090							1	1,090					
BERNARD WOLNAK & ASSOC	1	5,900					1	5,900							
BRADLEY UNIV	2	47,519							1	5,609	1	41,910			
CHICAGO MEDICAL SCHOOL	2	24,411	1	18,900					1	5,511					
CHICAGO PARK DISTRICT															
ADLER PLANETARIUM	1	16,982									1	16,982			
CHICAGO STATE COL	1	11,190									1	11,190			
CHICAGO, CITY OF	1	150,000			1	150,000									

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
ILLINOIS															
COL OF DU PAGE	1	7,400									1	7,400			
CTR FOR RES LIBRARIES	1	400,000					1	400,000							
DEPAUL UNIV	7	41,349	3	15,700					1	8,156	3	17,493			
EASTERN ILLINOIS UNIV	1	17,000	1	17,000											
ELMHURST COL	1	6,500									1	6,500			
FDN FOR ILL ARCHAEOLO INC	1	27,500	1	27,500											
FIELD MUSEUM OF NAT HIST	8	331,440	6	302,700							2	28,740			
GOVERNORS STATE UNIV	1	32,000	1	32,000											
IIT RESEARCH INSTITUTE	4	256,600	1	2,000			3	254,600							
ILL ST MUSEUM	1	45,000	1	45,000											
ILLINOIS BENEDICTINE COL	2	12,259							1	6,394	1	5,865			
ILLINOIS INST OF TECH	24	723,777	13	394,400			1	17,800	2	67,471	8	244,106	1	3,000	3,842
ILLINOIS SCI LECTURE ASSN	1	1,200									1	1,200			
ILLINOIS ST UNIV	6	95,043	1	17,500					1	6,247	4	71,296			
JOHN CRERAR LIBRARY	1	43,000							1	43,000					
KNOX COL	3	88,953	1	40,000					1	1,635	1	47,318			
LAKE FOREST COL	2	11,655	1	5,800					1	5,855					
LAKE LAND COL	1	1,300									1	1,300			
LOYOLA UNIV	4	24,126							1	7,884	3	16,242			
LOYOLA UNIV-SCH OF MED	1	24,800	1	24,800											
INSTITUTION TOTAL	5	48,926	1	24,800					1	7,884	3	16,242			
MACMURRAY COL	1	6,950									1	6,950			
MONMOUTH COL	1	6,863							1	6,863					
MUSEUM OF SCI & IND	1	37,000									1	37,000			
NAT OPINION RESEARCH CTR	4	466,200	4	466,200											
NINTH INTL CONG OF A&E SC	1	30,000	1	30,000											
NORTHEASTERN ILL ST COL	1	5,609							1	5,609					

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
ILLINOIS															
NORTHERN ILLINOIS UNIV	14	499,561	8	283,500	2	97,688			1	8,745	7	149,624			
NORTHWESTERN UNIV	67	3,580,240	55	3,028,350	4	293,032	2	75,100	2	49,506	4	134,052	14	54,000	59,152
NORTHWSTRN U-CHGO-MED SCH	2	71,000	2	71,000											
INSTITUTION TOTAL	69	3,651,240	57	3,099,350	4	293,032	2	75,100	2	49,506	4	134,052	14	54,000	59,152
PRESBY-ST LUKES HOSP	1	33,000	1	33,000											
ROOSEVELT UNIV	1	32,380									1	32,380			
SOUTHERN ILL U-CARBONDALE	10	200,450	5	95,500					2	10,472	3	94,478			
SOUTHN ILL U-EDWARDSVILLE	4	78,168	1	30,800					1	6,968	2	40,400			
TRINITY COL	1	1,090							1	1,090					
UNIV OF CHICAGO	120	8,452,564	112	7,256,950	1	1,800	5	1,081,300	1	59,414	1	52,500	42	126,000	161,355
UNIV OF ILLINOIS SYS OFF	1	10,434							1	10,434					
UNIV OF ILLINOIS-CHGO CTR	35	1,025,256	31	478,600			1	75,100	1	16,412	2	55,144	1	3,000	3,842
UNIV OF ILLINOIS-MED CTR	4	145,400	4	145,400											
UNIV OF ILLINOIS-URBANA	150	10,759,449	122	6,471,600	2	89,100	13	1,898,200	3	158,799	10	2,141,750	32	96,300	122,317
WESTERN ILLINOIS UNIV	2	11,924							1	5,524	1	6,400			
OTHER GRANTS & CONTRACTS	41	174,175	3	78,200	9	48,239			27	16,373	2	30,363			
STATE TOTAL		28,738,757		19,747,100		679,859		4,425,950		514,261		3,371,587		282,300	361,128
		553		382		19		71		55		55		94	
INDIANA															
BALL STATE UNIV	4	129,160							1	3,270	3	125,890			
COUNCIL OF BIOL EDITORS	1	4,100							1	4,100					
DEPAUW UNIV	1	5,757							1	5,757					
EARLHAM COL	2	10,615							1	5,475	1	5,140			
INDIANA STATE UNIV	4	110,715	1	37,000					2	43,171	1	30,544			
INDIANA U REG CAM SYS OFF	1	5,511							1	5,511					
IND UNIV-FORT WAYNE	1	6,100	1	6,100											

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
INDIANA															
INSTITUTION TOTAL	2	11,611	1	6,100					1	5,511					
INDIANA UNIV-BLOOMINGTON	79	3,301,295	58	2,547,200	1	55,300	2	143,400	2	52,880	16	502,515	9	27,000	34,576
INDIANA UNIV-INDIANAPOLIS	1	7,295							1	7,295					
IND UNIV-SCH OF MED	3	95,000	3	95,000											
INSTITUTION TOTAL	4	102,295	3	95,000					1	7,295					
MANCHESTER COL	1	8,990									1	8,990			
PURDUE UNIV	104	5,761,079	73	3,187,500	2	13,200	11	1,386,900	2	63,549	16	1,109,930	19	57,000	72,994
PURDUE UNIV-AGR EXP STA	1	149,000	1	149,000											
INSTITUTION TOTAL	105	5,910,079	74	3,336,500	2	13,200	11	1,386,900	2	63,549	16	1,109,930	19	57,000	72,994
ROSE-HULMAN INST OF TECH	1	2,180							1	2,180					
TAYLOR UNIV	2	3,690							1	1,090	1	2,600			
UNIV OF NOTRE DAME	32	2,069,541	20	1,363,700			4	305,700	1	35,308	7	364,833	1	3,000	3,842
VALPARAISO UNIV	3	41,518							1	1,090	2	40,428			
WABASH COL	1	18,308	1	18,300											
OTHER GRANTS & CONTRACTS	11	6,325							11	6,325					
STATE TOTAL		11,728,171		7,395,800		68,500		1,836,000		237,001		2,190,870		87,000	111,412
	253		158		3		17		27		48		29		
IOWA															
CENTRAL COL	1	10,610									1	10,610			
CLARKE COL	1	1,090							1	1,090					
COE COL	1	4,905							1	4,905					
CORNELL COL	1	4,360							1	4,360					
DES MOINES AREA CC-ANKENY	1	4,905							1	4,905					
DRAKE UNIV	4	135,228									4	135,228			
GRACELAND COL	1	2,725							1	2,725					
GRINNELL COL	3	45,042	1	35,000					1	5,842	1	4,200			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
IOWA															
IOWA CENTRAL COMM COL	1	1,090							1	1,090					
IOWA LAKES COMMUNITY COL	1	1,900									1	1,900			
IOWA ST U OF SCIENCE&TECH	32	1,253,030	22	840,200			2	213,000	2	16,711	6	163,119	1	3,000	3,842
LORAS COL	1	1,090							1	1,090					
LUTHER COL	4	31,625							1	2,725	3	28,900			
SOUTHEASTERN CMTY COLLEGE	1	8,211							1	8,211					
UNIV OF IOWA	41	1,298,256	25	769,800					3	76,383	13	452,073	1	9,000	11,525
U OF IOWA-COL OF MED	2	63,000	2	63,000											
INSTITUTION TOTAL	43	1,361,256	27	832,800					3	76,383	13	452,073	1	9,000	11,525
UNIV OF NORTHERN IOWA	4	94,583							1	4,360	3	90,223			
WARTBURG COL	3	12,390							1	2,725	2	9,665			
OTHER GRANTS & CONTRACTS	11	47,795					1	40,980	10	6,815					
STATE TOTAL		3,021,835		1,708,000				253,980		163,937		895,918		12,000	15,367
	114		50				3		27		34		4		
KANSAS															
BENEDICTINE COLLEGE	2	16,152							1	5,462	1	10,690			
BETHANY COL	1	1,635							1	1,635					
BETHEL COL	1	15,000	1	15,000											
CENTER FOR RESEARCH INC	1	58,900	1	58,900											
UNIV OF KANS-CTR FOR RES	1	29,900	1	29,900											
INSTITUTION TOTAL	2	88,800	2	88,800											
DODGE CITY COMM JR COL	1	1,900									1	1,900			
JOHNSON CO COMMUNITY COLL	1	3,815							1	3,815					
KANS ST COL OF PITTSBURG	1	39,451									1	39,451			
KANSAS STATE TCHRS COL	6	212,821							1	3,815	5	209,006			
KANSAS STATE UNIV	20	542,844	13	364,800					1	27,416	6	150,628			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
KANSAS															
KANSAS WESLEYAN	1	1,090							1	1,090					
SOUTHWESTERN COL	1	2,725							1	2,725					
UNIV OF KANSAS	36	965,171	28	799,000					1	36,661	7	129,510			
UNIV OF KANSAS MED CENTER															
UNIV OF KANSAS MED CENTER	2	52,888	2	52,000											
WASHBURN UNIV OF TOPEKA	1	2,725							1	2,725					
WICHITA STATE UNIV	5	99,674	3	71,300					1	7,513	1	20,861			
OTHER GRANTS & CONTRACTS	5	3,333							5	3,333					
STATE TOTAL		2,049,136		1,390,900						96,190		562,046			
	86		49						15		22				
KENTUCKY															
ASBURY COL	2	28,431									2	28,431			
BELLARMINE-URSULINE COL	1	5,720							1	5,720					
CENTRE COL OF KENTUCKY	2	11,840							1	4,360	1	6,680			
COUNCIL OF STATE GOVTS	3	64,200					3	64,200							
CUMBERLAND COL	1	1,090							1	1,090					
EASTERN KENTUCKY UNIV	1	2,180							1	2,180					
KENTUCKY LEGISLATIVE RES	1	25,200					1	25,200							
KENTUCKY STATE COL	1	5,560							1	5,560					
KENTUCKY WESLEYAN COL	1	4,700									1	4,700			
MOREHEAD STATE UNIV	2	17,407							1	8,527	1	8,880			
THOMAS MORE COL	4	33,992							1	3,815	3	30,177			
UNIV OF KENTUCKY	15	223,278	12	150,280					1	43,461	2	29,617			
UNIV OF KY-COL OF AGR	1	3,866									1	3,866			
INSTITUTION TOTAL	16	227,144	12	150,280					1	43,461	3	33,483			
UNIV OF LOUISVILLE	11	233,292	3	51,500					1	10,445	7	171,347	1	3,000	3,842

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
KENTUCKY															
U OF LOUISVILLE-SCH MED	3	81,700	3	81,700											
INSTITUTION TOTAL	14	314,992	6	133,200					1	10,445	7	171,347	1	3,000	3,842
WESTERN KENTUCKY UNIV	3	40,231							1	6,075	2	34,156			
OTHER GRANTS & CONTRACTS	1	613							1	613					
STATE TOTAL		782,500		283,400				89,400		91,846		317,854		3,000	3,842
	53		18				4		11		20		1		
LOUISIANA															
APPLIED ALUMINUM RES CORP	1	4,582			1	4,582									
DELGADO VOC TECH JR COLL	1	7,099							1	7,099					
GRAMBLING COL	5	101,790	3	45,600					1	6,480	1	49,510			
LA ST UNIV BATON ROUGE	30	896,963	20	532,600			2	146,300	1	37,242	7	180,821	3	9,000	11,525
LA ST UNIV-AGR EXP STA	2	36,900	2	36,900											
INSTITUTION TOTAL	32	933,863	22	569,500			2	146,300	1	37,242	7	180,821	3	9,000	11,525
LA ST UNIV NEW ORLEANS	9	126,714	5	101,831					1	8,690	3	16,193			
LA ST UNIV SYSTEM OFFICE	1	8,026							1	8,026					
LOUISIANA TECH UNIVERSITY	2	10,816							1	5,916	1	4,900			
LOYOLA UNIV	4	88,383									4	88,383			
NICHOLLS STATE UNIVERSITY	3	66,102							1	2,180	2	63,922			
NORTHEAST LOUISIANA UNIV	1	33,100	1	33,100											
NORTHWESTERN ST UNIV-LA	1	5,487							1	5,487					
SOUTHERN UNIV	6	351,213	2	28,200			1	263,500	1	8,102	2	51,411			
ST MARYS DOMINICAN COL	2	17,230									2	17,230			
TULANE UNIV	17	466,961	13	290,500			1	85,800	1	25,377	2	65,284	1	9,000	11,525
UNIV OF SOUTHWESTERN LA	2	5,836			1	300			1	5,536					
OTHER GRANTS & CONTRACTS	5	41,874	1	37,960					4	3,914					
STATE TOTAL		2,269,876		1,186,891		4,882		495,600		124,849		537,654		18,000	23,050
	92		47		2		4		15		24		6		

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' YSTDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MAINE															
BOWDOIN COL	5	152,251	1	10,000					1	5,732	3	136,519			
COLBY COL	1	60,890									1	60,890			
JACKSON LAB	4	91,552	1	53,000							3	38,552			
MT DESERT ISLAND BIOL LAB	1	76,100	1	76,100											
RICKER COL	1	2,900									1	2,900			
U OF ME-PORTLAND-GORHAM	1	7,862							1	7,862					
UNIV MAINE, PRESQUE ISLE	1	1,090							1	1,090					
UNIV OF MAINE ORONO	17	376,019	8	206,100	1	5,125	1	23,603	1	17,137	6	124,057			
UNIV OF MAINE, FARMINGTON	1	26,508									1	26,508			
OTHER GRANTS & CONTRACTS	4	18,233	1	15,580			1	509	2	2,224					
STATE TOTAL		813,405		360,700		5,125		24,109		34,045		389,426			
	36		12		1		2		6		15				
MARYLAND															
AMER SOC OF BIOL CHEM	2	12,000							2	12,000					
AMER TYPE CULTURE COLLECT	1	25,000	1	25,000											
BOWIE STATE COL	1	6,014							1	6,014					
CATONSVILLE COMM COL	1	5,450							1	5,450					
CHARLES COUNTY COMM COL	1	98,910									1	98,910			
CHESAPEAKE COLLEGE	1	5,487							1	5,487					
CHESPKE RES CONSRTIUM INC	1	1,649,700					1	1,649,700							
COL OF NOTRE DAME OF MD	1	1,300									1	1,300			
COLUMBIA UNION COL	2	13,097	1	7,500					1	5,597					
COPPIN STATE COL	2	283,788	1	54,888							1	228,900			
ENTOMOLOGICAL SOC OF AMER	1	18,888	1	18,888											
GOUCHER COL	1	5,487							1	5,487					
HOOD COL	1	3,000									1	3,000			

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GRANTEE OR CONTRACTOR	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' YSTDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT		FELLOWSHIPS		
														Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MARYLAND															
HYDROSPACE RESEARCH CORP	4	472,875			4	472,875									
JOHNS HOPKINS UNIV	66	3,121,781	55	2,283,888	4	293,188	1	325,883	3	244,637	3	56,244	7	21,000	25,493
JOHNS HOPKINS UNIV-HYG	5	144,500	4	141,500					1	3,000					
JOHNS HOPKINS UNIV-MED	14	485,888	14	485,888											
INSTITUTION TOTAL	85	3,751,281	73	2,829,588	4	293,188	1	325,888	4	247,637	3	56,244	7	21,000	26,693
MARTIN COMPANY	2	129,566	1	59,600	1	69,966									
MARTIN CO-RIAS DIVISION	3	105,700	2	49,400			1	56,300							
INSTITUTION TOTAL	5	235,266	3	109,000	1	69,966	1	56,383							
MATHEMATICA															
MATHEMATICA INC	1	119,956					1	119,956							
MD ACAD OF SCIENCES	1	24,900									1	24,900			
MORGAN STATE COL	1	59,425									1	59,425			
RICHARD P MUELLER & ASSOC	1	22,393					1	22,393							
RMC RESEARCH CORPORATION	2	135,000			2	135,000									
ST JOHNS COL	1	1,090							1	1,090					
ST MARYS COL OF MD	1	1,090							1	1,090					
TERRASPACE INC	1	54,100					1	54,100							
U S NAVAL ACADEMY	2	26,724									2	26,724			
UNIV OF MARYLAND	84	4,616,759	70	3,613,050	3	138,000	4	566,300	1	56,097	6	243,312	2	6,000	7,693
U OF MD-CHESAPEAKE BIOL	1	10,100									1	10,100			
INSTITUTION TOTAL	85	4,626,859	70	3,613,050	3	138,000	4	566,300	1	56,097	7	253,412	2	6,000	7,693
UNIV OF MARYLAND SYS OFF	1	15,983							1	15,983					
UNIV OF MD, BALT CNTY	9	160,837	8	153,980					1	6,137					
UNIV OF MD, BALTIMORE	3	95,888	3	95,888											
UNIV OF MD, ESTRN SHORE	1	5,499							1	5,499					
WESTERN MARYLAND COL	1	6,186							1	6,186					
WESTINGHOUSE ELECT CORP															
WESTINGHOUSE DEFENSE CTR	1	93,931					1	93,931							

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GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MARYLAND															
WOLF RES AND DEV CORP	1	212							1	212					
OTHER GRANTS & CONTRACTS	56	130,191	1	60	6	11,966	21	81,006	17	25,183	11	11,776			
STATE TOTAL		12,158,743		6,899,410		1,120,907		2,968,886		405,149		764,591		27,000	34,576
	279		162		20		32		36		29		9		
MASSACHUSETTS															
ART ASSOCIATES INC	1	93,250					1	93,250							
AMER ACAD OF ARTS AND SCI	2	165,200					1	138,300	1	26,900					
AMER AUTO CONTROL COUNCIL	1	50,000	1	50,000											
AMER METEOROLOGICAL SOC	2	24,400	2	24,400											
AMERICAN INTL COL	1	1,090							1	1,090					
AMHERST COL	9	308,637	6	285,500					1	8,347	2	15,090			
ARTHUR D LITTLE INC	1	34,860					1	34,860							
BOSTON ARCHITECTURAL CTR	1	21,000	1	21,000											
BOSTON BIOMED RES INST	5	172,300	5	172,300											
BOSTON CITY HOSPITAL	1	373,700					1	373,700							
BOSTON COL	13	500,348	5	187,000			1	67,100	1	25,988	6	220,260			
BOSTON DISPENSARY	1	25,000	1	25,000											
BOSTON UNIV	14	459,895	9	245,800			1	115,000	1	18,653	3	81,242	1	3,000	3,842
BOSTON UNIV-SCH OF MED	3	119,500	3	119,500											
INSTITUTION TOTAL	17	579,395	12	364,500			1	115,000	1	18,653	3	81,242	1	3,000	3,842
BRANDEIS UNIV	34	1,254,553	33	1,065,200			1	79,700	1	23,903	3	85,850	2	6,000	7,693
BRIDGEWATER STATE COLLEGE	3	65,909							1	1,635	2	64,274			
CHILDRENS HOSP MED CTR	2	110,000	2	110,000											
CLARK UNIV	6	205,263	4	185,800					1	8,963	1	10,500			
COL OF OUR LADY OF ELMS	1	3,460									1	3,460			
COL OF THE HOLY CROSS	2	65,619									2	65,619			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MASSACHUSETTS															
CONTRACT RESEARCH CORP	1	100,572					1	100,572							
DATA RESOURCES, INC	1	90,391					1	90,391							
DEVELOPMENT SCIENCES, INC	1	5,525					1	5,525							
DYNATECH R/D CO.	1	427,000					1	427,000							
EASTERN NAZARENE COL	1	3,600									1	3,600			
EDUCATION DEVELOPMENT CTR	11	867,864									11	867,864			
EMMANUEL COL	1	10,642							1	10,642					
FITCHBURG STATE COLLEGE	1	1,635							1	1,635					
GORDON COL	1	13,090	1	13,090											
HAMPSHIRE COLLEGE	2	36,459							1	6,805	1	29,654			
HARBRIDGE HOUSE, INC	1	70,466			1	70,466									
HARVARD UNIV	173	7,456,180	157	5,673,164			10	1,501,752	1	59,077	5	222,187	170	510,000	653,104
HARVARD UNIV-GRAD SCH B & A	1	105,200					1	105,200							
HARVARD UNIV-HERBARIUM	5	280,524	5	280,524											
HARVARD UNIV-MED SCH	13	380,084	11	261,284	1	11,300			1	27,580					
HARVARD UNIV-OBSERVATORY	7	270,362	7	270,362											
HARVARD UNIV-PEABODY MUS	3	80,202	3	80,202											
HARVARD UNIV-SCH PUB HLTH	1	13,857									1	13,857			
INSTITUTION TOTAL	203	8,506,409	183	6,565,456	1	11,300	11	1,606,952	2	86,657	6	236,044	170	510,000	653,104
LINCOLN LABORATORY	1	4,000	1	4,000											
LOWELL TECHNOLOGICAL INST	2	143,885	1	130,900					1	12,985					
M.I.T. DEVELOP FOUNDATION	1	28,000			1	28,000									
MANLABS INC	2	80,700	2	80,700											
MARINE BIOLOGICAL LAB	5	224,600	5	224,600											
MASS COL OF OPTOMETRY	1	4,905							1	4,905					
MASS GENERAL HOSPITAL	3	102,000	3	102,000											
MASS INST OF TECH	195	17,760,984	148	11,642,626	9	2,153,000	21	3,331,405	9	317,274	8	305,679	192	576,000	736,782
MASS SCIENCE & TECH FDN	2	74,700			1	50,700	1	24,000							

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MASSACHUSETTS															
MERRIMACK COL	1	1,090							1	1,090					
MITRE CORPORATION	1	74,600			1	74,600									
MT HOLYOKE COL	2	5,805	1	900					1	4,905					
NEW ENG RGN OF HIGHER EDU	1	355,500							1	355,500					
NEW ENGL MED CTR HOSP	1	8,700					1	8,700							
NEW ENGLAND AQUARIUM CORP	1	37,100	1	37,100											
NEWTON COLLEGE	2	365,620									2	365,620			
NORTHEAST RADIO OBS CORP	3	785,806	2	698,467					1	87,339					
NORTHEASTERN UNIV	15	556,023	11	467,200			1	35,500	1	25,923	2	27,400			
O'DONNELL ASSOCIATES	1	31,000			1	31,000									
R S PEABODY FDN ARCH	1	38,000	1	38,000											
RADCLIFFE COLLEGE	2	29,846	1	24,200					1	5,646					
REGIS COL	2	16,683							1	7,121	1	9,562			
SCORE INC	1	30,000					1	30,000							
SIMMONS COL	3	31,413							1	3,270	2	28,143			
SMITH COL	6	164,861	4	143,900					1	6,051	1	14,910			
SOC FOR EXP STRESS ANAL	1	5,000	1	5,000											
SOUTHEASTERN MASS UNIV	2	116,541	1	110,600					1	5,941					
TUFTS UNIV	9	158,410	4	55,600					1	19,082	4	83,728	1	3,000	3,842
TUFTS UNIV-SCH OF MED	5	246,400	4	181,300			1	65,100							
INSTITUTION TOTAL	14	404,810	8	236,900			1	65,100	1	19,082	4	83,728	1	3,000	3,842
U MASS MED SCH-WORCESTER	2	81,000	2	81,000											
UNIV OF MASS SYSTEMS OFF	1	5,708							1	5,708					
UNIV OF MASS, BOSTON															
U OF MASS-MARINE STATION	1	29,888	1	29,888											
UNIV-MASS AMHERST CAMPUS	66	2,264,997	55	1,868,300	1	54,400	4	157,000	1	38,055	7	147,242	1	3,000	3,842
UNIV-MASS BOSTON CAMPUS	3	36,110	2	29,900					1	6,210					

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MASSACHUSETTS															
WELLESLEY COL	2	53,253	1	47,300					1	5,953					
WENTWORTH INST	1	16,222							1	16,222					
WESTERN NEW ENGLAND COL	1	3,760									1	3,760			
WESTFIELD STATE COLLEGE	1	35,359									1	35,359			
WGBH EDUCATIONAL FOUND	1	50,000									1	50,000			
WHEATON COL	1	4,905							1	4,905					
WILLIAMS COL	6	97,290	1	5,000					1	6,382	4	85,908			
WOODS HOLE OCEAN INST	60	6,059,563	40	1,949,125	15	3,933,900	1	104,000	3	72,538					
WORCESTER FDN EXP BIO	5	232,000	5	232,000											
WORCESTER POLYTECH INST	7	182,736	4	83,700					1	10,249	2	88,787			
OTHER GRANTS & CONTRACTS	41	118,998	1	33,500	2	26,108	2	19,171	35	19,305	1	20,915			
STATE TOTAL		44,901,211		27,375,964		6,443,474		6,866,926		1,263,377		2,951,470		1,101,000	1,409,895
	805		559		34		55		81		76		367		
MICHIGAN															
ADRIAN COL	3	14,971							1	5,511	2	9,460			
ALBION COL	2	9,375							1	5,475	1	3,900			
ALMA COL	4	23,425							1	4,905	3	18,520			
AMER ENTOMOLOGICAL INST	1	24,300	1	24,300											
CALVIN COL	1	5,646							1	5,646					
EASTERN MICHIGAN UNIV	2	14,428							1	5,928	1	8,500			
FERRIS ST COL	1	2,180							1	2,180					
FORD SCIENTIFIC LAB	1	695,220					1	695,220							
GRAND VALLEY STATE COL	1	51,216									1	51,216			
HENRY FORD COMM COL	1	4,000									1	4,000			
HOPE COL	9	129,284	2	24,200					1	6,394	5	98,690			
KALAMAZOO COL	2	15,435							1	4,905	1	10,530			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MICHIGAN															
KALAMAZOO STATE HOSPITAL	1	17,300	1	17,300											
LAWRENCE INST OF TECH	1	13,046									1	13,046			
MARYGROVE COL	1	1,090							1	1,090					
MENTAL HEALTH RES INST	2	118,600	2	118,600											
MERCY COL OF DETROIT	2	70,700					1	65,250	1	5,450					
MICH COL OSTEOPATHIC MED	1	8,139	1	8,139											
MICH TECHNOLOGICAL UNIV	8	231,046	3	131,600					1	8,483	4	90,963			
MICHIGAN CANCER FDN	1	19,800	1	19,800											
MICHIGAN STATE UNIV	61	3,743,132	45	2,936,488	1	31,200	2	371,100	1	51,298	12	353,134	10	30,000	34,413
NORTHERN MICHIGAN UNIV	1	5,462							1	5,462					
OAKLAND UNIV	8	227,347	4	145,100					1	7,132	3	75,115			
SAGINAW VALLEY COL	1	7,900									1	7,900			
SIENA HEIGHTS COL	1	8,778							1	8,778					
SOCIETY-MANUFACTURING ENG	1	19,900			1	19,900									
UNIV OF DETROIT	4	147,984							1	7,066	3	140,918			
UNIV OF MICHIGAN	152	7,052,850	138	5,406,145	6	476,700	7	907,200	1	63,327	8	196,978	65	195,000	249,717
U OF MICH-DEARBORN CAMPUS	1	51,512									1	51,512			
U OF MICH-MED SCH	4	159,700	4	159,700											
INSTITUTION TOTAL	157	7,263,262	134	5,565,845	6	476,700	7	907,200	1	63,327	9	250,490	65	195,000	249,717
WAYNE STATE UNIV	21	588,926	9	218,200	1	7,623	1	37,100	2	26,214	8	219,789	2	6,000	7,683
WAYNE ST UNIV-SCH OF MED	2	76,400	2	76,400											
INSTITUTION TOTAL	23	585,326	11	294,600	1	7,623	1	37,100	2	26,214	8	219,789	2	6,000	7,683
WESTERN MICH UNIV	10	256,872	1	6,100					1	6,892	8	243,080			
OTHER GRANTS & CONTRACTS	18	97,624	1	86,528					17	11,104					
STATE TOTAL		13,831,988		9,382,584		535,423		2,875,870		242,940		1,595,251		231,000	295,816
		329		287		9		12		37		64		77	

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MINNESOTA															
BEMIDJI STATE COL	1	5,916							1	5,916					
BETHEL COL & SEM	1	1,090							1	1,090					
CARLETON COL	5	78,941	1	3,400					1	5,928	3	61,613			
COL OF ST BENEDICT	1	1,090							1	1,090					
COL OF ST TERESA	1	17,023									1	17,023			
E J LONGYEAR COMPANY	1	66,600			1	66,600									
GUSTAVUS ADOLPHUS COL	2	9,848							1	5,548	1	4,300			
INTERSTUDY	1	112,936					1	112,936							
INTL STUDIES ASSOCIATION	1	11,100					1	11,100							
MACALESTER COL	2	15,348							1	6,848	1	8,500			
MANKATO STATE COL	1	26,950									1	26,950			
MINN ST PLANNING AGENCY	1	36,400					1	36,400							
MOORHEAD STATE COL	1	5,499							1	5,499					
SOUTHWEST MINN STATE COL	3	17,410									3	17,410			
ST CLOUD STATE COL	2	46,368							1	4,368	1	42,000			
ST JOHNS UNIV	1	1,090							1	1,090					
ST MARYS COL	1	66,397									1	66,397			
ST OLAF COL	4	36,351							1	5,891	3	30,460			
UNIV OF MINNESOTA	82	3,489,242	63	2,037,980	3	128,800	6	907,400	4	84,464	6	330,678	16	48,000	61,469
U OF MINN-AGR EXP STA	3	181,100	3	181,100											
U OF MINN-INST OF TECH	5	187,400	5	187,400											
U OF MINN-MED SCH	2	88,100	2	88,100											
UNIV OF MINNESOTA, DULUTH	1	6,870									1	6,870			
UNIV OF MINNESOTA, MORRIS	1	14,723									1	14,723			
INSTITUTION TOTAL	94	3,879,435	73	2,486,580	3	128,800	6	907,400	4	84,464	8	352,271	16	48,000	61,469
OTHER GRANTS & CONTRACTS	9	29,185			1	23,328			6	5,785					
STATE TOTAL		4,456,897		2,489,980		218,728		1,867,836		133,509		626,932		48,000	61,469
		133		74		5		9		22		23		16	

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MISSISSIPPI															
ALCORN AGR & MECH COL	6	66,195	2	14,100					1	5,597	3	46,498			
COPIAH-LINCOLN JR COL	1	8,700									1	8,700			
DELTA STATE COL	3	52,035									3	52,035			
EAST CENTRAL JR COL	1	8,700									1	8,700			
GULF COAST RESEARCH LAB	1	7,700	1	7,700											
HINDS JR COL	1	14,500									1	14,500			
JACKSON STATE COL	5	433,097	1	13,400					1	5,855	3	413,842			
MARY HOLMES COLLEGE	2	60,333					1	54,000	1	6,333					
MILLSAPS COL	1	8,700									1	8,700			
MISS VALLEY ST COL	2	47,624									2	47,624			
MISSISSIPPI COL	3	33,018							1	5,475	2	27,543			
MISSISSIPPI INDUS COL	1	2,000									1	2,000			
MISSISSIPPI STATE UNIV	6	155,896	2	63,600			1	50,500	1	30,942	2	10,654			
RUST COL	4	33,838	1	5,900					1	3,815	2	24,123			
TOUGALOO COL	1	8,700									1	8,700			
UNIV OF MISSISSIPPI	9	216,803	2	70,600			1	30,400	1	9,933	5	105,870			
UNIV OF MISS MEDICAL CTR	1	5,600							1	5,600					
INSTITUTION TOTAL	10	222,403	2	70,600			1	30,400	2	15,533	5	105,870			
UNIV OF SOUTHERN MISS	8	166,721	1	12,200					1	5,597	6	148,924			
UTICA JR COL	1	8,700									1	8,700			
STATE TOTAL		1,338,860		187,700				134,900		79,147		937,113			
	57		10				3		9		35				
MISSOURI															
CENTRAL METHODIST COL	2	3,990							1	1,090	1	2,900			
CENTRAL MO STATE COL	3	20,535							1	4,905	2	15,630			
LINCOLN UNIV	2	10,671	1	5,200					1	5,671					

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MISSOURI															
MIDWEST RESEARCH INST	2	147,500			1	37,500	1	110,000							
MINERAL AREA COL	1	3,200									1	3,200			
MISSOURI SOUTHERN COL	1	2,725							1	2,725					
MO BOTANICAL GARDEN	4	227,500	4	227,500											
NORTHEAST MO ST COL	2	57,553							1	5,524	1	52,029			
NORTHWEST MO STATE UNIV	2	28,332							1	4,905	1	23,427			
SOUTHEAST MO STATE COL	1	1,090							1	1,090					
SOUTHWEST MO STATE COL	1	1,090							1	1,090					
ST LOUIS UNIV	9	211,528	4	151,700					1	9,661	4	50,159			
ST LOUIS UNIV-SCH OF MED	3	75,100	3	75,100											
INSTITUTION TOTAL	12	286,628	7	226,800					1	9,661	4	50,159			
UNIV OF MISSOURI COLUMBIA	40	1,077,782	28	588,250	1	102,000	4	193,000	2	45,407	5	149,125			
UNIV OF MISSOURI KAN CITY	3	35,035					1	25,800	1	6,805	1	2,430	1	3,000	3,842
UNIV OF MISSOURI ROLLA	27	1,210,385	13	462,700			5	528,000	2	65,054	7	154,631			
UNIV OF MISSOURI ST LOUIS	6	126,381	5	118,900					1	7,481					
WASHINGTON UNIV	50	2,389,595	40	1,488,300	1	5,600	4	678,400	1	40,485	4	176,810	4	12,000	15,367
WASH UNIV-SCH OF MEDICINE	7	302,100	7	302,100											
INSTITUTION TOTAL	57	2,691,695	47	1,790,400	1	5,600	4	678,400	1	40,485	4	176,810	4	12,000	15,367
OTHER GRANTS & CONTRACTS	6	3,154							6	3,154					
STATE TOTAL		5,935,438		3,419,750		145,100		1,535,200		205,047		630,341		15,000	19,209
	172		105		3		15		22		27		5		
MONTANA															
DAWSON COL	1	4,360							1	4,360					
MONTANA COL MINERAL SCI	3	111,890	1	18,600			1	91,400	1	1,090					
MONTANA STATE UNIV	10	230,971	4	75,600			1	49,900	1	25,730	4	79,741	1	3,000	3,842
NORTHERN MONTANA COL	1	49,617									1	49,617			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MONTANA															
UNIV OF MONTANA	13	250,636	5	33,600			1	85,800	1	40,753	6	90,483	2	6,000	7,643
OTHER GRANTS & CONTRACTS	1	700							1	700					
STATE TOTAL		647,374		127,800				227,100		72,633		219,841		9,000	11,525
	29		10				3		5		11		3		
NEBRASKA															
CHADRON STATE COL	1	8,600	1	8,600											
KEARNEY STATE COL	2	21,388							1	4,905	1	16,483			
MIDLAND LUTHERAN COL	1	1,090							1	1,090					
NEBRASKA WESLEYAN UNIV	5	112,711							1	5,658	4	107,053			
U OF NEB MED CTR AT OMAHA	1	21,200	1	21,200											
UNIV OF NEB SYSTEM OFFICE	1	6,641							1	6,641					
UNIV OF NEBRASKA-LINCOLN	28	514,542	12	307,200	2	74,600	1	50,100	1	26,070	4	56,572	1	3,000	3,842
OTHER GRANTS & CONTRACTS	5	3,873							5	3,873					
STATE TOTAL		690,045		337,000		74,600		50,100		48,237		180,108		3,000	3,842
	36		14		2		1		10		9		1		
NEVADA															
DESERT RESEARCH INSTITUTE	7	623,900	5	472,800			2	151,100							
UNIV OF NEV RENO CAMPUS	11	367,967	5	161,700					1	17,804	5	188,463			
UNIV OF NEVADA LAS VEGAS	1	5,953							1	5,953					
UNIV OF NEVADA SYS OFF	2	90,712	1	71,000					1	19,712					
OTHER GRANTS & CONTRACTS	3	2,378							3	2,378					
STATE TOTAL		1,090,910		705,500				151,100		45,847		188,463			
	24		11				2		6		5				

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NEW HAMPSHIRE															
AMERICAN UNIV FIELD STAFF	1	18,190									1	18,190			
DARTMOUTH COL	24	641,691	16	461,100			1	79,500	1	20,961	6	80,130	2	6,000	7,683
DARTMOUTH COL-MED SCH	1	33,000	1	33,000											
DARTMOUTH COL-THAYER ENG	2	180,900	1	47,600			1	133,300							
INSTITUTION TOTAL	27	855,591	18	541,700			2	212,800	1	20,961	6	80,130	2	6,000	7,683
MT WASH OBSERVATORY INC	2	57,553	2	57,553											
NATHANIEL HAWTHORNE COL	1	1,090							1	1,090					
NEW HAMPSHIRE COLLEGE	2	21,430							1	5,560	1	15,870			
PLYMOUTH STATE COLLEGE	1	17,532									1	17,532			
ST ANSELMAS COL	1	5,732							1	5,732					
UNIV OF N H DURHAM	17	398,396	7	248,000					1	27,661	9	122,735	2	6,000	7,683
UNIV OF NEW HAMPSHIRE															
U OF N H-COL OF TECH	1	39,600	1	39,600											
OTHER GRANTS & CONTRACTS	3	21,565			1	20,700			2	865					
STATE TOTAL		1,436,879		887,053		20,700		212,800		61,869		254,457		12,000	15,366
	56		28		1		2		7		18		4		
NEW JERSEY															
ALPINE GEOPHYS ASSOC INC	1	97,900			1	97,900									
AM FED OF INF PROCESS SOC	1	9,000	1	9,000											
AMER RES CTR IN EGYPT INC	1	5,500	1	5,500											
COL OF MED & DENT OF N J	1	6,100							1	6,100					
COL OF MED-RUTGERS MED SC	1	50,916	1	50,916											
INSTITUTION TOTAL	2	57,016	1	50,916					1	6,100					
COMPUTER HORIZONS INC	3	186,248							3	186,248					
COUNCIL FOR ADV SCI WRIT	1	5,000							1	5,000					
DREW UNIV	2	9,105	1	4,200					1	4,905					

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NEW JERSEY															
EDUCATIONAL TESTING SERV	4	309,300	1	37,500							3	271,800			
EDUCOM INC	2	127,800	2	97,800						30,000					
FAIRLEIGH DICKINSON UNIV															
FAIRLGH D U-FLORHM-MADSN	1	26,647									1	26,647			
FAIRLGH D U-TEANECK	2	72,709	1	19,200							1	53,509			
INSTITUTION TOTAL	3	99,356	1	19,200							2	80,156			
GLASSBORO STATE COL	1	12,400									1	12,400			
INST FOR ADVANCED STUDY	2	468,500	2	468,500											
JERSEY CITY STATE COL	1	5,744							1	5,744					
MONMOUTH COL	1	5,757							1	5,757					
MONTCLAIR STATE COL	3	59,557							1	5,584	2	53,973			
NATL ENGL-CRNLDEL RES CTR	1	76,700					1	76,700							
NEWARK COL OF ENGINEERING	4	58,487	1	32,000					1	7,377	2	19,330			
PRINCETON UNIV	97	4,937,557	85	4,416,400	1	24,100	3	324,300	2	57,378	6	115,379	77	231,000	295,818
PIDER COL	3	77,560	2	67,600							1	9,960			
RUTGERS UNIVERSITY	74	2,669,466	65	2,139,200			2	310,700	1	41,782	6	177,784			
RUTGERS U-MEDICAL SCHOOL	2	67,800	2	67,800											
RUTGERS U-NEWARK CAMPUS	1	10,600									1	10,600			
INSTITUTION TOTAL	77	2,747,866	67	2,207,000			2	310,700	1	41,782	7	188,384			
SETON HALL UNIV	5	30,548							1	5,475	4	25,073			
ST PETERS COL	1	11,666							1	11,666					
STEVENS INST OF TECH	15	614,976	12	554,600					1	12,309	2	48,067			
TEXTILE RESEARCH INST	1	43,700					1	43,700							
TRENTON STATE COL	2	48,683							1	4,905	1	43,778			
OTHER GRANTS & CONTRACTS	15	20,334			2	2,489			13	17,845					
STATE TOTAL		18,126,188		7,978,216		124,489		755,400		407,775		868,308		231,000	295,818
	249		177		4		7		38		31		77		

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NEW MEXICO															
COL OF SANTA FE	1	5,781							1	5,781					
EASTERN NEW MEXICO UNIV	2	16,115							1	7,415	1	8,700			
LOS ALAMOS SCIENTIFIC LAB	3	1,728,000	2	138,000			1	1,590,000							
NEW MEX INST MINING & TEC	11	561,862	7	321,600			2	210,800	1	16,612	1	12,850			
NEW MEXICO HIGHLANDS UNIV	3	63,346							1	3,815	2	59,531			
NEW MEXICO STATE UNIV	15	301,377	10	194,100					1	47,491	4	59,786			
SCH OF AMER RESEARCH	1	74,300	1	74,300											
UNIV OF ALBUQUERQUE	1	5,622							1	5,622					
UNIV OF NEW MEXICO	19	601,812	16	341,900			2	148,900	1	30,844	2	79,368	1	3,000	3,842
U OF N M-SCH OF MED	1	33,000	1	33,000											
INSTITUTION TOTAL	20	634,812	15	374,900			2	148,900	1	30,844	2	79,368	1	3,000	3,842
OTHER GRANTS & CONTRACTS	3	2,984							3	2,984					
STATE TOTAL		3,393,399		1,102,900				1,949,700		120,564		220,235		3,000	3,842
	60		35				5		10		10		1		
NEW YORK															
ADELPHI UNIV	3	91,636							1	7,143	2	84,493			
AGR & TECH COL ALFRED	1	14,000									1	14,000			
ALFRED UNIV	1	5,646							1	5,646					
AMER ASSOC OF PHYS TCHRS	1	1,380									1	1,380			
AMER GEOGRAPHICAL SOC	1	12,100			1	12,100									
AMER INST OF AERO & ASTRO	1	36,000					1	36,000							
AMER INST OF PHYSICS	2	313,000							1	296,500	1	16,500			
AMER MUSEUM OF NAT HIST	7	296,090	5	281,700					1	7,300	1	7,090			
AMER MUS NAT HIST-HAYDEN	1	15,156									1	15,156			
INSTITUTION TOTAL	8	311,246	5	281,700					1	7,300	2	22,246			
AMER SOC OF CIVIL ENG	5	156,600	1	5,600	1	78,100	1	29,800	2	43,100					

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NEW YORK															
AMER SOC OF MECH ENG	1	3,000	1	3,000											
AMERICAN INST OF RESEARCH	1	155,400					1	155,400							
AMERICAN SOC OF H,R,A/C	1	5,000					1	5,000							
ASSOCIATED UNIV INC															
ASSOCIATED UNIV INC-UPTON	1	10,000					1	10,000							
AUDIO PRODUCTIONS	6	154,000			2	16,000	2	55,500		3,500	2	79,000			
B THOMPSON INST PLANT RES	2	40,766	1	32,400							1	8,366			
BANK STREET COL OF ED	1	9,344							1	9,344					
BARNARD COL	2	26,149	1	20,000					1	6,149					
BROOKHAVEN LAB	9	1,055,820	4	261,750			2	780,000	1	7,200	2	7,270			
CENTER FOR RESID SEC OES	1	95,800					1	95,401							
CLARKSON COL OF TECH	14	420,183	7	256,600			1	38,401	1	11,361	5	111,822			
CNTR FOR POLICY RESEARCH	2	333,138	1	267,500			1	65,638							
COL AT BROCKPORT	6	145,581	2	26,330					1	6,051	3	113,230			
COL AT BUFFALO	2	9,580	1	7,400					1	2,180					
COL AT CORTLAND	1	5,658							1	5,658					
COL AT FREDONIA	1	6,100							1	6,100					
COL AT GENESEO	1	25,000	1	25,000											
COL AT NEW PALTZ	1	4,800	1	4,800											
COL AT OSWEGO	4	66,654	1	7,100					1	6,239	2	53,515			
COL AT PLATTSBURGH	2	11,403							1	5,511	1	5,892			
COL OF ST ROSE	1	1,090							1	1,090					
COLD SPRING HARBOR LAB	5	215,008	5	212,500							1	2,508			
COLGATE UNIV	4	102,834	1	3,100							3	99,734			
COLUMBIA UNIV	77	7,180,447	67	5,021,950	1	3,150	5	461,401	1	101,552	3	112,365	11	33,000	42,260
COLUMBIA U-COL OF PHYS	10	581,800	9	511,900			1	69,100							
COLUMBIA U-LAMONT GEO OBS	41	4,142,100	30	1,677,400	11	2,464,700									

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NEW YORK															
INSTITUTION TOTAL	128	11,823,547	106	8,211,250	12	2,467,880	6	930,500	1	101,552	3	112,365	11	33,000	42,260
COLUMBIA UNIV SYS OFF	1	27,000			1	27,000									
CONFERENCE BOARD	2	154,900	1	94,900			1	60,000							
COOPER UNION	2	13,691							1	5,511	1	8,180			
CORNELL UNIV	109	9,746,186	99	9,385,830			3	116,500	1	58,314	6	185,542	61	189,000	242,031
CORNELL U-MEDICAL COL	4	348,500	4	348,500											
INSTITUTION TOTAL	113	10,094,686	103	9,734,330			3	116,500	1	58,314	6	185,542	61	189,000	242,031
CORNELL UNIVERSITY															
CORNELL UNIV - ENDOWED	10	409,700	10	409,700											
CORNELL UNIV - STATE	4	236,400	4	236,400											
INSTITUTION TOTAL	14	646,100	14	646,100											
CORNING COMM COL	1	5,450							1	5,450					
CUNY BROOKLYN COL	7	183,563	3	73,600					1	7,459	3	102,504			
CUNY CENTRAL SYS OFF	1	12,618							1	12,618			3	9,000	11,525
CUNY CITY COL	13	377,932	9	202,500			1	54,900	1	11,012	2	109,520			
CUNY HUNTER COL	5	169,796	3	159,600					1	6,696	1	3,500			
CUNY LEHMAN COLLEGE	2	11,757	1	6,000					1	5,757					
CUNY MT SINAI SCH OF MED	1	37,200	1	37,200											
CUNY QUEENS COL	5	160,179	4	147,000					1	6,979	1	6,200			
CUNY RICHMOND COL	2	83,966	1	56,000							1	27,966			
CUNY YORK COLLEGE	1	16,256									1	16,256			
DIEBOLD GROUP INC	2	70,000			2	70,000									
DOMINICAN COL OF BLAUVELT	1	545							1	545					
DOWLING COLLEGE	2	4,190	1	3,100					1	1,090					
DOWNST MED CTR AT BRKLYN	1	90									1	90			
ENG INDEX INC	1	128,000							1	128,000					
FORDHAM UNIV	9	133,553	6	60,700					1	7,568	2	65,285			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PL'N'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NEW YORK															
GENERAL ELECTRIC COMPANY															
GEN ELEC R & D CENTER	1	69,158			1	69,158									
GENETICS SOC OF AMERICA	1	20,000	1	20,000											
GRADUATE SCH & UNIV CTR	9	252,397	5	161,700					2	62,637	1	28,060			
HEALTH RESEARCH INC	1	42,000	1	42,000											
HEALTH RES-ROSWELL PARK	7	193,720	6	170,000							1	23,720			
INSTITUTION TOTAL	8	235,720	7	212,000							1	23,720			
HOBART AND WM SMITH COL	1	2,300									1	2,300			
HOFSTRA UNIV	4	104,526	1	12,000					1	6,517	2	86,009			
INST OF ELECT ENGRS	4	173,300	2	10,000					2	163,300					
INST SOC, ETHICS LIFE SCI	1	102,000					1	102,000							
INTERMAGNETICS GENL CORP	1	52,600			1	52,600									
ITHACA COL	4	16,735							1	3,270	3	13,465			
LEMOYNE COL	1	5,475							1	5,475					
LONG ISLAND UNIVERSITY	1	8,472							1	8,472					
MANHATTAN COL	5	96,381	2	63,100					1	6,100	2	27,181			
MANHATTANVILLE COL	2	26,900	1	19,700							1	7,200			
MARITIME COLLEGE	1	6,370							1	6,370					
MT ST MARY COL	1	1,090							1	1,090					
N Y ACAD OF SCIENCES	3	5,000	3	5,000											
N Y BOTANICAL GARDEN	15	422,650	15	422,650											
N Y CITY COMM COL	1	545							1	545					
N Y INST OF TECHNOLOGY															
N Y INST OF TECH-CTY CAMP	1	1,090							1	1,090					
N Y ST PSYCHIATRIC INST	1	15,000	1	15,000											
N Y ZOOLOGICAL SOC	1	9,700	1	9,700											
NAT BUREAU OF ECON RES	8	1,940,888	6	1,715,000	2	225,800									

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PL'N'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NEW YORK															
NEW SCHOOL FOR SOCIAL RES	7	97,233	4	84,350					1	5,977	2	6,906			
NEW YORK CITY-RAND INST	2	215,700					2	215,700							
NEW YORK MEDICAL COL	5	77,297	2	62,300					1	8,658	2	6,339			
NEW YORK ST SCI&TECH FDN	1	11,500					1	11,500							
NEW YORK STATE ASSEMBLY	1	53,100					1	53,100							
NEW YORK UNIV	55	2,263,210	45	1,718,200	4	232,600	2	166,500	1	53,020	3	92,890	3	9,000	11,525
N Y UNIV-SCH OF MEDICINE	3	125,000	3	125,000											
N Y UNIV-UNIV HEIGHTS CTR	4	196,520	3	146,100							1	50,420			
INSTITUTION TOTAL	62	2,584,730	51	1,989,300	4	232,600	2	166,500	1	53,020	4	143,310	3	9,000	11,525
NIAGARA UNIV	1	8,090									1	8,090			
NYACK MISSIONARY COL	1	900									1	900			
PACE COL	1	5,400									1	5,400			
PERFORMANCE COMMUN INC	1	15,000					1	15,000							
POLYTECHNIC INST OF BKLYN	15	554,720	9	433,100					1	26,424	5	95,196			
PRATT INST	1	5,879							1	5,879					
PROJECT UNIQUE, INC	1	121,300									1	121,300			
PUBLIC HEALTH RES INST	5	174,900	5	174,900											
RENSSELAER POLYTECH INST	30	1,119,347	22	798,000			1	48,900	1	32,343	6	240,104	6	18,000	23,051
ROCHESTER INST OF TECH	4	81,515	3	77,700					1	3,815					
ROCKEFELLER UNIV	20	850,776	17	806,100					1	18,586	2	26,090	2	6,000	7,693
ST BONAVENTURE UNIV	2	1,442							1	1,090	1	352			
ST JOHN VIANNEY SEM	1	5,462							1	5,462					
ST JOHNS UNIV	2	48,250							1	43,000	1	5,250			
ST LAWRENCE UNIV	4	74,738							1	1,090	3	73,648			
STATE UNIV AT ALBANY	39	1,867,537	30	857,100	1	25,800	1	33,500	3	118,409	4	32,728			
STATE UNIV AT BINGHAMTON	12	234,688	7	153,000			1	48,800	1	8,178	3	24,710	1	3,000	3,842
STATE UNIV AT BUFFALO	44	1,221,701	37	1,035,000			2	69,000	1	39,510	4	78,191			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NEW YORK															
STATE UNIV AT STONY BROOK	73	3,892,450	58	2,319,600	1	52,300	2	356,300	2	50,492	10	513,858	2	6,000	7,683
STATE UNIV N Y SYST OFF	1	6,161							1	6,161					
SUNY C ENV SCI & FORESTRY	15	479,787	11	455,700					2	11,208	2	13,279			
SYRACUSE UNIV	37	1,583,195	27	1,195,535					1	30,174	9	357,395	2	6,000	7,683
SYRACUSE UNIV RES CORP'N	1	65,891			1	65,891									
TEACHERS COL	8	264,036	5	167,250					1	11,156	2	85,730			
TISSUE CULTURE ASSN INC	1	50,000	1	50,000											
UNION COL	5	146,111	3	80,300					1	5,965	1	59,846			
UNITED ENG TRUSTEES	2	31,800			1	19,000	1	12,800							
UNIV OF ROCHESTER	48	2,540,949	39	2,180,700			2	212,200	1	55,885	6	92,164	2	6,000	7,683
U OF ROCHESTER-SCH MED	5	529,700	4	138,900			1	390,800							
INSTITUTION TOTAL	53	3,070,649	43	2,319,600			3	603,000	1	55,885	6	92,164	2	6,000	7,683
UPST MED CTR AT SYRACUSE	1	7,300							1	7,300					
UTICA COLLEGE	1	6,609							1	6,609					
VASSAR COL	1	19,500									1	19,500			
WALDEMAR MED RES FDN	1	13,420									1	13,420			
WEBB INST OF NAVAL ARCH	1	6,914							1	6,914					
YESHIVA UNIV	14	354,173	12	319,300					1	29,623	1	5,250			
YESHIVA U-ALBERT EINSTEIN	12	417,100	12	417,100											
INSTITUTION TOTAL	26	771,273	24	736,400					1	29,623	1	5,250			
OTHER GRANTS & CONTRACTS	87	377,134	3	106,360	6	217,677	1	23	76	46,631	1	6,446			
STATE TOTAL		50,990,381		38,315,666		3,631,906		4,170,158		1,692,948		3,479,703		285,000	364,968
		1,058		693		37		43		150		135		95	

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NORTH CAROLINA															
APPALACHIAN STATE UNIV	2	12,450							1	5,450	1	7,000			
BARBER-SCOTIA COL	1	1,090							1	1,090					
BENNETT COL	1	26,757									1	26,757			
CAMPBELL COL	1	21,499									1	21,499			
DUKE UNIV	51	2,601,755	40	1,687,300	3	460,000	1	122,500	1	47,409	6	284,546	11	33,000	42,250
DUKE UNIV-MARINE LAB	4	122,300	2	38,600	2	83,700									
DUKE UNIV-SCH OF MEDICINE	5	197,400	5	197,400											
INSTITUTION TOTAL	60	2,921,455	47	1,923,300	5	543,700	1	122,500	1	47,409	6	284,546	11	33,000	42,250
EAST CAROLINA UNIV	3	132,700							1	5,475	2	127,225			
EDGECOMBE TECHNICAL INST	1	1,100									1	1,100			
ELIZABETH CITY STATE UNIV	2	178,490							1	1,090	1	177,400			
GUILFORD COL	1	2,800							1	2,800					
GUILFORD TECHNICAL INST	1	1,100									1	1,100			
LENOIR-RHYNE COL	1	1,090							1	1,090					
LIVINGSTONE COL	1	215,000									1	215,000			
LOUISBURG COL	1	1,090							1	1,090					
MARS HILL COL	2	14,556							1	5,536	1	9,020			
N C AGRIC & TECH ST UNIV	4	80,033	1	11,100					1	8,254	2	60,679			
N C STATE UNIV AT RALEIGH	18	1,507,897	7	340,700	2	738,700	3	243,500	2	73,189	4	111,808	1	3,000	3,942
NATIONAL LAB HIGHER EDUC	1	9,405									1	9,405			
NO CAROLINA CENTRAL UNIV	2	47,806							1	5,977	1	41,829			
NORTH CAROLINA FDN M H R	1	38,300	1	38,300											
RESEARCH TRIANGLE INST	2	153,400					2	153,400							
SHAW UNIV	1	6,696							1	6,696					
ST ANDREWS PRESBY COL	1	5,609							1	5,609					
ST AUGUSTINES COL	1	172,400									1	172,400			
UNIV OF N C AT ASHEVILLE	3	41,938							2	27,560	1	14,378			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NORTH CAROLINA															
UNIV OF N C AT CHAP HILL	54	2,318,729	43	1,805,500			4	166,200	2	137,110	5	209,919	4	24,000	33,735
U OF N C AT CHAP HILL-MED	4	80,200	4	80,200											
U OF N C CHAP HILL-FISH	1	25,000	1	25,000											
INSTITUTION TOTAL	59	2,423,929	48	1,910,700			4	166,200	2	137,110	5	209,919	4	24,000	33,735
UNIV OF N C AT CHARLOTTE	1	12,100									1	12,100			
UNIV OF N C AT GREENSBORO	1	6,816							1	6,816					
WAKE FOREST UNIV	4	35,378							1	10,369	3	25,009			
WAKE FOREST-GRAY SCH MED	1	24,000	1	24,000											
INSTITUTION TOTAL	5	59,378	1	24,000					1	10,369	3	25,009			
WESTERN CAROLINA UNIV	1	12,470									1	12,470			
WINSTON-SALEM STATE UNIV	4	472,790							1	1,090	3	471,700			
OTHER GRANTS & CONTRACTS	10	6,767							10	6,767					
STATE TOTAL		8,588,903		4,248,100		1,282,400		685,600		360,467		2,012,336		60,000	75,837
	193		105		7		10		32		39		20		
NORTH DAKOTA															
MINOT ST COL	2	17,640							1	3,270	1	14,370			
NORTH DAKOTA STATE UNIV	7	95,501							1	20,065	6	75,436			
UNIV OF NORTH DAKOTA	7	170,379	1	40,000					1	9,922	5	120,457			
U OF N D-SCH OF MED	1	32,000	1	32,000											
INSTITUTION TOTAL	8	202,379	2	72,000					1	9,922	5	120,457			
STATE TOTAL		315,520		72,000						33,257		210,263			
	17		2						3		12				

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
OHIO															
ANTIOCH COL	2	81,262							1	7,884	1	73,378			
BALDWIN-WALLACE COL	1	24,278									1	24,278			
BATTELLE MEMORIAL INST	6	239,430	3	147,300	1	45,000			1	7,600	1	36,530			
BLUFFTON COL	1	17,900	1	17,900											
BOWLING GREEN STATE UNIV	8	183,608	4	115,400					1	6,870	3	61,338	1	3,000	3,842
CASE WESTERN RESERVE UNIV	65	3,170,947	52	2,463,700	2	41,600	2	293,300	2	218,682	7	153,665	3	9,000	11,525
CASE W R UNIV-SCH OF MED	3	116,500	3	116,500											
INSTITUTION TOTAL	68	3,287,447	55	2,580,200	2	41,600	2	293,300	2	218,682	7	153,665	3	9,000	11,525
CENTRAL STATE UNIV	4	416,129	1	22,900					1	5,536	2	389,693			
CHAS F KETTERING RES FDN															
C KETTERING RES FDN-LAB	1	40,000	1	40,000											
CLEVELAND CLINIC FDN	1	35,000	1	35,000											
CLEVELAND MUS OF NAT HIST	1	39,800	1	39,800											
CLEVELAND STATE UNIV	2	25,524							1	5,524	1	20,000			
COL MT ST JOSEPH-ON-OHIO	1	5,475							1	5,475					
COL OF WOOSTER	3	16,640							1	5,450	2	11,190			
DAYTON, CITY OF	1	90,000			1	90,000									
DENISON UNIV	1	5,524							1	5,524					
FED FOR UNIFIED SCI EDU	2	86,872									2	86,872			
FELS RESEARCH INSTITUTE	1	46,200	1	46,200											
HEIDELBERG COL	3	20,906							1	5,536	2	15,370			
HIRAM COL	4	45,217	1	11,100					1	6,124	2	27,993			
JOHN CARROLL UNIV	2	12,482							1	5,891	1	6,591			
KENT STATE UNIV	11	325,249	5	220,800					1	19,979	5	84,470			
KENYON COL	1	4,905							1	4,905					
MARIETTA COL	2	37,890							1	2,725	1	35,165			
MIAMI UNIV	3	62,359	1	38,000					1	8,941	1	23,418			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NATL NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
OHIO															
MT UNION COL	1	5,700									1	5,700			
MUSKINGUM COL	2	29,497							1	5,573	1	23,924			
NOTRE DAME COL	2	18,113							1	1,635	1	16,478			
OBERLIN COL	8	115,231	2	21,700					1	6,641	5	86,890			
OHIO DOMINICAN COL	1	11,559									1	11,559			
OHIO NORTHERN UNIV	1	1,090							1	1,090					
OHIO STATE UNIV	102	4,011,842	77	2,714,400	5	53,400	3	254,300	5	565,539	12	423,403	5	15,000	19,209
OHIO ST UNIV-COL OF MED	1	40,500	1	40,500											
INSTITUTION TOTAL	103	4,051,542	78	2,754,900	5	53,400	3	254,300	5	565,539	12	423,403	5	15,000	19,209
OHIO UNIV	13	288,147	8	217,780					1	9,748	4	60,699			
OHIO WESLEYAN UNIV	1	2,725							1	2,725					
SINCLAIR COL	1	1,090							1	1,090					
UNIV OF AKRON	10	393,461	7	350,300			1	34,700	1	7,971	1	490			
UNIV OF CINCINNATI	19	613,478	12	375,000	1	18,100			1	18,586	5	201,792			
UNIV OF DAYTON	4	100,504							1	37,063	3	63,441			
UNIV OF TOLEDO	9	157,546	3	109,100					1	6,247	5	42,199			
WILBERFORCE UNIV	1	251,000									1	251,000			
WITTENBERG UNIV	1	5,584							1	5,584					
WRIGHT STATE UNIV	5	156,773	2	80,100	1	61,600			1	7,873	1	7,200			
XAVIER UNIV	2	10,357							1	2,180	1	8,177			
OTHER GRANTS & CONTRACTS	20	58,901			2	49,200			18	9,701					
STATE TOTAL		11,424,395		7,215,400		361,900		582,300		1,011,892		2,252,903		27,000	34,576
	334		187		13		6		54		74		9		

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NATL NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
OKLAHOMA															
CENTRAL STATE UNIVERSITY	2	5,190							1	1,090	1	4,100			
EAST CENTRAL STATE COL	1	6,100							1	6,100					
LANGSTON UNIV	1	5,524							1	5,524					
MIDCON ENVIR CTR ASSN INC	1	25,000					1	25,000							
MURRAY STATE COLLEGE	2	3,390							1	1,090	1	2,300			
NORTHWESTERN STATE COL	1	6,240									1	6,240			
OKLA MEDICAL RES FDN	1	25,000			1	25,000									
OKLAHOMA CITY UNIV	1	5,793							1	5,793					
OKLAHOMA COL LIBERAL ARTS	1	1,090							1	1,090					
OKLAHOMA STATE UNIV	32	1,211,851	18	580,100			3	162,600	1	63,207	10	405,944			
SEMINOLE JR COL	1	24,252									1	24,252			
SOUTHEASTERN STATE COL	2	53,885							1	5,977	1	47,908			
SOUTHWESTERN STATE COL	3	67,845							1	2,725	2	65,120			
UNIV OF OKLAHOMA	30	922,241	17	485,650	1	29,700	1	75,600	1	27,612	10	303,673	4	12,000	15,367
UNIV OKLA-MEDICAL CENTER	1	12,561									1	12,561			
INSTITUTION TOTAL	31	934,802	17	485,650	1	29,700	1	75,600	1	27,612	11	316,240	4	12,000	15,367
UNIV OF TULSA	3	46,777	1	25,000					1	6,761	1	15,015			
OTHER GRANTS & CONTRACTS	2	2,346							1	471	1	1,875			
STATE TOTAL		2,425,085		1,090,750		54,700		263,200		127,440		888,995		12,000	15,367
	85		36		2		5		12		30		4		
OREGON															
EDU COORDINATING COUNCIL	1	498,144									1	498,144			
GOOD SAMARITAN HOSP&MED C	1	45,000	1	45,000											
LANE COMM COL	1	1,500									1	1,500			
LEWIS AND CLARK COL	1	2,725							1	2,725					
LINFIELD COL	2	11,743							1	5,953	1	5,790			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
OREGON															
MT HOOD COMM COL	1	2,800									1	2,800			
N W REG EDUCATIONAL LAB	2	80,000									2	80,000			
OREG GRAD CTR STUDY & RES	2	53,277	1	52,487							1	790			
OREG ST HIGHER ED SYS OFF	1	9,846							1	9,846					
OREGON COL OF EDUCATION	2	135,807									2	135,807			
OREGON GRADUATE CENTER	2	327	1	59,500					1	6,427					
OREGON STATE UNIV	65	3,811,704	41	1,430,200	14	2,030,730			2	63,547	4	287,257			
OREGON TECH INST	1	2,500									1	2,500			
PORTLAND COMM COL	1	8,300									1	8,300			
PORTLAND STATE UNIVERSITY	6	73,660	1	17,000					1	6,357	4	50,303			
REED COL	9	150,087	3	101,300					1	7,197	5	41,590			
U OREGON MEDICAL SCHOOL	1	61,400	1	61,400											
UNIV OF OREGON - EUGENE	50	2,763,853	39	1,610,400	1	793,650	2	194,300	4	82,352	4	82,851	1	3,000	3,842
UNIV OF PORTLAND	2	52,126									2	52,126			
OTHER GRANTS & CONTRACTS	7	34,791	2	30,570					5	4,221					
STATE TOTAL		7,865,590		3,407,857		2,824,380		194,300		198,725		1,249,758		3,000	3,842
	158		90		15		2		17		14		1		
PENNSYLVANIA															
ACAD OF NAT SCI OF PHILA	8	231,900	7	224,900					1	7,000					
ALBERT EINSTEIN MED CTR	3	88,500	2	74,700					1	13,800					
ALBRIGHT COL	1	7,481							1	7,481					
ALLEGHENY COL	2	22,330									2	22,330			
AMER INST INDIAN STUDIES	1	100,000	1	100,000											
AMER SOC OF ICHTHYOLHERP	1	6,813	1	6,813											
BEAVER COL	4	148,397							1	5,524	3	142,873			
BIOLOGICAL ABSTRACTS	1	275,000							1	275,000					

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
PENNSYLVANIA															
BLOOMSBURG STATE COL	1	4,770									1	4,770			
BRYN MAWR COL	5	27,750	2	8,700					1	5,830	2	13,220			
BUCKNELL UNIV	4	55,088							1	6,149	3	48,939			
CARLOW COLLEGE	2	38,531									2	38,531			
CARNEGIE INST	3	37,541	3	37,541											
CARNEGIE MELLON UNIV	55	3,775,812	45	2,127,100	1	1,075,000	5	427,300	1	44,962	3	101,450			
CAREGIE MEL UNIV-INST TEC	1	36,400					1	36,400					1	3,000	3,842
INSTITUTION TOTAL	56	3,812,212	45	2,127,100	1	1,075,000	6	463,700	1	44,962	3	101,450	1	3,000	3,842
CLARION STATE COL	2	47,821									2	47,821			
COL MISERICORDIA	1	1,090							1	1,090					
DICKINSON COL	1	5,867							1	5,867					
DREXEL UNIVERSITY	20	969,349	10	298,400	1	115,100	3	267,900	1	15,677	5	272,272	1	3,000	3,842
DUQUESNE UNIV	3	10,195	2	4,500					1	5,695			1	3,000	3,842
EAST STROUDSBRG STATE COL	1	7,197							1	7,197					
EDINBORO STATE COL	2	67,188							1	1,090	1	66,098			
FRANKLIN AND MARSHALL COL	4	48,553	1	8,000					1	7,023	2	25,530			
FRANKLIN INST															
FRANKLIN INST-BARTOL FOUN	5	278,508	3	154,700	1	115,000					1	8,800			
GELLMAN & ASSOCIATES	1	56,400			1	56,400									
GENEVA COL	1	3,815							1	3,815					
HAHNEMANN MED COL & HOSP	2	26,744							1	8,244	1	18,500			
HAVERFORD COL	3	41,372	1	30,000					1	7,132	1	4,240			
INDIANA UNIV OF PA	1	131,420									1	131,420			
INST FOR CANCER RESEARCH	5	171,000	5	171,000											
INST FOR SCIENTIFIC INFO	2	110,951		17,500					2	93,451					
JUNIATA COL	2	12,215							1	5,475	1	6,740			
KINGS COL	1	12,200									1	12,200			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
PENNSYLVANIA															
LAFAYETTE COL	1	5,450							1	5,450					
LEHIGH UNIV	39	1,676,501	29	1,295,250			3	203,700	2	102,680	5	74,871	1	3,000	3,842
LINCOLN UNIV	2	249,417							1	7,317	1	242,100			
LYCOMING COL	1	6,600									1	6,600			
MANSFIELD STATE COL	1	1,090							1	1,090					
MARYWOOD COL	1	1,090							1	1,090					
MEDICAL COLLEGE OF PA	3	33,572	2	27,300					1	6,272					
MERCYHURST COL	1	9,060									1	9,060			
MUHLENBERG COL	1	3,815							1	3,815					
NAT FED SCI ARSKIND SERV	1	78,300							1	78,300					
PA SCIENCE&ENGINEERING FN	2	68,800					2	68,800							
PENNSYLVANIA COL OPTOMET	1	51,100	1	51,100											
PENNSYLVANIA STATE UNIV	76	3,813,329	62	2,166,700	2	87,600	3	375,900	4	196,993	5	186,136	3	9,000	11,525
PHILA COL OF PHARM & SCI	1	1,056									1	1,056			
PHILADELPHIA OFFICE MAYOR	1	46,000					1	46,000							
POINT PARK COL	1	1,090							1	1,090					
SETON HILL COL	1	47,224									1	47,224			
SHIPPENSBURG STATE COL	1	2,725							1	2,725					
SLIPPERY ROCK STATE COL	2	41,683							1	3,815	1	37,868			
SOC FOR IND & APPL MATH	2	77,900	1	8,700			1	69,200							
ST JOSEPHS COL	1	5,744							1	5,744					
SUSQUEHANNA UNIV	1	226,500									1	226,500			
SWARTHMORE COL	8	196,877	5	169,100					1	6,247	2	21,530			
TEMPLE UNIV	12	217,637	8	141,000					2	37,535	2	39,102			
THIEL COL	1	5,634							1	5,634					
THOS JEFFERSON UNIV HOSP	2	54,675	1	40,000					1	14,675					
THOS JEFFERSON U HOSP-MED	3	93,300	3	93,300											

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
PENNSYLVANIA															
INSTITUTION TOTAL	5	147,975	4	133,300					1	14,675					
UNIV CITY SCIENCE CENTER	3	256,100	2	107,700			1	148,400							
UNIV OF PENNSYLVANIA	76	5,642,185	65	4,815,600			5	633,500	4	120,285	2	72,800	10	30,000	38,418
U OF PA SCH OF VET MED	2	55,500	2	55,500											
UNIV OF PA-SCH OF MED	7	288,300	7	288,300											
UNIV OF PA-WHARTON SCH	6	327,100	4	220,700	1	89,400					1	17,000			
INSTITUTION TOTAL	91	6,313,085	78	5,380,100	1	89,400	5	633,500	4	120,285	3	89,800	10	30,000	38,418
UNIV OF PITTSBURGH	54	2,576,011	44	1,811,300					2	190,389	8	574,322	4	12,000	15,367
UNIV OF PITT-SCH OF MED	4	157,000	4	157,000											
INSTITUTION TOTAL	58	2,733,011	48	1,968,300					2	190,389	8	574,322	4	12,000	15,367
UNIV OF SCRANTON	1	3,815							1	3,815					
WEST CHESTER STATE COL	1	39,943									1	39,943			
WESTINGHOUSE ELECT CORP	1	49,069					1	49,069							
WESTMINSTER COL	2	8,990							1	1,090	1	7,900			
WILSON COL	1	1,090							1	1,090					
WISTAR INST	1	14,200	1	14,200											
OTHER GRANTS & CONTRACTS	44	21,144			2	78	3	1,418	36	18,912	3	736			
STATE TOTAL	519	22,506,806	324	14,726,604	9	1,538,578	29	2,327,387	88	1,143,555	69	2,670,682	21	63,000	92,674
RHODE ISLAND															
AMER MATHEMATICAL SOC	5	100,400	4	100,100							1	300			
BROWN UNIV	71	3,736,245	53	2,780,350	3	513,500	2	107,100	5	66,117	8	269,178	5	15,000	13,200
GORDON RES CONFERENCES	6	32,200	6	32,200											
PROVIDENCE COL	3	14,129							1	5,487	2	8,642			
RHODE ISLAND DEPT OF HLTH	1	33,000					1	33,000							
ROGER WILLIAMS COLLEGE	1	3,400									1	3,400			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS														FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
RHODE ISLAND																	
UNIV OF RHODE ISLAND	16	573,322	10	275,400	3	245,700			1	27,754	2	24,468	3	9,000	11,525
U OF R I-GRAD SCH OF OCEN	15	919,100	7	248,900	8	670,200									
INSTITUTION TOTAL	31	1,492,422	17	524,300	11	915,900			1	27,754	2	24,468	3	9,000	11,525
OTHER GRANTS & CONTRACTS	10	9,119							9	5,689	1	3,430			
STATE TOTAL		5,420,915		3,436,950		1,429,400		140,100		105,047		309,418		24,000	33,734
	128		80		14		3		16		15		8		
SOUTH CAROLINA															
BENEDICT COL	2	10,390									2	10,390			
BRKLY-CH-DRCHSTR TE ED CO	1	7,300									1	7,300			
CLAFLIN COL	1	154,000									1	154,000			
CLEMSON UNIV	9	218,270	5	147,800					1	27,727	3	42,743			
CONVERSE COL	1	1,090							1	1,090					
FRIENDSHIP JR COL	1	900									1	900			
FURMAN UNIV	5	60,919	1	9,100			1	30,600	1	5,499	2	15,720			
MED UNIV OF S CAROLINA	1	10,947							1	10,947			1	3,000	3,842
MORRIS COL	1	31,492									1	31,492			
SOUTH CAROLINA STATE COL	3	304,658							1	5,560	2	299,098			
UNIV OF SOUTH CAROLINA	15	423,141	6	239,300	1	11,000			1	11,535	7	161,306			
OTHER GRANTS & CONTRACTS	3	1,282							3	1,282					
STATE TOTAL		1,224,389		396,200		11,000		30,600		63,640		722,949		3,000	3,842
	43		12		1		1		9		20		1		
SOUTH DAKOTA															
AUGUSTANA COL	4	93,806			1	34,200			1	6,198	2	52,608			
DAKOTA STATE COLLEGE	1	5,548							1	5,548					
MT MARTY COL	1	5,458							1	5,458					

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS														FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
SOUTH DAKOTA															
NORTHERN STATE COL	2	20,590							1	1,090	1	19,500			
SIOUX FALLS COL	1	5,462							1	5,462					
SOUTH DAK SCH MINES TECH	4	158,815	3	142,800					1	16,015					
SOUTH DAKOTA STATE UNIV	3	35,837							1	22,687	2	13,150			
UNIV OF SOUTH DAKOTA	5	188,600					1	52,100	1	6,431	3	130,069			
OTHER GRANTS & CONTRACTS	3	1,865							3	1,865					
STATE TOTAL		515,173		142,800		34,200		52,100		70,746		215,327			
	24		3		1		1		11		8				
TENNESSEE															
AMER SOC OF PLANT TAXON	1	8,600	1	8,600											
AUSTIN PEAY STATE UNIV	3	172,892							1	1,635	2	171,257			
CARSON-NEWMAN COL	2	22,447							1	5,548	1	16,899			
CHRISTIAN BROTHERS COL	5	99,362	1	13,100					1	5,769	3	80,493			
EAST TENNESSEE STATE UNIV	1	7,556									1	7,556			
ENVIRONMENTAL MUTAGEN SOC	1	3,000	1	1,000				2,000							
FISK UNIV	2	59,164							1	6,002	1	53,162			
GEORGE PEABODY COL TCHRS	4	264,128					1	78,000	1	5,475	2	180,653			
LANE COL	1	13,600	1	13,600											
LE MOYNE-OWEN COL	1	5,487							1	5,487					
MEHARRY MEDICAL COL	1	10,892							1	10,892					
MEMPHIS STATE UNIV	5	70,020							1	9,911	4	60,109			
MIDDLE TENN STATE UNIV	1	78,748									1	78,748			
OAK RIDGE ASSOCIATED UNIV	2	72,060									2	72,060			
OAK RIDGE NAT LAB	6	3,528,708	2	2,110,800			4	1,417,900							
SOUTHWESTERN AT MEMPHIS	2	15,345	1	9,000					1	6,345					
TENNESSEE STATE UNIV	3	263,318							1	5,928	2	257,390			

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GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
TENNESSEE															
TENNESSEE TECHNOLOGL UNIV	7	106,886	1	16,800					1	6,382	5	83,704			
U OF TENN MED UNITS MEMPH	2	52,500	2	52,500									1	3,000	3,842
UNIV OF TENN AT CHATTNGA	1	25,740									1	25,740			
UNIV OF TENN SYSTEM OFF	1	7,208							1	7,208					
UNIV OF TENNESSEE	12	1,314,088	20	689,500	1	69,600	6	460,800	1	42,180	4	135,928	1	9,000	11,525
UNIV OF TENN SPACE INST	1	12,000	1	12,000											
INSTITUTION TOTAL	33	1,326,088	21	617,500	1	69,600	6	460,800	1	42,180	4	135,928	1	9,000	11,525
UNIV OF THE SOUTH	3	54,838							1	1,090	2	53,748			
VANDERBILT UNIV	31	983,629	21	793,500					1	25,415	9	164,714	1	3,000	3,842
VANDERBILT U-SCH OF MED	6	291,300	5	143,200			1	148,100							
INSTITUTION TOTAL	37	1,274,929	26	936,700			1	148,100	1	25,415	9	164,714	1	3,000	3,842
OTHER GRANTS & CONTRACTS	11	6,611					1	6	10	6,605					
STATE TOTAL		7,550,039		3,779,600		69,600		2,106,906		151,872		1,442,161		15,000	19,209
	136		57		1		13		25		40		5		
TEXAS															
ANGELO STATE UNIVERSITY	1	24,000	1	24,000											
AUSTIN COL	1	552,500									1	552,500			
BAYLOR COL OF MEDICINE	4	117,882	3	97,500					1	19,582					
BAYLOR UNIV	7	84,910	3	60,200					1	10,347	3	14,363			
BEE COUNTY COL	1	1,090							1	1,090					
BISHOP COL	3	255,152							1	5,977	2	249,175			
CLINGMAN AND COMPANY	1	6,400					1	6,400							
EAST TEXAS STATE UNIV	1	58,594									1	58,594			
HOUSTON BAPTIST COL	1	5,990							1	5,990					
INCARNATE WORD COL	1	11,147									1	11,147			
LAMAR UNIVERSITY	2	86,700	1	18,000			1	68,700							

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
TEXAS															
M D ANDERSON HOSPITAL	1	45,000	1	45,000											
MCLENNAN COMM COL	1	1,090							1	1,090					
NORTH TEXAS STATE UNIV	7	33,631							1	6,914	2	26,717			
OUR LADY OF THE LAKE COL	1	5,450							1	5,450					
PAN AMERICAN UNIVERSITY	1	1,090							1	1,090					
PRAIRIE VIEW A & M COL	4	54,449	2	37,200					1	6,772	1	10,477			
RICE UNIV	45	1,798,038	37	1,689,350			1	73,500	1	36,970	6	78,218	3	9,000	11,525
SAM HOUSTON STATE UNIV	3	58,480							1	5,450	2	53,030			
SOUTHERN METHODIST UNIV	15	442,457	9	186,980			2	213,800	1	14,729	3	27,028			
SOUTHWEST CTR-URBAN RES	1	263,700					1	263,700							
SOUTHWEST TEXAS ST UNIV	1	5,634							1	5,634					
ST EDWARDS UNIV	1	1,090							1	1,090					
ST MARYS UNIV SAN ANTONIO	1	1,090							1	1,090					
STEPHEN F AUSTIN ST UNIV	1	5,757							1	5,757					
SUL ROSS STATE UNIV	1	21,300	1	21,300											
TARLETON STATE COL	1	3,815							1	3,815					
TARRANT COUNTY JR COL	1	4,360							1	4,360					
TEXAS A & M UNIV	50	2,541,317	31	1,393,215	12	892,700			1	55,650	6	199,752			
TEXAS A & M UNIV SYS OFF													3	9,000	11,525
TEXAS ARTS & INDUST UNIV	3	23,794							1	5,524	2	18,270			
TEXAS CHRISTIAN UNIV	3	14,370							1	7,535	2	6,835			
TEXAS SOUTHERN UNIV	4	150,257							1	5,450	3	144,807			
TEXAS TECH UNIVERSITY	16	359,425	11	295,900	1	19,500			1	15,666	3	24,359	1	3,000	3,842
TEXAS WOMANS UNIV	2	51,493							1	6,039	1	45,454			
TRINITY UNIV	3	43,575							1	3,415	2	39,760			
U TEX MED BRNCH GALVESTON	2	58,500	1	4,900	1	53,600									
UNIV OF HOUSTON	16	746,411	9	262,100			2	410,200	1	21,428	4	52,683	1	3,000	3,842

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
TEXAS															
UNIV OF ST THOMAS	1	6,039							1	6,039					
UNIV OF TEXAS ARLINGTON	2	5,824							1	5,806	1	18			
UNIV OF TEXAS AT AUSTIN	91	4,075,348	73	2,628,000			3	448,300	5	155,625	10	843,423	11	33,000	42,260
UNIV TEX AUS-MAR SCI INST	2	307,800			2	307,800									
UNIV TEX AUS-MCDONALD OBS	1	43,888	1	43,000											
INSTITUTION TOTAL	94	4,426,148	74	2,671,800	2	307,800	3	448,300	5	155,625	10	843,423	11	33,000	42,260
UNIV OF TEXAS AT DALLAS	17	534,993	15	489,400	1	15,000			1	30,593			1	3,000	3,842
UNIV OF TEXAS AT EL PASO	4	69,637	1	18,400					1	8,451	2	42,786			
UNIV OF TEXAS SYSTEM OFF	1	16,984							1	16,984					
UNIV. OF TEXAS HEALTH CTR															
UNIV OF TEXAS MEDICAL SCH	1	36,000	1	36,000											
UNIV. OF TEX MEDICAL SCH	1	1,000	1	1,000											
UNIV. OF TEX S.W. MED SCH	3	136,900	3	136,900											
UNIV. TEX GRAD,BIOMED SC	1	24,000	1	24,000											
INSTITUTION TOTAL	6	197,900	6	197,900											
WEST TEXAS STATE UNIV	1	7,600									1	7,600			
OTHER GRANTS & CONTRACTS	35	94,294			3	42,288			32	52,006					
STATE TOTAL		13,298,469		7,432,265		1,330,888		1,484,600		539,728		2,510,988		60,000	76,836
	365		286		28		11		69		59		20		
UTAH															
BRIGHAM YOUNG UNIV	7	161,974	5	150,400							2	11,574			
SNOW COLLEGE	1	2,725							1	2,725					
UNIV OF UTAH	55	1,882,578	45	1,388,120	1	34,300	1	247,000	1	47,080	7	174,070	2	5,000	7,683
U OF UTAH-COL OF MED	1	28,880	1	28,880											
INSTITUTION TOTAL	56	1,822,578	46	1,320,120	1	34,300	1	247,000	1	47,080	7	174,070	2	5,000	7,683
UTAH STATE UNIV	20	2,036,617	7	1,623,100	2	16,700	3	184,100	3	59,660	5	143,067	1	3,000	3,842

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
UTAH															
WEBER STATE COL	3	40,659	1	20,500					1	5,609	1	14,550			
WESTMINSTER COL	1	37,629									1	37,629			
OTHER GRANTS & CONTRACTS	5	4,601	1	1,500					4	3,101					
STATE TOTAL		4,108,775		3,115,620		51,000		431,100		128,165		380,890		9,000	11,525
	93		60		3		4		10		15		3		
VERMONT															
BENNINGTON COL	1	18,957									1	18,957			
MIDDLEBURY COL	3	14,395							1	5,695	2	8,700			
NORWICH UNIV	1	1,090							1	1,090					
TRINITY COL	1	8,374							1	8,374					
UNIV OF VERMONT	6	78,085	3	52,300					1	18,138	2	7,647			
UNIV OF VT-COL OF MED	1	15,000	1	15,000											
INSTITUTION TOTAL	7	93,085	4	67,300					1	18,138	2	7,647			
WINDHAM COL	1	1,635							1	1,635					
STATE TOTAL		137,536		67,300						34,932		35,304			
	14		4						5		5				
VIRGINIA															
AMER SOC OF PHOTOGRAMM	1	65,000							1	65,000					
BRIDGEWATER COL	1	1,090							1	1,090					
COL OF WILLIAM AND MARY	7	160,186	1	72,600			1	61,400	1	8,331	4	17,855			
ECO SYSTEMS, INC	1	52,926			1	52,926									
EXOTECH SYSTEMS INC	5	330,179							1	39,968	4	290,211			
FORECASTING INTRNATL, LTD	4	91,600			2	55,600	2	36,000							
GEORGE MASON UNIVERSITY	1	6,000									1	6,000			
HAMPDEN-SYDNEY COL	3	9,450							1	3,270	2	6,180			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NATL NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
VIRGINIA															
HAMPTON INST	1	5,879							1	5,879					
HOLLINS COL	2	12,325							1	5,695	1	6,630			
INST FOR DEFENSE ANALYSES	2	101,800			2	101,800									
MADISON COL	3	26,196							1	1,090	2	25,106			
MITRE CORPORATION															
THE MITRE CORPORATION	5	2,362,334		28,000			2	182,534			3	2,159,800			
NORTHERN VIRGINIA COMM CO	1	5,450							1	5,450					
OLD DOMINION UNIV	3	54,793							1	13,290	2	41,503			
RADFORD COL	1	34,603									1	34,603			
RANDOLPH-MACON COL	1	5,450							1	5,450					
RANDOLPH-MACON WOMANS COL	2	37,385							1	5,658	1	31,727			
ROANOKE COL	1	5,548							1	5,548					
SPACE RADIATION EFFECTS L	1	261,100	1	261,100											
SWEET BRIAR COL	2	9,090							1	1,090	1	8,000			
UNIV OF VIRGINIA	45	1,716,302	36	1,190,900	3	283,900	1	61,400	1	30,948	4	149,154	2	6,000	7,697
U OF VA-SCH OF MED	6	239,500	6	239,500											
INSTITUTION TOTAL	51	1,955,802	42	1,430,400	3	283,900	1	61,400	1	30,948	4	149,154	2	6,000	7,697
VA COMMONWEALTH UNIV	1	11,394							1	11,394					
VA COMONWLTH U-HEALTH SCI	1	43,300	1	43,300											
INSTITUTION TOTAL	2	54,694	1	43,300					1	11,394					
VA INST OF MARINE SCIENCE	3	105,100	3	105,100											
VIRGINIA MILITARY INST	2	14,667							1	5,584	1	9,083			
VIRGINIA POLYTECHNIC INST	40	1,311,306	26	812,700	3	119,700	3	210,500	1	32,773	7	136,031	2	6,000	7,644
VIRGINIA STATE COL	4	274,603	1	10,000					1	5,634	2	258,969			
WASHINGTON & LEE UNIV	1	45,200	1	45,200											
WETA/CHANNEL 26	1	34,000									1	34,000			
OTHER GRANTS & CONTRACTS	55	66,329	3	18,195	13	7,499	6	14,139	31	26,054	2	442			

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GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
VIRGINIA															
STATE TOTAL		7,500,085		2,818,195		621,425		565,973		279,196		3,215,296		12,000	15,366
	207		79		24		15		50		39		4		
WASHINGTON															
BATTELLE MEMORIAL INST															
BATELLE MEM INST BATT NW	4	331,500	1	38,200	1	39,600	2	253,700							
CENTRAL WASH STATE COL	3	66,090	2	65,000					1	1,090					
EASTERN WASH STATE COL	2	34,250							1	1,090	1	33,160			
EVERGREEN STATE COLLEGE	1	50,000									1	50,000			
FDN GLACIER & ENVRNL RES	1	9,075									1	9,075			
PACIFIC LUTHERAN UNIV	2	14,434							1	5,634	1	8,800			
SEATTLE COMM COL	1	7,099							1	7,099					
SEATTLE UNIV	2	65,928									2	65,928			
SPOKANE WORLD EXPOSITION	1	50,000									1	50,000			
TACOMA, CITY OF	1	2,000					1	2,000							
UNIV OF PUGET SOUND	2	42,456							1	6,517	1	35,939			
UNIV OF WASHINGTON	145	11,583,498	117	6,467,650	11	3,768,800	8	923,300	3	101,753	6	321,995	16	48,000	61,459
U OF WASH-PRESS	1	30,000	1	30,000											
INSTITUTION TOTAL	146	11,613,498	118	6,497,650	11	3,768,800	8	923,300	3	101,753	6	321,995	16	48,000	61,459
WALLA WALLA COL	2	14,988							1	5,818	1	9,091			
WASHINGTON STATE UNIV	35	1,154,590	25	838,380					1	32,376	9	283,914			
WESTERN WASH STATE COL	7	175,809							1	7,121	6	168,688			
WHITMAN COL	1	12,698									1	12,698			
OTHER GRANTS & CONTRACTS	13	54,844	1	4,265	1	42,578			11	8,039					
STATE TOTAL		13,699,179		7,443,415		3,850,970		1,179,000		176,507		1,049,287		48,000	61,459
	224		147		13		11		22		31		16		

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GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
WEST VIRGINIA															
ARCADIA INST SCI RES INC	1	5,000	1	5,000											
BETHANY COL	2	58,358									2	58,358			
FAIRMONT STATE COL	1	1,090							1	1,090					
NAT RADIO ASTRON OBSERV	3	9,785,000			3	9,785,000									
WEST VIRGINIA INST TECH	1	11,710							1	11,710					
WEST VIRGINIA STATE COL	1	19,900	1	19,900											
WEST VIRGINIA UNIV	13	377,070	4	87,800			1	124,500	1	29,972	7	134,798			
WEST VA UNIV-SCH OF MED	1	31,300	1	31,300											
INSTITUTION TOTAL	14	408,378	5	119,100			1	124,500	1	29,972	7	134,798			
WEST VIRGINIA WESLEYN COL	1	5,462							1	5,462					
WHEELING COL	1	1,090							1	1,090					
OTHER GRANTS & CONTRACTS	1	661							1	661					
STATE TOTAL		10,296,641		144,000		9,785,000		124,500		49,985		193,156			
	26		7		3		1		6		9				
WISCONSIN															
BELOIT COL	3	18,784							1	5,904	2	12,880			
CARROLL COL	2	8,168							1	4,360	1	3,808			
INST OF PAPER CHEMISTRY	1	1,635							1	1,635					
INSTITUTE OF ECOLOGY	3	162,609	1	16,309	1	52,000	1	94,300							
LAWRENCE UNIV	3	97,848							1	5,548	2	92,300			
MARQUETTE UNIV	10	198,384	4	113,580					1	9,203	5	75,681			
MEDICAL COLLEGE OF WISC	5	160,135	4	152,000					1	8,135					
RIPON COL	2	28,560							1	5,450	1	15,110			
ST NORBERT COL	1	1,090							1	1,090					
UNIV OF WIS CENTERS															
U W CTR-MARINETTE COUNTY	1	2,700									1	2,700			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
WISCONSIN															
UNIV OF WIS-EAU CLAIRE	1	7,753							1	7,753					
UNIV OF WIS-GREEN BAY	2	23,987							1	6,598	1	17,389			
UNIV OF WIS-LA CROSSE	3	86,448							1	5,511	2	78,937			
UNIV OF WIS-MADISON	167	7,714,977	134	6,748,470	11	395,500	7	664,520	4	114,323	11	392,224	59	165,000	211,299
UNIV OF WIS-MILWAUKEE	23	781,422	16	478,400	1	212,700			1	13,192	5	76,733	1	3,000	3,842
UNIV OF WIS-OSHKOSH	5	77,487							1	5,487	4	72,000			
UNIV OF WIS-PARKSIDE	1	5,560							1	5,560					
UNIV OF WIS-RIVER FALLS	1	34,346									1	34,346			
UNIV OF WIS-STEVENS POINT	4	46,136							1	5,671	3	40,465			
UNIV OF WIS-STOUT	1	7,143							1	7,143					
UNIV OF WIS-SUPERIOR	4	169,395									4	169,395			
UNIV OF WIS-WHITEWATER	4	45,405	1	6,200					1	1,090	2	38,115			
UNIV OF WISCONSIN CTR	1	5,524							1	5,524					
UNIV OF WISCONSIN MADISON															
U OF WISC-MADISON-MED SCH	2	47,700	2	47,700											
UNIV OF WISCONSIN SYS OFF	1	53,644									1	53,644			
VITERBO COL	1	4,780									1	4,780			
OTHER GRANTS & CONTRACTS	17	11,904							17	11,904					
STATE TOTAL		9,393,436		6,562,939		660,200		758,800		231,081		1,180,416		168,000	215,141
	269		162		13		8		39		47		56		
WYOMING															
UNIV OF WYOMING	25	1,003,558	14	479,400	2	67,700	2	131,300	1	25,444	6	318,705	1	3,000	3,842
OTHER GRANTS & CONTRACTS	2	848							2	848					
STATE TOTAL		1,004,398		479,400		67,700		131,300		26,292		318,705		3,000	3,842
	27		14		2		2		3		6		1		
UNITED STATES TOTAL		523,526,166		274,196,317		101,363,289		54,961,835		23,736,129		59,299,076		4,407,030	5,642,746
	13,396		6,129		533		533		1,478		1,623		1,469		

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
FEDERAL GOVERNMENT															
ATOMIC ENERGY COMMISSION															
AEC-ALBUQUERQUE OPS OFF	1	20,600					1	20,600							
AEC-CHICAGO OPER OFFICE	1	398,000					1	398,000							
AEC-OAK RIDGE OP OFFICE	7	2,338,900	1	1,500			6	2,329,400							
AEC-SAN FRAN OPER OFFICE	9	1,447,100	1	5,000			8	1,442,100							
ATOMIC ENERGY COMMISSION	2	251,700	1	162,000			1	89,700							
AGENCY TOTAL		4,448,300		168,500				4,271,800							
	20		3				17								
COUNCIL ON ENVRNMTL QLITY															
COUNCIL ON ENVRNMTL QLITY	1	74,950					1	74,950							
AGENCY TOTAL		74,950						74,950							
	1						1								
DEPARTMENT OF AGRICULTURE															
AGR RESEARCH SERVICE	1	5,980							1	5,980					
DEPARTMENT OF AGR	1	65,000					1	65,000							
AGENCY TOTAL		70,980						65,000		5,980					
	2						1		1						
DEPARTMENT OF COMMERCE															
BUREAU OF THE CENSUS	4	384,800					1	10,300	3	374,500					
DEPARTMENT OF COMMERCE	1	80,000					1	80,000							
MARITIME ADMINISTRATION	1	15,000			1	15,000									
NAT BUREAU OF STANDARDS	6	1,051,550	2	274,000			4	777,550							

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
DEPARTMENT OF COMMERCE															
NATIONAL TECH INFO SERV	2	141,500							2	141,500					
NATL OCEANIC ATMOS ADMIN	7	875,500	1	3,000	5	828,500	1	44,000							
NOAA-ATLANTIC OCML-MGL&GL	1	202,000			1	202,000									
NOAA-ENVIRON RESEARCH LAB	4	175,833	2	102,300	1	34,500	1	39,033							
DEPARTMENT TOTAL	12	1,253,333	3	105,300	7	1,065,000	2	83,033							
NOAA AT BOULDER	1	141,750	1	141,750											
NOAA	1	53,000			1	53,000									
AGENCY TOTAL		3,128,933		521,050		1,133,000		950,883		516,000					
	28		6		9		8		5						
DEPARTMENT OF DEFENSE															
DEPARTMENT OF ARMY															
ARMY-CRREL	4	428,700			4	428,700									
ARMY-WATERWAYS EXP STA	1	125,000					1	125,000							
CORPS OF ENGINEERS	3	175,097			3	175,097									
DEPARTMENT TOTAL	8	728,797			7	603,797	1	125,000							
DEPARTMENT OF DEFENSE	5	17,992,000			5	17,992,000									
DEPARTMENT OF NAVY	2	19,795,300			1	19,740,000			1	55,300					
D NAVY-NAV FAC & ENG COMM	1	65,000			1	65,000									
DEPT NAVY-AIR SYSTEMS COM	2	13,100			2	13,100									
DEPT OF NAVY-ORD SYS COMM	1	20,000			1	20,000									
MIL SEA TRANS SERV	4	1,455,000			4	1,455,000									
NAVAL RESEARCH LAB	1	41,250			1	41,250									
NAVY SUBSISTENCE OFFICE	1	40,000			1	40,000									
NAVY-NAV ORD MIS TEST FAC	1	2,500			1	2,500									
NAVY-NAVAL OCEANOGRAP OFF	1	27,200			1	27,200									
NAVY-PUBLICATION&PRINTING	1	2,000			1	2,000									

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
DEPARTMENT OF DEFENSE															
OFFICE OF NAVAL RES	7	2,752,000	3	137,000	4	2,615,000									
DEPARTMENT TOTAL	22	24,213,350	3	137,000	16	24,821,050			1	55,300					
DEPT OF AIR FORCE															
DEPT-AIR FORCE-RAMEY AFB	1	29,000			1	29,000									
AGENCY TOTAL		42,963,147		137,000		42,645,847		125,000		55,300					
	36		3		31		1		1						
DEPARTMENT OF INTERIOR															
BUREAU OF RECLAMATION															
BUR RECLAM-ENGERES CTR	1	4,000					1	4,000							
DEPARTMENT OF INTERIOR	2	245,000					2	245,000							
GEOLOGICAL SURVEY	3	219,530			2	214,250					1	5,280			
AGENCY TOTAL		468,530				214,250		249,000				5,280			
	6				2		3				1				
DEPARTMENT OF STATE															
DEPARTMENT OF STATE	3	114,400					1	103,400	2	11,000					
AGENCY TOTAL		114,400						103,400		11,000					
	3						1		2						
ENVIRON PROTECTION AGENCY															
ENVIRON PROTECTION AGENCY	3	129,803			3	129,803									
AGENCY TOTAL		129,803				129,803									
	3				3										

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
GENERAL SERVICES ADMIN.															
GENERAL SERVICES ADMIN	1	74			1	74									
AGENCY TOTAL		74				74									
	1				1										
HOUSING&URBAN DEVELOPMENT															
HOUSING&URBAN DEVELOPMENT	1	20,000					1	20,000							
AGENCY TOTAL		20,000						20,000							
	1						1								
LIBRARY OF CONGRESS															
LIBRARY OF CONGRESS	2	117,450			1	111,870			1	5,580					
AGENCY TOTAL		117,450				111,870				5,580					
	2				1				1						
NATL AERO & SPACE ADMIN															
NASA	4	156,800			1	15,000	2	140,200	1	1,600					
NASA-AMES RESEARCH CTR	1	257,000					1	257,000							
NASA-LEWIS RESEARCH CTR	1	11,700					1	11,700							
DEPARTMENT TOTAL	6	425,500			1	15,000	4	408,900	1	1,600					
NAT AERO & SPACE ADMIN															
MARSHALL SPACE FL CTR MIS	1	83,572			1	83,572									
AGENCY TOTAL		509,072				98,572		408,900		1,600					
	7				2		4		1						

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NATL INSTITUTES OF HEALTH															
HEALTH-INST MENTAL HEALTH	2	11,000							2	11,000					
AGENCY TOTAL	2	11,000							2	11,000					
SMITHSONIAN INSTITUTION															
SMITHSONIAN INSTITUTION	7	567,911	2	216,496	2	212,300			1	105,655	2	33,460			
AGENCY TOTAL	7	567,911	2	216,496	2	212,300			1	105,655	2	33,460			
FEDERAL GOVERNMENT TOTAL	119	52,688,550	14	1,843,046	51	44,545,716	37	6,268,933	14	712,115	3	38,740			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
U.S. POSSESSIONS															
PUERTO RICO															
INTER AMER UNIV OF P R	1	43,657									1	43,657			
NATIONAL ASTRON, IONOSPHER	3	3,144,000			3	3,144,000									
UNIV OF P R MAYAGUEZ	5	127,042	2	93,000					1	12,342	2	21,700			
UNIV OF P R RIO PIEDRAS	2	43,235	1	20,500					1	22,735					
UNIV OF P R SAN JUAN	1	71,300	1	71,300											
UNIV OF P R SYS OFF	1	17,032							1	17,032					
POSSESSION TOTAL	13	3,446,266	4	184,800	3	3,144,000			3	52,109	3	65,357			
VIRGIN ISLANDS															
COL OF VIRGIN ISLANDS	2	25,565	1	15,700					1	8,865					
POSSESSION TOTAL	2	25,565	1	16,700					1	8,865					
U.S. POSSESSIONS TOTAL	15	3,471,831	5	201,500	3	3,144,000			4	60,974	3	65,357			

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
FOREIGN COUNTRIES															
BERMUDA															
BERMUDA BIOL STA FOR RES	3	56,100	1	15,100	2	41,000									
COUNTRY TOTAL	3	56,100	1	15,100	2	41,000									
CANADA															
DEPT ENRGY MINES&RESOURCE	2	71,500			2	71,500									
UNIV OF BRITISH COLUMBIA													4	2,000	15,367
UNIV OF WESTERN ONTARIO													1	500	3,842
UNIVERSITY OF GUELPH	1	23,000			1	23,000									
UNIVERSITY OF OTTAWA	1	7,300	1	7,300											
OTHER GRANTS & CONTRACTS	1	577							1	577					
COUNTRY TOTAL	5	102,377	1	7,300	3	94,500			1	577			5	2,500	19,209
COSTA RICA															
ORGAN FOR TROPICL STUDIES	4	368,061	4	368,061											
COUNTRY TOTAL	4	368,061	4	368,061											
DENMARK															
TECH UNIV OF DENMARK	1	29,700			1	29,700									
COUNTRY TOTAL	1	29,700			1	29,700									

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
ENGLAND															
CAMBRIDGE UNIV													4	2,000	15,367
OXFORD UNIV													4	2,000	15,367
UNIV OF LONDON													2	1,000	7,683
UNIV OF MANCHESTER													1	500	3,842
UNIV OF SUSSEX													1	500	3,842
OTHER GRANTS & CONTRACTS	1	532							1	532					
COUNTRY TOTAL	1	532							1	532			12	6,000	46,101
FRANCE															
UNESCO	1	50,000			1	50,000									
OTHER GRANTS & CONTRACTS	1	88,550							1	88,550					
COUNTRY TOTAL	2	138,550			1	50,000			1	88,550					
INDIA															
CENTRAL DRUG RES INST	1	1,558							1	1,558					
OTHER GRANTS & CONTRACTS	7	11,938							7	11,938					
COUNTRY TOTAL	8	13,496							8	13,496					
MEXICO															
UNIV NAC AUTONO DE MEXICO	1	12,000	1	12,000											
COUNTRY TOTAL	1	12,000	1	12,000											

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GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
N IRELAND															
OTHER GRANTS & CONTRACTS	1	270							1	270					
COUNTRY TOTAL		270								270					
	1								1						
NEW ZEALAND															
CANTERBURY MUSEUM	1	50,000									1	50,000			
OTHER GRANTS & CONTRACTS	1	1,490							1	1,490					
COUNTRY TOTAL		51,490								1,490		50,000			
	2								1		1				
SCOTLAND															
UNIV OF EDINBURGH	1	30,000	1	30,000											
UNIV OF GLASGOW													1	500	1,842
COUNTRY TOTAL		30,000		30,000										500	1,842
	1		1										1		
SWEDEN															
UNIV OF UPPSALA													1	500	1,842
COUNTRY TOTAL														500	1,842
													1		
SWITZERLAND															
UNIV OF BERN	1	33,200			1	33,200									
COUNTRY TOTAL		33,200				33,200									
	1				1										

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL' Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
OTHER GRANTS & CONTRACTS	1	930							1	930					
COUNTRY TOTAL		930								930					
	1								1						
FOREIGN COUNTRIES TOTAL		936,786		432,451		248,400				135,845		50,000		9,500	72,994
	31		8		4				14		1		19		
GRAND TOTAL		580,443,453		279,863,044		149,301,405		71,210,764		24,615,763		55,453,173		4,416,500	5,715,740
	10,561		6,156		595		670		1,510		1,630		1,488		

Grants and Contracts Awarded from Appropriation 493/40102, Scientific Activities, Special Foreign Currency Program

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL INPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
CALIFORNIA															
STANFORD RESEARCH INST	1	33,468	1	33,468											
UNIV OF CAL BERKELEY	2	168,868	2	168,868											
UNIV OF CAL LOS ANGELES		6,680		6,680											
OTHER GRANTS & CONTRACTS	3	2,324							3	2,324					
STATE TOTAL		202,392		208,868						2,324					
	6		3						3						
COLORADO															
OTHER GRANTS & CONTRACTS	1	1,723							1	1,723					
STATE TOTAL		1,723								1,723					
	1								1						
DELAWARE															
UNIV OF DELAWARE	1	15,309	1	15,309											
STATE TOTAL		15,309		15,309											
	1		1												
DISTRICT OF COLUMBIA															
AMER INST OF BIOL SCI	1	15,888	1	15,888											
OTHER GRANTS & CONTRACTS	1	50,590							1	50,590					
STATE TOTAL		65,598		15,888						50,590					
	2		1						1						

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
GEORGIA															
OTHER GRANTS & CONTRACTS	1	1,343							1	1,343					
STATE TOTAL		1,343								1,343					
	1								1						
HAWAII															
OTHER GRANTS & CONTRACTS	2	1,503							2	1,503					
STATE TOTAL		1,503								1,503					
	2								2						
ILLINOIS															
OTHER GRANTS & CONTRACTS	4	5,530							4	5,530					
STATE TOTAL		5,530								5,530					
	4								4						
INDIANA															
OTHER GRANTS & CONTRACTS	2	1,775							2	1,775					
STATE TOTAL		1,775								1,775					
	2								2						
MARYLAND															
OTHER GRANTS & CONTRACTS	1	880							1	880					
STATE TOTAL		880								880					
	1								1						

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MASSACHUSETTS															
OTHER GRANTS & CONTRACTS	3	3,821							3	3,821					
STATE TOTAL		3,821								3,821					
	3								3						
MINNESOTA															
OTHER GRANTS & CONTRACTS	1	647							1	647					
STATE TOTAL		647								647					
	1								1						
MISSOURI															
OTHER GRANTS & CONTRACTS	1	1,327							1	1,327					
STATE TOTAL		1,327								1,327					
	1								1						
MONTANA															
UNIV OF MONTANA	1	7,181	1	7,181											
STATE TOTAL		7,181		7,181											
	1		1												
NEW YORK															
FRANKLIN BOOK PROG INC	1	150,080							1	150,080					
OTHER GRANTS & CONTRACTS	4	4,785	1	2,700					3	2,085					
STATE TOTAL		154,785		2,700						152,085					
	5		1						4						

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
NORTH CAROLINA															
OTHER GRANTS & CONTRACTS	1	477							1	477					
STATE TOTAL		477								477					
	1								1						
OHIO															
OTHER GRANTS & CONTRACTS	1	1,707							1	1,707					
STATE TOTAL		1,707								1,707					
	1								1						
OKLAHOMA															
OKLAHOMA STATE UNIV		132,140		132,140											
STATE TOTAL		132,140		132,140											
OREGON															
OTHER GRANTS & CONTRACTS	1	1,994							1	1,994					
STATE TOTAL		1,994								1,994					
	1								1						
PENNSYLVANIA															
OTHER GRANTS & CONTRACTS	2	2,829							2	2,829					
STATE TOTAL		2,829								2,829					
	2								2						

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
RHODE ISLAND															
OTHER GRANTS & CONTRACTS	2	910							2	910					
STATE TOTAL		910								910					
	2								2						
SOUTH CAROLINA															
UNIV OF SOUTH CAROLINA	1	34,570	1	34,570											
STATE TOTAL		34,570		34,570											
	1		1												
SOUTH DAKOTA															
OTHER GRANTS & CONTRACTS	1	887							1	887					
STATE TOTAL		887								887					
	1								1						
TEXAS															
OTHER GRANTS & CONTRACTS	3	4,655							3	4,655					
STATE TOTAL		4,655								4,655					
	3								3						
WASHINGTON															
OTHER GRANTS & CONTRACTS	1	1,118							1	1,118					
STATE TOTAL		1,118								1,118					
	1								1						

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
WISCONSIN															
OTHER GRANTS & CONTRACTS	1	887							1	887					
STATE TOTAL		887								887					
	1								1						
UNITED STATES TOTAL		645,980		406,968						239,012					
	45		8						37						

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT. GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
BURMA															
OTHER GRANTS & CONTRACTS	1	161							1	161					
COUNTRY TOTAL		161								161					
	1								1						
GUINEA															
OTHER GRANTS & CONTRACTS	1	900							1	900					
COUNTRY TOTAL		900								900					
	1								1						
INDIA															
AMERIND PUBLISHING CO,LTD	1	150,000							1	150,000					
ANDHRE UNIVERSITY	1	64,186	1	64,186											
BANARAS HINDU UNIVERSITY	1	42,242	1	42,242											
BOSE INSTITUTE	1	40,000	1	40,000											
INDIAN INST TECH, MADRAS	1	11,218	1	11,218											
INDIAN INST TECH, N DELHI	2	67,827	2	67,827											
MAHARASHTRA ASSN CULT SCI	1	33,856	1	33,856											
PANJAB UNIVERSITY	1	14,156	1	14,156											
SARDAR PATEL UNIVERSITY	1	23,578	1	23,578											
OTHER GRANTS & CONTRACTS	1	3,963							1	3,963					
COUNTRY TOTAL		449,338		295,375						153,963					
	11		9						2						

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS														FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
MOROCCO															
OTHER GRANTS & CONTRACTS	1	11							1	11					
COUNTRY TOTAL		11								11					
	1								1						
PAKISTAN															
OTHER GRANTS & CONTRACTS	1	11,900							1	11,900					
COUNTRY TOTAL		11,900								11,900					
	1								1						
POLAND															
CENTRAL INST FOR SCI TECH	1	300,000							1	300,000					
POLISH ACADEMY OF SCIENCE	1	1,391,259	1	1,391,259											
RES CTR FOR MONOCRYSTALS	1	68,492	1	68,492											
TECHNICAL UNIV OF WARSAW	1	76,444	1	76,444											
UNIVERSITY OF WARSAW	2	418,617	2	418,617											
OTHER GRANTS & CONTRACTS	1	32,070							1	32,070					
COUNTRY TOTAL		2,286,882		1,954,812						332,070					
	7		5						2						
TUNISIA															
AGENCE TUNISIENNE PUB REL	1	100,000							1	100,000					
CTR ECON & SOCIAL RES	1	5,369	1	5,369											
NATIONAL SCH OF ENGRG	1	132,000	1	132,000											
UNIVERSITY OF TUNIS	1	5,000							1	5,000					
OTHER GRANTS & CONTRACTS	1	3,350							1	3,350					
COUNTRY TOTAL		245,719		137,369						108,350					
	5		2						3						

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS														FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
UNITED ARAB REPUBLIC															
AMERICAN UNIV OF CAIRO	3	35,694	3	35,694											
UNIV OF ALEXANDRIA	2	117,000	2	117,000											
OTHER GRANTS & CONTRACTS	5	34,694	1	1,899					4	32,799					
COUNTRY TOTAL		188,188		155,389						32,799					
	10		6						4						
YUGOSLAVIA															
JOZEF STEFAN NUCLEAR INST	1	11,500	1	11,500											
NOLIT PUBLISHING HOUSE	1	50,000							1	50,000					
UNIV OF LJUBLJANA	1	248,000	1	248,000											
UNIV OF SARAJEVO	1	94,000	1	94,000											
UNIVERSITY OF SKOPJE	1	115,000	1	115,000											
OTHER GRANTS & CONTRACTS	1	2,365							1	2,365					
COUNTRY TOTAL		512,865		468,500						52,365					
	6		4						2						
FOREIGN COUNTRIES TOTAL		3,695,964		3,003,445						692,519					
	43		26						17						
GRAND TOTAL		4,341,944		3,410,413						931,531					
	86		34						54						

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
CALIFORNIA	6	202	3	200					3	2					
COLORADO	1	2							1	2					
DELAWARE	1	15	1	15											
DISTRICT OF COLUMBIA	2	66	1	15					1	51					
GEORGIA	1	1							1	1					
HAWAII	2	2							2	2					
ILLINOIS	4	6							4	6					
INDIANA	2	2							2	2					
MARYLAND	1	1							1	1					
MASSACHUSETTS	3	4							3	4					
MINNESOTA	1	1							1	1					
MISSOURI	1	1							1	1					
MONTANA	1	7	1	7											
NEW YORK	5	155	1	3					4	152					
NORTH CAROLINA	1								1						
OHIO	1	2							1	2					
OKLAHOMA		132		132											
OREGON	1	2							1	2					
PENNSYLVANIA	2	3							2	3					
RHODE ISLAND	2	1							2	1					
SOUTH CAROLINA	1	35	1	35											
SOUTH DAKOTA	1	1							1	1					
TEXAS	3	5							3	5					
WASHINGTON	1	1							1	1					
WISCONSIN	1	1							1	1					
UNITED STATES TOTAL	45	646	8	407					37	239					

GRANTEE OR CONTRACTOR	PROGRAM GRANTS AND CONTRACTS												FELLOWSHIPS		
	TOTAL		SCIENTIFIC RESEARCH PROJECT SUPPORT		NATL & SPC RES PGM NATL RSCH CTRS		RES APPL TO NAT'L NEEDS INT-GVMTL SCI PROG		SCIENCE INFO ACT PLN'G & POL'Y STDY'S INTRNL COOP SCIEN ACT INSTL IMPVT		SCIENCE EDUCATION SUPPORT			Amount	
	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	Amount	No.	INSTITUTION	INDIVIDUAL
FOREIGN COUNTRIES TOTAL	43	3,696	26	3,883					17	693					
GRAND TOTAL	88	4,342	34	3,418					54	932					

93D CONGRESS, 2d Session } HOUSE OF REPRESENTATIVES { REPORT No. 93-1302

NATIONAL SCIENCE FOUNDATION AUTHORIZATION ACT, 1975

AUGUST 19, 1974.—Ordered to be printed

Mr. TEAGUE, from the committee of conference, submitted the following

CONFERENCE REPORT

[To accompany H.R. 13999]

The committee of conference on the disagreeing votes of the two Houses on the amendment of the Senate to the bill (H.R. 13999) to authorize appropriations for activities of the National Science Foundation, and for other purposes, having met, after full and free conference, have agreed to recommend and do recommend to their respective Houses as follows:

That the House recede from its disagreement to the amendment of the Senate and agree to the same with an amendment as follows:

In lieu of the matter proposed to be inserted by the Senate amendment insert the following:

That there is hereby authorized to be appropriated to the National Science Foundation for the fiscal year ending June 30, 1975, for the following categories:

(1) *Scientific Research Project Support, $358,700,000.*
(2) *National and Special Research Programs, $91,900,000.*
(3) *National Research Centers, $52,500,000.*
(4) *Science Information Activities, $6,300,000.*
(5) *International Cooperative Scientific Activities, $8,000,000.*
(6) *Research Applied to National Needs, $148,900,000.*
(7) *Intergovernmental Science Program, $2,000,000.*
(8) *Institutional Improvement for Science, $12,000,000.*
(9) *Graduate Student Support, $15,000,000.*
(10) *Science Education Improvement, $70,000,000.*
(11) *Planning and Policy Studies, $2,700,000.*
(12) *Program Development and Management, $39,500,000.*

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SEC. 2. Notwithstanding any other provision of this or any other Act—

(a) of the total amount authorized under section 1, not less than $10,000,000 shall be available for the purpose of "Institutional Improvement for Science";

(b) of the total amount authorized under section 1, not less than $15,000,000 shall be available for the purpose of "Graduate Student Support";

(c) of the total amount authorized under section 1, not less than $70,000,000 shall be available for the purpose of "Science Education Improvement";

(d) of the total amount authorized in category (2) of section 1—

(1) not less than $1,600,000 shall be available for "Experimental R. & D. Incentives", and

(2) not less than $4,000,000 shall be available for "Ship Construction/Conversion";

(e) of the total amount authorized in category (6) of section 1—

(1) not less than $1,000,000 shall be available for "Fire Research", and

(2) not less thon $8,000,000 shall be available for "Earthquake Research and Engineering"; and

(f) of the total amount authorized in category (10) of section 1—

(1) not less than $1,500,000 shall be available for "Science Faculty Fellowships for College Teachers",

(2) not less than $3,800,000 shall be available for "Student Programs" including "Undergraduate Student Projects" and "Student Originated Studies", and

(3) not less than $2,000,000 shall be available for "High School Student Projects".

SEC. 3. Appropriations made pursuant to this Act may be used, but not to exceed $5,000, for official consultation, representation, or other extraordinary expenses upon the approval or authority of the Director of the National Science Foundation, and his determination shall be final and conclusive upon the accounting officers of the Government.

SEC. 4. In addition to such sums as are authorized by section 1, not to exceed $5,000,000 is authorized to be appropriated for the fiscal year ending June 30, 1975, for expenses of the National Science Foundation incurred outside the United States to be paid for in foreign currencies which the Treasury Department determines to be excess to the normal requirements of the United States.

SEC. 5. Appropriations made pursuant to sections 1 and 4 shall remain available for obligation, for expenditure, or for obligation and expenditure, for such period or periods as may be specified in Acts making such appropriations.

SEC. 6. No funds may be transferred from any particular category listed in section 1 to any other category or categories listed in such section if the total of the funds so transferred from that particular category would exceed 10 per centum thereof, and no funds may be transferred to any particular category listed in section 1 from any other category or categories listed in such section if the total of the funds so transferred to that particular category would exceed 10 per centum thereof, unless—

(A) a period of thirty legislative days has passed after the Director or his designee has transmitted to the Speaker of the House of Representatives and to the President of the Senate and to the Committee

on Science and Astronautics of the House of Representatives and to the Committee on Labor and Public Welfare of the Senate a written report containing a full and complete statement concerning the nature of the transfer and the reason therefor, or

(B) each such committee before the expiration of such period has transmitted to the Director written notice to the effect that such committee has no objection to the proposed action.

SEC. 7. Notwithstanding any other provision of this or any other Act, the Director of the National Science Foundation shall keep the Committee on Science and Astronautics of the House of Representatives and the Committee on Labor and Public Welfare of the Senate fully and currently informed with respect to all of the activities of the National Science Foundation.

SEC. 8. This Act may be cited as the "National Science Foundation Authorization Act, 1975".

And the Senate agree to the same.

OLIN E. TEAGUE,
JOHN W. DAVIS,
JAMES W. SYMINGTON,
MIKE MCCORMACK,
CHARLES A. MOSHER,
ALPHONZO BELL,
MARVIN L. ESCH,
Managers on the Part of the House.

EDWARD KENNEDY,
CLAIBORNE PELL,
THOMAS F. EAGLETON,
ALAN CRANSTON,
WALTER F. MONDALE,
PETER H. DOMINICK,
ROBERT T. STAFFORD,
Managers on the Part of the Senate.

JOINT EXPLANATORY STATEMENT OF THE COMMITTEE OF CONFERENCE

The managers on the part of the House and the Senate at the conference on the disagreeing votes of the two Houses on the amendment of the Senate to the bill (H.R. 13999) to authorize appropriations for activities of the National Science Foundation, and for other purposes, submit the following joint statement to the House and the Senate in explanation of the effect of the action agreed upon by the managers and recommended in the accompanying conference report:

The amendment of the Senate struck out all after the enacting clause in the House bill and substituted new language. The committee of conference agreed to accept the Senate amendment with certain amendments and stipulations proposed by the conferees.

The National Science Foundation requested authorization in the amount of $783,200,000 for fiscal year 1975, plus $5,000,000 in excess foreign currencies. The House authorized the amount requested. The respective Senate figures were $829,800,000 and $5,000,000 in excess foreign currencies.

The committee of conference recommends $807,500,000, plus $5,000,000 in excess foreign currencies. This figure is $24,300,000 more than authorized by the House and $22,300,000 less than authorized by the Senate for fiscal year 1975.

The specific actions taken by the conference are as follows:

SECTION 1—FUNDS

1. For Scientific Research Project Support, the budget request of the National Science Foundation was $363,700,000. The House authorized $354,000,000 and the Senate authorized $363,700,000. The two Houses agreed on $358,700,000.

2. For National and Special Research Programs, the Foundation requested $84,800,000. The House authorized $86,000,000 and the Senate authorized $94,700,000. A compromise of $91,900,000 was approved by the conferees, which includes an additional $5,900,000 for oceanography-related programs, with emphasis on ship construction/conversion.

3. For National Research Centers, the House, the Senate, and the conferees approved the Foundation request for $52,500,000.

4. For Science Information Activities, the Foundation requested $5,000,000. The House authorized $8,300,000 which was the 1974 level of support and the Senate authorized $5,000,000. The conference committee agreed on $6,300,000 as a reasonable sum to maintain this vital function.

5. For International Cooperative Scientific Activities, the House, the Senate, and the conferees approved the Foundation request for $8,000,000.

6. For Research Applied to National Needs, the Foundation requested $148,900,000. The House authorized $139,100,000 and the Senate authorized $160,700,000. A compromise was reached at the original figure requested, $148,900,000.

7. For Intergovernmental Science Programs, the Foundation requested $1,000,000, which the House approved. The Senate authorized $3,000,000. A compromise was reached at $2,000,000.

8. For Institutional Improvement for Science, the Foundation requested $3,000,000. The House increased this figure to $10,000,000, largely to revitalize the Institutional Grants Program. The Senate authorized $12,000,000, to which the House agreed in conference.

9. For Graduate Student Support, the Foundation requested $12,700,000. The House authorized $13,200,000 and the Senate authorized $17,000,000. The committee of conference agreed on $15,000,000 as adequate for this program.

10. For Science Education Improvement, the Foundation requested $61,400,000. The House authorized $68,900,000 in order to compensate for funds diverted from this program to technical training. The Senate authorized $71,000,000. The conferees agreed on a compromise of $70,000,000.

11. For Planning and Policy Studies, the Foundation requested $2,700,000 which both the House and Senate accepted.

12. For Program Development and Management, the Foundation requested $39,500,000 which was accepted by both the House and Senate.

SECTION 2

The bill as passed by the House put budgetary floors under the following:

(1) National and Special Research Program—$2,200,000 to assure continuance of the Experimental R&D Incentives Program.

(2) The Research Applied to National Needs Program—$2,000,000 for Fire Research to assure continuance of this effort.

(3) The Institutional Improvement for Science Program—$10,000,000.

(4) The Graduate Student Support Program—$13,200,000.

(5) The Science Education Improvement Program—$68,900,000, which included three sub-floor limitations. The latter were $1,500,000 for Science Faculty Fellowships, $3,800,000 for College Student Science Education, and $2,000,000 for High School Students Projects.

The Senate put floors under the following:

(1) National and Special Research Programs—$8,000,000 for Ship Construction and Conversion.

(2) Research Applied to National Needs—$8,000,000 to assure continuance of the Earthquake Research Program.

(3) Institutional Improvement for Science—$12,000,000.

(4) Graduate Student Support—$17,000,000.

(5) Science Education Improvement—$71,000,000.

The latter three floors incorporated by the Senate, in effect, fixed the floor at the total amount of the Senate authorization and were designed to assure that these programs should not be cut in any way.

The committee of conference agreed to lower most of these floors in order to permit the Foundation additional funding flexibility in

view of the fact that appropriations were expected to be lower than the authorization figures. The conferees agreed to the following floors:

(1) National and Special Research Programs—$1,600,000 for the Experimental R&D Incentives Program; $4,000,000 for Ship Construction and Conversion.

(2) Research Applied to National Needs—$1,000,000 for Fire Research; the $8,000,000 for Earthquake Research was retained.

(3) Institutional Improvement for Science—$10,000,000.

(4) Graduate Student Support—$15,000,000.

(5) Science Education Improvement—$70,000,000.

The sub-floors placed by the House within the Science Education Improvement category remain intact: for Science Faculty Fellowships, $1,500,000; for College Student Science Education, $3,800,000; for High School Student Projects, $2,000,000.

Section 3

Section 3 is identical to Section 3 of the House bill and Section 5 of the Senate bill.

Section 4

Section 4 is identical to Section 4 in both the House and Senate bills.

Section 5

Section 5 is identical to Section 5 of the House bill and Section 6 of the Senate bill.

Section 6

Section 6 is identical to Section 6 of the House bill and Section 7 of the Senate bill.

Section 7

Section 7 is identical to Section 8 of both House and Senate bills.

Section 8

Section 8 is identical to Section 9 of both House and Senate bills.

Additional Conference Action

The committee of conference made three non-funding changes in the two versions as follows:

(1) *The Student Unrest Provision.*—the House bill carried a provision which the Foundation authorization bills had carried for several years to the effect that students or other persons receiving grants or payment of any kind from NSF should be completely severed from any NSF program providing such funds, if it were found that they had been guilty of causing disruption or damage by the use of force to the institution attended. The Senate bill eliminated this clause on the grounds that it was no longer necessary. The House concurred in the Senate view, but conferees wish to point out that similar restrictions are contained in the Appropriations Act pertaining to the National Science Foundation. Hence, inclusion of the clause in the Authorization Bill is redundant.

(2) *Fetal Research.*—the House bill contained a provision, adopted by amendment on the Floor of the House, to the effect that no funds appropriated pursuant to this act should be used to conduct research on a human fetus. The Senate bill eliminated this provision on the grounds that it was unnecessary. It was pointed out that H.R. 7724, which was in conference at the time and which is now P.L. 93–348, contained a special title known as the "Protection of Human Subjects Act." This law establishes a broad gauge expert commission whose duties will include the study of all kinds of research on humans and eventuate in recommendations to the Congress for necessary legislation. The House concurred with the Senate view on this matter, and believes such action to be particularly appropriate since, in any event, the Foundation has never supported research of the kind involved and does not do so at present.

(3) *Solar Energy Research.*—the House bill contained a provision which would have required special coordination between the National Science Foundation and the National Aeronautics and Space Administration with regard to solar energy research. The purpose of the provision was to insure that the two agencies, which were equally responsible for the findings of the President's Solar Energy Research Advisory Panel of several years ago, should coordinate their efforts in this area. While it was acknowledged that NSF should be the lead agency in this area, it was directed that those applied research areas in which NASA had particular capabilities should be managed and carried out by NASA when appropriate. The Senate eliminated this provision and substituted a clause providing simply that the Director of the National Science Foundation should be responsible for the planning, coordinating and directing of solar energy research throughout the federal government. In conference it was agreed that both provisions should be eliminated from the bill, and the essence of both stipulated in the Statement of Managers as follows:

First, the National Science Foundation should be the lead agency responsible for such research, as it has been designated by the Administration.

Second, prior to the inauguration of new phases of its program of Solar Energy Research and Technology, the Foundation is directed to coordinate such programs, particularly with regard to such areas as heating and cooling of buildings, wind energy, and satellite solar energy with the National Aeronautics and Space Administration and other appropriate Federal agencies, and report the resulting plans, schedules, and other findings to the Committee on Science and Astronautics of the House of Representatives and the Committee on Labor and Public Welfare of the Senate within 90 days from the effective date of this Act. The coordinated program should be designed to take maximum advantage of the special capabilities of the Foundation, NASA, or other agencies involved. Such part or parts of the program which can be feasibly carried out by NASA or other appropriate agencies should be so assigned, including managerial responsibility, and should be funded by the Foundation pursuant to section 11(c) of Public Law 81–507.

Third, the Foundation is further directed to coordinate its Solar Energy and Technology program with the academic community, and

with private industry—giving particular attention to the capabilities of small businesses and to innovative applied research proposals emanating therefrom.

OLIN E. TEAGUE,
JOHN W. DAVIS,
JAMES W. SYMINGTON,
MIKE MCCORMACK,
CHARLES A. MOSHER,
ALPHONZO BELL,
MARVIN L. ESCH,
Managers on the Part of the House.

EDWARD M. KENNEDY,
CLAIBORNE PELL,
THOMAS F. EAGLETON,
ALAN CRANSTON,
WALTER F. MONDALE,
PETER H. DOMINICK,
ROBERT T. STAFFORD,
Managers on the Part of the Senate.

○

H. R. 13999

Ninety-third Congress of the United States of America

AT THE SECOND SESSION

Begun and held at the City of Washington on Monday, the twenty-first day of January, one thousand nine hundred and seventy-four

An Act

To authorize appropriations for activities of the National Science Foundation, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby authorized to be appropriated to the National Science Foundation for the fiscal year ending June 30, 1975, for the following categories:

(1) Scientific Research Project Support, $358,700,000.
(2) National and Special Research Programs, $91,900,000.
(3) National Research Centers, $52,500,000.
(4) Science Information Activities, $6,300,000.
(5) International Cooperative Scientific Activities, $8,000,000.
(6) Research Applied to National Needs, $148,900,000.
(7) Intergovernmental Science Program, $2,000,000.
(8) Institutional Improvement for Science, $12,000,000.
(9) Graduate Student Support, $15,000,000.
(10) Science Education Improvement, $70,000,000.
(11) Planning and Policy Studies, $2,700,000.
(12) Program Development and Management, $39,500,000.

SEC. 2. Notwithstanding any other provision of this or any other Act—

(a) of the total amount authorized under section 1, not less than $10,000,000 shall be available for the purpose of "Institutional Improvement for Science";

(b) of the total amount authorized under section 1, not less than $15,000,000 shall be available for the purpose of "Graduate Student Support";

(c) of the total amount authorized under section 1, not less than $70,000,000 shall be available for the purpose of "Science Education Improvement";

(d) of the total amount authorized in category (2) of section 1—

(1) not less than $1,600,000 shall be available for "Experimental R. & D. Incentives", and

(2) not less than $4,000,000 shall be available for "Ship Construction/Conversion";

(e) of the total amount authorized in category (6) of section 1—

(1) not less than $1,000,000 shall be available for "Fire Research", and

(2) not less than $8,000,000 shall be available for "Earthquake Research and Engineering"; and

(f) of the total amount authorized in category (10) of section 1—

(1) not less than $1,500,000 shall be available for "Science Faculty Fellowships for College Teachers",

(2) not less than $3,800,000 shall be available for "Student Programs" including "Undergraduate Student Projects" and "Student Originated Studies", and

(3) not less than $2,000,000 shall be available for "High School Student Projects".

SEC. 3. Appropriations made pursuant to this Act may be used, but not to exceed $5,000, for official consultation, representation, or other

extraordinary expenses upon the approval or authority of the Director of the National Science Foundation, and his determination shall be final and conclusive upon the accounting officers of the Government.

SEC. 4. In addition to such sums as are authorized by section 1, not to exceed $5,000,000 is authorized to be appropriated for the fiscal year ending June 30, 1975, for expenses of the National Science Foundation incurred outside the United States to be paid for in foreign currencies which the Treasury Department determines to be excess to the normal requirements of the United States.

SEC. 5. Appropriations made pursuant to sections 1 and 4 shall remain available for obligation, for expenditure, or for obligation and expenditure, for such period or periods as may be specified in Acts making such appropriations.

SEC. 6. No funds may be transferred from any particular category listed in section 1 to any other category or categories listed in such section if the total of the funds so transferred from that particular category would exceed 10 per centum thereof, and no funds may be transferred to any particular category listed in section 1 from any other category or categories listed in such section if the total of the funds so transferred to that particular category would exceed 10 per centum thereof, unless—

(A) a period of thirty legislative days has passed after the Director or his designee has transmitted to the Speaker of the House of Representatives and to the President of the Senate and to the Committee on Science and Astronautics of the House of Representatives and to the Committee on Labor and Public Welfare of the Senate a written report containing a full and complete statement concerning the nature of the transfer and the reason therefor, or

(B) each such committee before the expiration of such period has transmitted to the Director written notice to the effect that such committee has no objection to the proposed action.

SEC. 7. Notwithstanding any other provision of this or any other Act, the Director of the National Science Foundation shall keep the Committee on Science and Astronautics of the House of Representatives and the Committee on Labor and Public Welfare of the Senate fully and currently informed with respect to all of the activities of the National Science Foundation.

SEC. 8. This Act may be cited as the "National Science Foundation Authorization Act, 1975".

Speaker of the House of Representatives.

Vice President of the United States and
President of the Senate.

August 23, 1974

Dear Mr. Director:

The following bill was received at the White House on August 23rd:

H.R. 13999

Please let the President have reports and recommendations as to the approval of this bill as soon as possible.

Sincerely,

Robert D. Linder
Chief Executive Clerk

The Honorable Roy L. Ash
Director
Office of Management and Budget
Washington, D. C.