Dave McLeod

DOD TECHNOLOGY BASE BUDGET
($ in Millions)

	FY 85 actual	FY 86 request	% Change*
Research (6.1)			
Army	234	268	+10.5
Navy	341	372	4.9
AF	204	230	8.4
Defense Agencies	83	101	17.0
	861	971	+ 8.5
Exploratory Development (6.2)			
Army	528	608	+10.7
Navy	442	481	4.6
AF	545	595	5.0
Defense Agencies	746	870	12.1
	2261	2554	+ 8.6
Advanced Technology Development (6.3)			
Army	477	593	+19.6
Navy	170	239	32.4
AF	516	714	33.1
Defense Agencies**	1603	3915	134.8
	2766	5461	+89.9
Total Technology Base	5888	8986	+46.8

* Using 0.9618 deflator for FY 86 numbers

** Includes SDI component of 1389 in FY 85 and 3717 in FY 86

SUBJECT: University Research Initiative (FY 86 Program Elements 61103A, 61103N, 61103F, 61103E)

The President's FY 1986 Budget contains a new initiative to enhance basic science and engineering capabilities of the nation towards meeting long term technology needs of defense. The initiative was established by PBD 200C which created four new program elements as vehicles for the program. Initially, there are two objectives: (1) expansion of university fellowship, assistantship, exchange scientist and instrumentation programs, and (2) initiation of multidisciplinary science and engineering research programs in high payoff areas such as materials and structures, biotechnology, communication networks, optical materials, mathematics, microelectronics, etc. During FY 1986 about half the funds should be applied to each objective. Of course, the ratio will have to be adjusted in the out years. These programs should be conducted so that we meet our objectives and at the same time minimize overhead and create a benefit for the in-house laboratories.

I urge the funding for fellowship, assistantship and exchange scientists programs be managed through the in-house laboratories with participation by the Service Research Offices. This should enhance the nation's science and engineering capabilities and at the same time strengthen the professional relationships between scientists in our laboatories and those in universities. However, the instrumentation objective should be integrated within the existing Defense University Research Instrumentation Program, with a single Tri-Service/DARPA soliciation from the universities.

With regard to the research aspects of the program, I believe it is prudent that a Tri-Service/DARPA committee be established to select, create and oversee the multidisciplinary science and engineerng research programs. This committee, composed of representatives of OSD, DARPA, and the Services, would provide a mechanism for coordination between the Services and DARPA as well as a single point of contact for the universities.

The Deputy Under Secretary of Defense (Research and Advanced Technology) will be the focal point for this program. I would appreciate your providing that office a point of contact by March 10, 1985 to work out details on the program.

POINT PAPER

DoD University Research Initiative

NEED:

During the period of the 1970's the nation's support for university research and education declined, resulting in a deteriorated capacity of universities to perform scientific research and to produce quality scientific and engineering personnel.

This reduction in both public and private sector support for university research and education has resulted in the following consequences:

- INCREASINGLY OBSOLETE RESEARCH LABORATORIES AND EQUIPMENT: Recent studies have shown the need for $1 billion to $2 billion worth of equipment to replace obsolete research instrumentation in the nation's universities. In addition, laboratory facilities are outdated and need to be replaced or modernized.

- A SERIOUS SHORTAGE OF FACULTY QUALIFIED TO TEACH STATE-OF-THE-ART TECHNOLOGY: There is a shortage of approximately 1800 qualified engineering faculty members, while shortages in the computer professions have also been reported. It is believed by some that the reported shortage of faculty is actually understated: adjusting the student-to-teacher ratio to 1968 levels would require 5,000 new faculty in addition to the currently identified shortage of 1800 instructors.

- LARGE DECLINES IN THE NUMBERS OF AMERICAN STUDENTS PURSUING GRADUATE DEGREES: The number of engineering doctoral degrees awarded to U.S. citizens declined by 42 percent between 1968 and 1982, while the number of advanced degrees awarded to foreign nationals almost tripled during this same period. New figures compiled by the National Science Foundation indicate that almost 60 percent of the engineering Ph.D.'s awarded last year went to foreign nationals, further reducing the pool of talent available to perform defense-related work.

DoD is dependent on the nation's universities to conduct half of its basic scientific and engineering research, and dependent on the scientific and technical talent that the universities produce: DoD either directly employs or affects through its spending almost one-fifth of the S&E's in the nation.

The defense needs of the future dictate that we must begin now to strengthen the capability of our universities and in-house laboratories to perform science and engineering research particularly in high-risk, high-payoff areas of importance to the nation's defense.

PLANS:

DoD proposes a University Research Initiative supported by an increase of $25 million in FY 86 and $50 million in FY 87 to begin to address some of the problems identified. Elements of the program include:

- Strengthening research thrusts in new technology areas which may be high risk but should provide extraordinary opportunities.

- Improving the university infrastructure by increased support for university research, instrumentation, fellowships, etc.

- Increasing the constructive interaction between universities and DoD laboratories through:

  - o Establishment of Multi-disciplinary Science and Engineering Research Programs on or near university campuses; and

  - o Setting up competitive Research Initiation Awards (RIA's) to provide special opportunities for academic faculty members to spend sabbaticals at DoD laboratories. These sabbaticals would enable researchers to initiate new research, help to improve the quality of on-going research at DoD laboratories, and permit them to continue their research in these areas when they subsequently return to their campuses.

The United States is the strongest nation in the free world, in large measure due to the research sponsored by far-sighted government administrators who recognized the essential part played by high technology in maintaining national security and our economic well-being. The Department of Defense has played a leading role in this since World War II. But, we are in danger of becoming complacent and forgetting that today's prosperity and security have derived from research initiated years ago. Research dollars may not be a vanishing species, but as a fraction of Defense R&D they have been declining steadily for more than 20 years, from over 5% in 1965 to less than 3% in 1985. Yet Defense has an excellent record of supporting and nurturing university research, and stimulating it to greater achievements, from aeronautics to lasers to microelectronics.

The partnership between Defense and Universities is vital to the success of this research, and for two reasons. First, the most independent thinkers in science and engineering are to be found in the universities; they are most kowledgeable about on-going research throughout the world; and they are most likely to come up with new scientific concepts, theories, and results. Second, nearly all scientists and engineers in the U.S. are the product of university education and training. While education can and should be influenced by DoD needs, it must not be controlled by any one vested interest, but must benefit them all.

There are a number of concerns which have been raised, both in Congress and outside, about the nation's commitment to the quality of university research and education in science and engineering. DoD has a number of proposals which address these Congressional concerns directly, and which deserve our strongest support.

We have a growing concern for the falling numbers United States citizens receiving engineering Ph.D. degrees: the number of U.S. citizens receiving engineering Ph.D.'s fell from 2200 in 1973 to 1300 in 1983, while in the same period the number of engineering Ph.D.'s granted to foreign students rose from 1200 in 1973 to 1500 in 1983. About 17% of U.S. scientists and engineers work for defense, with an even higher proportion in the engineering disciplines, particularly in electronics and aeronautics, which are vital to both our defense and commerical interests. Thus, DoD has a vital stake in the quantity and especially the quality of young American scientists and engineers being graduated from our universities.

We are concerned about the impact of obsolete and obsolescent instrumentation and equipment and crumbling buildings at some of our major universities, which will affect the quality of our future scientists and engineers. It has been estimated that for our universities to fully modernize their research instrumentation

would require a sum of $2 billion. Since 1983 DoD has had a program which increased its previous support for university research instrumentation by $30 million per year, but clearly this only meets a fraction of the need.

We are concerned about the funding available for research in high-risk, high-payoff technologies, when there is hardly enough to go round for more established technologies with more predictable short-term results.

We are concerned that the estrangement between the academic and defense communities which developed as a result of an unpopular war has not yet been fully overcome, to the detriment of the national security and economic progress.

We, therefore, fully support the DoD initiatives in all these areas. We welcome the recognition that DoD should be more active in supporting the research and educational endeavors in our universities from which Defense itself benefits. This includes fellowships and graduate assistantships with adequate funding to attract the best talent into those disciplines which have the greatest impact on our national security and well-being. It also includes increasing support for the existing and highly beneficial University Research Instrumentation Program started by DoD in FY 83. It should include additional support for high-risk, high-payoff technologies on which our future well-being may one day depend.

Finally, I am particularly pleased to see the provisions in the DoD initiative to strengthen DoD laboratory interactions, both by the proposed establishment of multidisciplinary science and engineering research programs on university campuses, and by the proposed establishment of research initiation awards for university faculty members to work at DoD laboratories with government scientists and engineers. This will maximize the Federal investment in research benefiting not only DoD but the Nation as a whole.

Copy for Tony Battista, per JK's request.

DOD University Initiative

Following the JK-Battista conversation of last spring on the need to rejuvenate DOD ties to the University Research Community, the Services, especially the Navy, responded enthusiastically to a possible $200M University Research Initiative.

The wimpy DOD bureaucracy eventually knocked this down to $25M in '86, going to $50M in '87 and $100M in '88, and took the path of least resistance by spreading resources evenly among the three services and DARPA. Thus all four elements would be subcritical and would not have the desired impact.

A bold thrust in ONR, with lesser ones in DARPA, AFOSR, and Army would be better. $150-200M would do the trick. 6.2 funds should not be reduced to fund this Initiative.

Personnel Legislation for Scientists and Engineers

DOD is strongly supporting the proposed legislation to set up a separate personnel system for Federal scientists and engineers. We feel that the legislation has a better chance of passage if focused on a single agency first. DOD is the logical choice since it has about 60 percent of scientists and engineers in the Federal Government. Who on the Hill would likely be interested in sponsoring such a bill for DOD, and how could we expedite its passage?

Defense R&D Budget

Research [illegible] Activities

Department of Defense
(In Millions of Dollars)

	Line Code		1984	1985	1986
				20	100
Conduct of R&D by Activity					
Basic Research	101	B.A.	843.0	860.8	970.8
		Oblig.	846.5	828.6	962.0
		Outlays	719.8	768.0	851.5
Applied Research	102	B.A.	2,212.0	2,260.2	2,554.3
		Oblig.	2,185.1	2,208.1	2,510.3
		Outlays	1,844.8	1,938.0	2,142.7
Development	103	B.A.	24,281.9	29,002.1	36,564.8
		Oblig.	23,376.6	29,281.5	35,953.3
		Outlays	21,018.4	25,832.9	31,865.6
Total Conduct of R&D	199	B.A.	27,336.9	32,123.1	40,089.9
		Oblig.	26,408.2	32,318.2	39,425.6
		Outlays	23,583.0	28,538.9	34,859.8
Conduct of R&D Performed by Colleges and Universities	201	B.A.	1,014.8	1,072.2	1,146.7
		Oblig.	982.7	1,057.5	1,128.1
		Outlays	862.6	957.5	1,031.2
R&D Facilities	301	B.A.	598.5	577.9	579.5
		Oblig.	531.6	588.7	555.8
		Outlays	382.5	469.0	446.3

The university numbers are unreliable

Research and Development Activities
Department of Defense
By Type of Activity
(In Millions of Dollars)

Type of Activity	FY 1984 Actual	FY 1985 Estimate	FY 1986 Estimate
Obligations			
Conduct of R&D			
Research, Development, Test and Evaluation			
Technology Base	3,031.6	3,036.8	3,472.3
Advanced Technology Development	1,210.4	2,652.2	5,255.7
Strategic Programs	7,595.1	8,508.2	8,545.9
Tactical Programs	7,626.4	9,848.7	12,215.0
Intelligence and Communications	3,322.0	3,897.0	4,966.7
Program Management and Support	2,887.5	3,305.0	3,955.7
Other Appropriations	735.2	1,070.3	1,114.4
Total Conduct of R&D	26,408.2	32,318.2	39,425.6
Total Conduct of basic research, included above	(846.5)	(828.6)	(962.0)
R&D facilities	531.6	588.7	555.8
Total Obligations	26,939.8	32,906.9	39,981.4
Outlays			
Conduct of R&D	23,583.0	28,538.9	34,859.8
R&D Facilities	382.5	469.0	446.3
Total Outlays	23,965.5	29,007.9	35,306.1

Navy University Initiative

DEPARTMENT OF THE NAVY
OFFICE OF NAVAL RESEARCH
ARLINGTON, VIRGINIA 22217

IN REPLY REFER TO
3910
Ser 102B/258
17 DEC 1984

Dr. John McTague
Deputy Director for Science and Technology Policy
New Office Executive Office Building
Washington, DC 20506

Dear Dr. McTague:

On October 3, 1984, Admiral Baciocco, Dr. Marvin Moss and I met with Dr. James Ling and yourself to discuss DOD support of basic research with particular emphasis on the Navy program. During our discussion you summarized OSTP concerns about the level and nature of federal support of the national technology base. Particular emphasis was placed on the need for new initiatives to sustain the health of U.S. universities. You requested that ONR define an "add-on" program that would compliment our current program plans, enhance university research and education capabilities in science and engineering, and strengthen the DOD/university relationship. It is our understanding that a similar request was made to the other services. The requested initiatives were to be bold and innovative with a significant orientation toward people, particularly young investigators, rather than specific disciplines. A target funding level of about $125M was suggested with the explicit assumption that the proposed initiatives would be funded from new monies, not a redistribution of Navy or DOD budget.

ONR has given your request very serious consideration. Throughout its history ONR has maintained a special relationship with the academic research community, a partnership that has paid ample dividends to the Navy and to the Nation. We welcome the opportunity to discuss ways to strengthen that partnership. Our response to your request is summarized in the enclosed report. A number of university related problems and issues have been identified that are of particular interest to DOD and the Navy. The ONR "add-on" initiatives provide a balanced approach to addressing those problems and issues when considered as a supplement to our current program plans.

If you or Dr. Ling wish to discuss the ONR "add-on" initiatives in greater detail, please contact Dr. Moss (696-4517) or Dr. Bruce Robinson (696-4484).

Very Respectfully,
Brad Mooney

J. B. MOONEY, JR.
Rear Admiral, USN
Chief of Naval Research

Encl: (1) ONR "Add-On" Research Program

Copy to:
Dr. J. Ling
VADM A. Baciocco

I. BACKGROUND

- o U.S. International Competitive Position - Military And Commercial - Is Strongly Dependent Upon Rapid Development And Implementaton Of New Technology
- o Long Run Ability To Compete Depends On Action Taken Now To Sustain Health Of National Technology Base
- o Health Of Universities Is A Particular Concern
  - Train Our Scientists And Engineers
  - Perform Bulk Of Fundamental Research In Science And Engineering
- o Bold National Initiatives Are Required
- o As Major User Of New Technology (And Of Scientists And Engineers), Navy Should Continue To Take A Leadership Role

II. PROBLEMS AND ISSUES ADDRESSED BY PROPOSED ONR INITIATIVES

- o An Indication Of The Relevance Of Proposed Initiatives To Problems And Issues Discussed In This Section Is Displayed In Table I

Loss Of Faculty And Potential Graduate Students

- o Higher Salaries And More Modern Equipment In Industry Attracting Faculty And Potential U.S. Graduate Students Away From Universities
  - During Period 1974-1981 Bachelor Degrees Awarded In Computer And Information Sciences Quadrupled While PhD's Awarded Was Constant
  - Total Number Of Graduate Degrees Awarded In More Mature Fields (e.g. Math and Physical Sciences) Declined During That Period
  - Number of Graduate Degrees Awarded To U.S. Nationals In These Fields Declined Significantly
  - In 1980 Foreign Students Received 46% Of The Doctorates In Engineering Awarded By U.S. Universities
- o This Phenomenon Is Directly Impacting Ability Of Universities To Sustain Quality Of Research And To Educate Next Generation Of U.S. Scientists And Engineers

Outmoded Equipment And Inadequate Research Support

- o Quality Of Research And Teaching Is Seriously Hampered By Out-Moded Instrumentation And Equipment
  - Equipment Purchases Associated With Federal Research Funds Has Not Kept Pace With Need For Over A Decade
  - In Spite Of Recent Efforts To Address Problem, Academic Instrumentation For Research Lags Behind That Available In Industry And Foreign Universities In Important Fields
  - Many Universities Can Not Provide Adequate Hands-On Experience For Their Students
- o Important Research Support Services Are Not Readily Available
  - Supercomputers Will Play An Essential Role At The Cutting Edge Of Virtually Every Field of Science; e.g.,

    Oceanographic Modelling and Prediction
    Dynamics and Function of Large Molecules Including Biomolecules Modelling And Simulation Of Electron Devices
    Fluid And Aerodynamics
  - Availability Of Ship And Space Platform Time To Oceanographers Is Of Special Interest To Navy

Need To Attract Bright Young Investigators

- o For Variety Of Reasons Including Vietnam War And After Effects Of Mansfield Amendment, Brightest Young Investigators Tended Not To Be Attracted To DOD Programs During The Decade Of The 70's
- o Need Special Initiatives To Identify Best Researchers Early In Their Careers, And Support Them In Areas Of Potential Interest To The Navy

Growing Importance Of Multi-Discipline Teams In Research And Education

- o Important Areas of Science And Engineering Will Only Yield To A Multi-Discipline Team Approach, e.g.,
  - Biotechnology Processing
  - Biological Intelligence
  - Microelectronic Research
  - Computer-Integrated Manufacturing
  - Decision Making/Information Systems
- o University Research In Science And Engineering Remains The Domain Of Small, Single-Investigator Programs
- o Industry Has Evolved A Multi-Discipline Team Approach To Scientific Research And Engineering Practice
- o Multi-Discipline Team Approach Provides Superior Training Environment For Future Engineers And For Scientists In Many Important Emerging Areas
- o Mechanism Are Needed To Bridge Traditional Academic Disciplines

Renewing U.S. Mathematics

- A Recent NRC Study, Renewing U.S. Mathematics: Critical Resource For The Future, Concludes That Support For Research In Fundamental Mathematics Suffered Substantial Decline Since Late 60's
- NRC Study Notes That Current Support Is Markedly Out Of Balance With Other Areas Of Science And Technology That Are Increasingly Dependent On Mathematics
- The Study Calls for Action To Restore The Balance

Improved Communications

- The Extensive Lag Between Concept And Application Can Only Be Minimized If Interactions Between The Basic Research Community And The Developers Of Technology Are Enhanced

Importance Of Foreign Research

- Decades Of U.S. Predominance In Basic Research Led To Dramatic Decline In Serious Foreign Language Studies In Training Of Scientists And Engineers
- Other Nations Are Now Very Competitive
- Japanese Are a Particularly Important Example; They Are Competitive In Research Areas Of High Interest To The Navy
- The Language Barrier Greatly Inhibits The Transfer Of This Knowledge
- There Is A Need For A Special Effort To Overcome This Barrier

III. PROPOSED ONR INITIATIVES

- Proposed Initiatives Are Described In Detail In The Following Pages
- Relevance Of Proposed Initiatives To University Problems And Issues Are Indicated In Table 1.

TABLE 1: RELEVANCE OF PROPOSED INITIATIVES TO PROBLEMS AND ISSUES

PROPOSED INITIATIVE	LOSS OF FACULTY & POTENTIAL GRADUATE STUDENTS	OUTMODED EQUIPMENT	LIMITED ACCESS TO RESEARCH SUPPORT SERVICES	NEED TO ATTRACT BRIGHT YOUNG INVESTIGATORS	ENCOURAGE MULTI-DISCIPLINE RESEARCH TEAMS	RENEWING U. S. MATHEMATICS	IMPROVED COMMUNICATIONS AND TRANSITION	IMPORTANCE OF FOREIGN RESEARCH
	PROBLEMS AND ISSUES ADDRESSED BY INITIATIVES							
1. GRADUATE FELLOWSHIP	X			X		X		X
2. YOUNG INVESTIGATORS	X	X		X	X	X		
3. INSTRUMENTS AND EQUIPMENT	X	X						
4. RESEARCH SUPPORT SERVICES	X		X				X	
5. MULTI-DISCIPLINE RESEARCH INITIATIVES	X	X		X	X			
6. MATHEMATICS ENHANCE	X					X		
7. INTERCHANGE AND JOINT RESEARCH	X	X			X		X	
8. U.S./JAPAN INTERCHANGE				X			X	X

1. ONR GRADUATE FELLOWSHIP PROGRAM

o Goal

- Encourage more outstanding U.S. nationals to enter graduate studies in areas of interest to the Navy

o Existing Program

- Funds about 40 new fellows per year (total of about 120 fellows at any given time) at a total cost of about $3M/yr.
- Targeted to disciplines and subspecialities of interest to the Navy/Nation
- Widely publicized
- Applications evaluated by American Society for Engineering Education
- Fellows selected by ONR based on ASEE panel recommendations

o Proposed Enhancement

- Double level of funding in FY 86 and again in FY 87
- Target some fellowships to encourage concurrent study of Japanese language
- Target some fellowships to support Navy Young Investigator and Navy Multi-Discipline Research Initiatives
- After FY 87 Navy will take lead on an interagency assessment of impact before considering further growth of program

o Budget (increment beyond current $3M/yr.)

86	87	88	89
3	9	9 (21)*	9 (21)

* Post 87 growth contingent on assessment of program impact.

2. ONR YOUNG INVESTIGATORS PROGRAM

o Goal

- Identify and support recent outstanding PhD's on university tenure tracks in areas of interest to Navy/Nation, establish closer ties with universities

o ONR Young Investigators

- Minimum award $50K per year for 3 to 5 years; average award about $100K including large instrumentation grant (university would guarantee full academic year salary)
- Broad topics selected for Navy/National interest
- Additional funds provided to match funding from industry or other Navy organizations with special weight on the latter
- Selection process includes proposals and possibly thesis seminars
- Widely publicized
- Candidates must be in a university tenure track position
- 50 selected in FY86 increasing to 100 in FY89

o Navy Chairs for Young Investigators

- Establish, through competition, chairs at universities to be occupied by young investigators in tenure track positions
- Competition among universities, judged by established organizations such as NAS/NRC and the Navy
- Support chair for 3 to 5 years with possibility for renewal
- Establish approximately 15 chairs for FY 87
- Incumbent selected by university with ONR concurrence. Incument must work in area of significant interest to Navy/Nation
- Stimulate incumbent to interact with Navy laboratories
- Annual meeting (Secretary of Navy Science Symposium) of chair holders where each recipient presents results of recent work.
- Funding large enough to support incumbent, several graduate students, a post doc and some instrumentation, about $200K a year

o Budget

	86	87	88	89
Young Investigators	5	7.5	9.5	9.5
Navy Chairs	2	2.5	2.5	2.5
TOTAL	7	10.0	12.0	12.0

3. INSTRUMENTATION AND EQUIPMENT ENHANCEMENT

- o Goal
  - Repair impact of decade of neglect; sustain support for state-of-the-art equipment at universities for research and education
- o Existing Program
  - Roughly 10% of ONR university contracts applied to equipment
  - DOD University Research Instrumentation Program (DURIP) added $10M/Yr. for each of the three services in FY 83 through FY 87
  - To-date only $90M funded out of a total request for $1,013M (for all DOD)
  - Current program does not meet needs of Navy contractors
  - Problem requires a major national initiative by all supporters of basic research and education in science and engineering
- o Proposed Enhancement
  - ONR supplement current program with front loaded initiative to contribute to relief of current problem; funding tapers down to a sustaining level by FY 89
- o Budget (Increment beyond current program)

86	87	88	89
58	37	30	23

4. RESEARCH SUPPORT SERVICES

- o Goal
  - Provide Navy supported research community with access to supercomputers for research and training in all relevant fields of science and engineering; enhance access to research ships for research and training in oceanography; enhance opportunities for university designed space oceanographic research via space shuttle
- o Supercomputers
  - Essential support to remain at cutting edge of many fields of research
  - ONR purchase blocks of supercomputer time during the period FY 86 through FY 88 and provide to selected university researchers through competitive proposals with a goal to stimulate supercomputer usage in more scientific disciplines
  - ONR establish a Class VII supercomputer at NRL in FY 89 that can be networked with other computing centers; blocks of time be offered to selected university researchers on a competitive basis
- o ONR Oceanograhic Ship And Space Research Fund
  - High cost of at-sea research is major impediment to academic research and training in oceanography; an area of special interest to the Navy
  - Similar considerations will limit university participation in space oceanographic experiments that are revolutionizing the study of ocean and atmospheric phenomena
  - ONR establish $10M/yr. Oceanographic Ship and Space Research Fund to support university research and education
  - Allocation of the fund resources will be the responsibility of an oversight board chaired by ONR
- o Budget

	86	87	88	89
Supercomputer				
Purchased Time	6	6	6	
Site Prep + Class VII	2	2	2	10*
Oceanographic Ship & Satellite Fund	10	10	10	10
TOTAL	18	18	18	20

* 19 M/yr. less 9M/yr. revenues

5. ONR MULTI-DISCIPLINE RESEARCH INITIATIVES

o Goal

- Improve diversity and quality of research and education in engineering and science; encourage formation of multi-discipline research teams involving senior faculty, junior faculty, young investigators, visiting scientists and graduate students

o Problem Addressed

- Important areas of science and engineering will only yield to a multi-discipline team aproach, e.g., biotechnology processing, biological intelligence, microelectronic research, computer-integrated manufacturing

- In most fields, university research in science and engineering remains the domain of small, single-investigator programs

- Industry has evolved a multi-discipline team approach to scientific research and engineering practice

- The multi-discipline team aproach would provide superior training environment for future engineers and for scientists in many important emerging areas

- Mechanisms are needed to bridge traditional academic disciplines and encourage the formation of multi-discipline research teams in the university environment

o Proposed Initiative

- ONR will offer support for multi-discipline research teams in areas of research of interest to the Navy

- Initial funding commitment for 3 years with possibility for 2 additional years; performance reviewed annually

- If fully successful, a limited number of research initiatives could evolve into formal research centers but, no support beyond 5 years is implied by initial funding

- Funding would tend to peak in the third year with average support at about $1-3M/yr; significant support for instruments and equipment

- Proposals judged on plans for collaborative research; plans to include significant level of graduate and undergraduate training; plans to include visiting scientists and engineers with visitors from industry and Navy Labs encouraged; significance of proposed research to Navy/Nation

o Budget

86	87	88	89
25	34	37	39

6. MATHEMATICS RESEARCH EHANCEMENT

o Goal

- Help restore the balance of support for Mathematics research as recommended by authors of NRC study and others

o Mathematics Enhancement

- NRC study notes that, in real dollars, level of support for fundamental mathematics is less than two-thirds of level in FY 68 and is markedly out of balance with support for areas of science and technology that are increasingly dependent on Mathematics; study confirms the judgment of many others

- This trend has been masked by the growth in support for computer sciences

- Currently proposed ONR FY 86 budget includes some increase in support for mathematics in response to NRC recommendations

- Mathematicians can participate in Graduate Fellowship, Young Investigator and Multi-Discipline Research Initiatives

- Proposed initiative would provide significant enhancement of ONR support for fundamental mathematics

o Budget (enhancement)

86	87	88	89
7	10	12	15

7. ONR INTERCHANGE AND JOINT RESEARCH PROGRAMS

o Goal

- Enhance flow of information between university, industrial and Navy laboratory communities

o ONR Scientist Interchange Program

- Encourage visits by young university faculty to high technology corporate research laboratories and ONR laboratories to obtain familiarity with technology problems to which their expertise might best be applied
- Would include full year sabbaticals, continuing collaborative efforts and summer appointments
- Opens direct line of communications at personal level between university researchers and the ultimate users of their research product
- A limited number of visiting outstanding faculty on sabbatical at ONR laboratories and the Navy Postgraduate School would be designated ONR Visiting Fellows
- In the case of visits to industry, ONR would provide "participatory" funding, not the entire budget

o Joint ONR Laboratory/University Research Programs

- NRL Plasma Physics Division currently has formal ties with the University of Maryland, Cornell and MIT that are mutually beneficial
- Initiative would encourage more formal arrangements between ONR laboratories and local universities by supporting joint research programs in selected areas of mutual interest
- PhD students could perform thesis work at ONR laboratories with University thesis advisors
- Universities could tap into facilities and equipment at ONR laboratories not available at the university
- ONR laboratories could tap more directly into bright young scientists at the universities
- Fundng would be split between university and laboratory

o Budget

ONR Scientist Interchange Program	86	87	88	89
University/Industry	0.5	0.5	0.5	0.5
University/ONR Labs	1.0	1.0	1.0	1.0
Joint ONR Lab/University Research	4.5	4.5	4.5	4.5
TOTAL	6.0	6.0	6.0	6.0

8. U.S./JAPAN INTERCHANGE PROGRAM

o Goal

- Reduce the unilateral nature of technical and scientific information flow between the U.S. and Japan

o Problem

- Japanese prowess in the application of technology is well known; in recent years they have established strong basic research efforts in areas of interest to the Navy and U.S. industry
- Still, there is a great disparity between the large number of Japanese at American universities, and the relatively few Americans studying technical subjects in Japan
- To a great extent, problem traced to a significant language barrier

o Initiative

- Some ONR Graduate Fellowships will be used to encourage collateral study of the Japanese language
- This initiative would provide in addition, ONR post-graduate fellowships to selected promising young scientists and engineers to spend 1-2 years doing research at outstanding institutions in Japan
- Would establish personal links to Japanese information network and encourage competence in the Japanese language
- A related initiative would support ONR technical workshops and seminars for outstanding U.S. and Japanese scientists in areas of interest to the Navy

o Budget

86	87	88	89
1	1	1	1

TABLE 2: BUDGET FOR PROPOSED ONR INITIATIVES
(CONSTANT 86 $)

	86	87	88	89
ONR GRADUATE FELLOWSHIPS	3	9	9*	9
ONR YOUNG INVESTIGATORS	7	10	12	12
INSTRUMENTATION & EQUIPMENT ENHANCEMENT	58	37	30	23
RESEARCH SUPPORT SERVICES				
SUPERCOMPUTERS	8	8	8	10
OCEANOGRAPHIC SHIP & SPACE SHUTTLE	10	10	10	10
ONR MULTI-DISCIPLINE INITIATIVES	25	34	37	39
MATHEMATICS ENHANCEMENT	7	10	12	15
ONR INTERCHANGE & JOINT RESEARCH	6	6	6	6
U.S./JAPAN INTERCHANGE	1	1	1	1
TOTAL	125	125	125	125

*After FY 87, Navy will take lead on interagency assessment of impacts of expanded graduate fellowship programs. Decision to increase level of support beyond 87 level depends on assessement results.

Note: The current ONR personnel skill mix is appropriate for management of the proposed initiatives. However, full fundng of the proposed initiatives package may require our upward adjustment of ONR personnel ceilings.

Air Force Univ. Initiative

Air Force Basic Research
University/Air Force Renewal Plan

Summary

- Increase Support of University Laboratory Equipment
- Increase Ties of University Investigators to Air Force Laboratories
- Increase Support of Air Force FY 86 Research Initiatives
- Increase Support of University Research in Areas of Vital Interest to the Air Force
- Broaden Scope of Air Force Support for University Research
- Increase Focus on Support for Young Investigators
- Increase Size and Flexibility of Individual Grants and Contracts
- Increase Support for Multi-Investigator and Multi-Year Grants and Contracts
- Establish/Expand Modest Centers of Excellence in Selected Disciplines with Increased Program Responsibility

Air Force Basic Research
New Research Programs ($15 M)

Mathematics (15%)

- Control of Distributed Systems
- Large Scale Optimization

Computer Sciences (5%)

- Computational Statistics
- Probabilistic Methods
- Rigorous Arithmetic

Physics (10%)

- Accelerator Physics
- Laser-Atom-Surface Interactions
- Coherent X-Ray Sources
- Theoretical Plasma Physics

Air Force Basic Research
New Research Programs (continued)

Life Sciences (10%)

- Cognitive Factors in Human Performance
- Measurement of Learning
- Auditory Pattern Recognition
- Bioreactivity

Environmental Sciences (5%)

Materials (25%)

- Non-Metallic Structural Materials
- Electromagnetic/Electro-optic Materials
- Biopolymers
- Metastable Electronic Materials
- Geotechnical Materials
- Physics and Chemistry of Formation and Microstructural Properties

Air Force Basic Research
New Research Programs (continued)

Electronics (10%)

- Ultrasubmicron Electronics
- Superconductive Electronics

Structures (5%)

- Nonlinear Structural Analysis
- Thermomechanical Fatigue in Metals and Ceramics

Fluid Mechanics (10%)

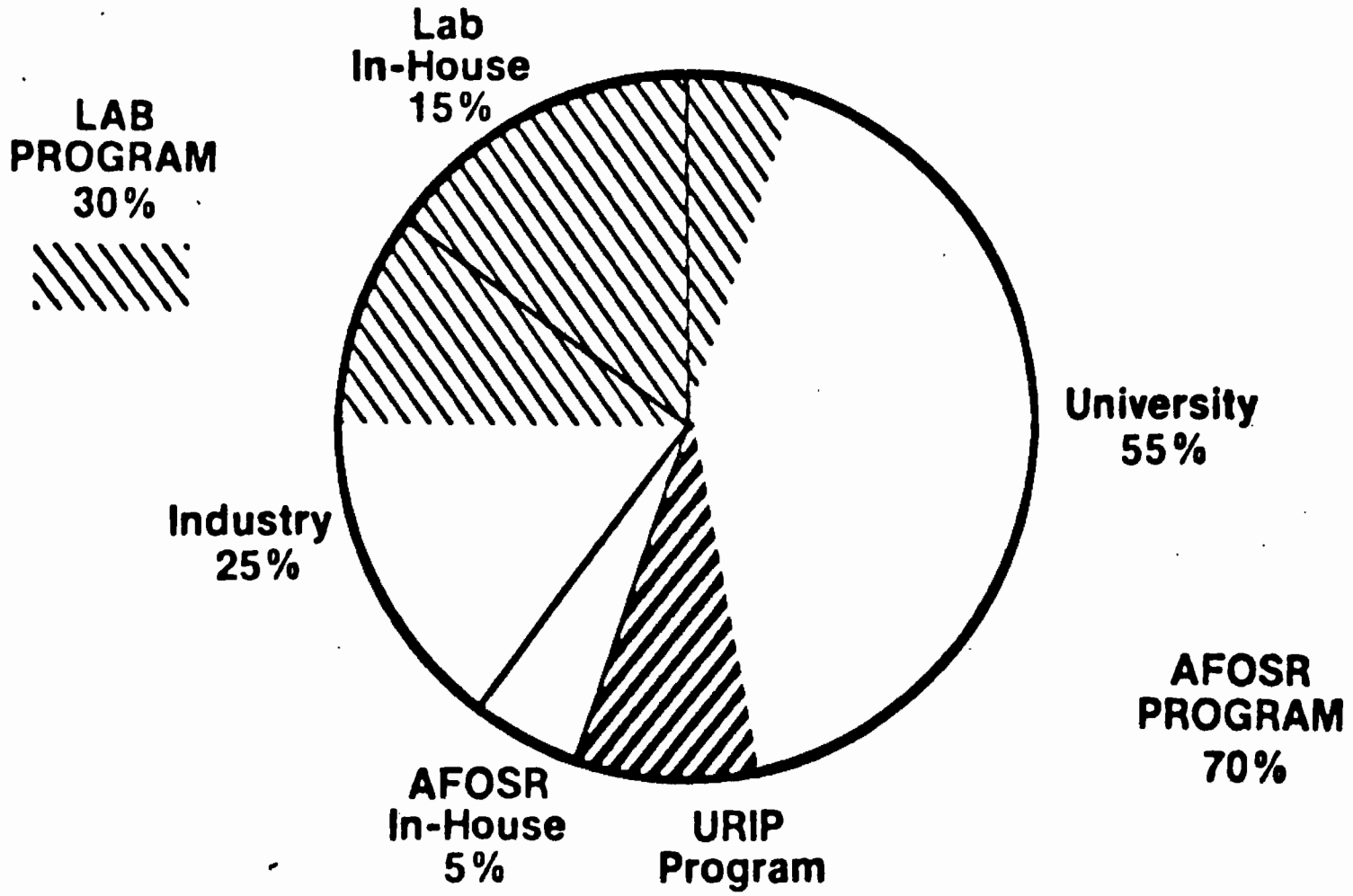
- Turbulent, Unsteady and Separated Flows
- Fluid/Structure Control Interaction

Propulsion (5%)

- Slurry Fuels
- Supersonic Combustion

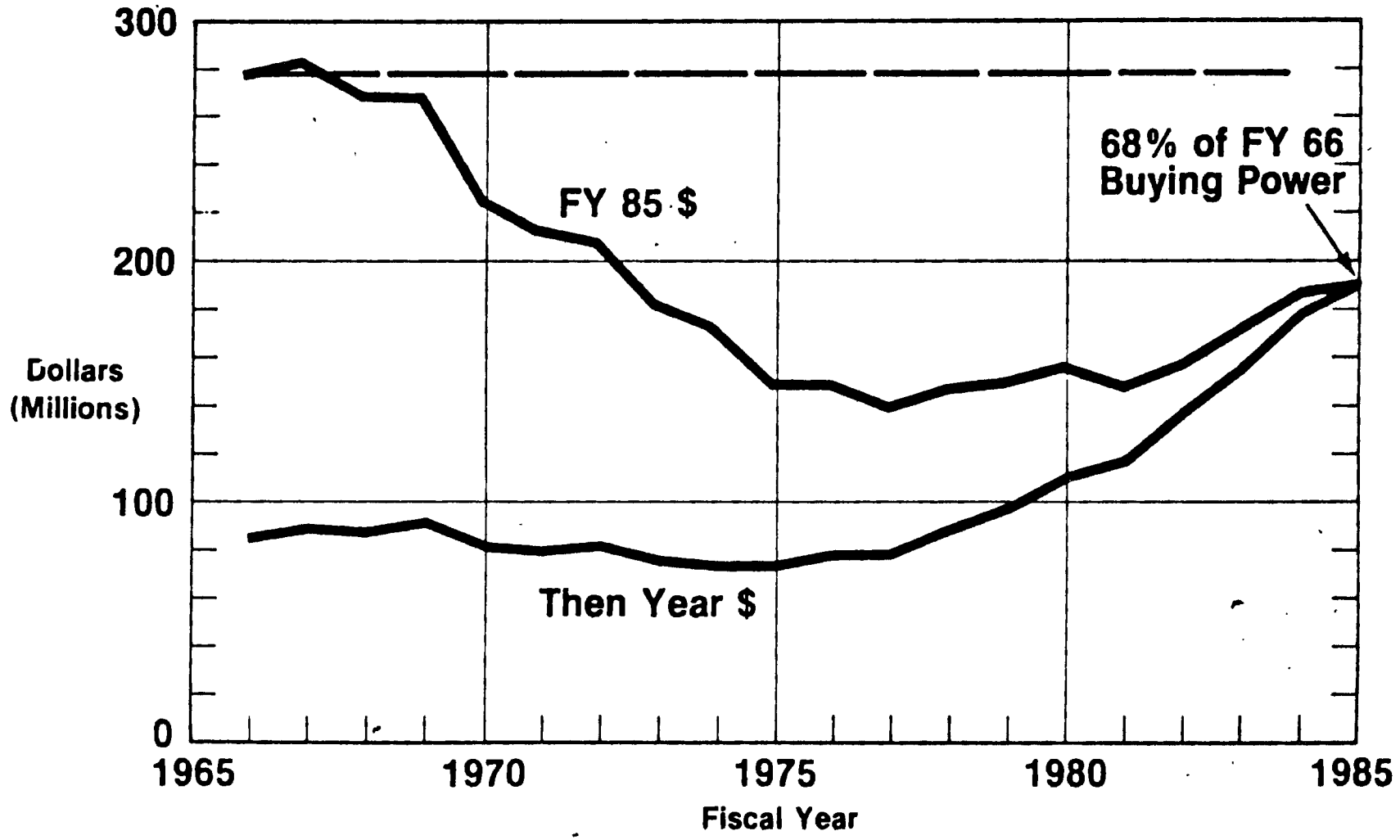
Air Force Basic Research

Fund Distribution



Air Force Basic Research

6.1 Research Funding



Air Force Basic Research

USAF FY 83 Funding to U.S. Universities

PE	LAB	TITLE	TOTAL FY 83	FY 83 TO UNIVERSITIES	
61101F		In-House Lab Ind Res	$ 12,600K	$ 1,181K	9.4%
61102F	AFOSR	Defense Research Sciences	155,000K	85,955K	55.5%
62101F	AFGL	Geophysics	37,785K	17,972K	47.6%
62102F	AFWAL/ML	Materials	46,190K	7,918K	17.1%
62201F	AFWAL/FI	Aerospace Flight Dynamics	61,184K	1,020K	2.0%
62202F	AMD/AMRL & SAM	Aerospace Biotechnology	40,500K	7,702K	19.0%
62203F	AFWAL/PO	Aerospace Propulsion	53,000K	1,253K	2.3%
62204F	AFWAL/AA	Aerospace Avionics	67,582K	1,664K	2.5%
62205F	AFHRL	Training & Simulation Technology	17,000K	1,203K	7.0%
62302F	AFRPL	Rocket Propulsion	37,100K	1,177K	3.1%
62601F	AFWL	Advanced Weapons	44,481K	1,885K	4.2%
62602F	AFATL	Conventional Munitions	37,386K	922K	2.5%
62702F	RADC	Command, Control & Communications	69,772K	5,114K	7.3%
62703F	AFHRL	Personnel Utilization	6,500K	146K	2.2%
6.1-6.2	Totals		$686,080K	$135,112K	19.6%
6.3-6.4	Totals			$ 17,956K	
	Total Air Force Funds			$153,068K	
Other Agency Funds Managed by the AF (estimate) ..... (DARPA, DOE, DMA, etc.)				$ 21,635K	
Total USAF Support to Universities				$174,703K	

SOURCE: HQ AFSC MASIS, 7 JUN 84

Air Force Basic Research
University Research Instrumentation

- DoD Initiative to Improve University Research Capability in Support of National Defense
- DoD Investment of $150 M
  - $10 M per Year for Each of the Three Services
- DoD Brochure Announced Program with Instructions
  - Emphasis on Large Equipment Items: $50 K to $1 M
  - Proposals Received by 15 Dec '83: 1,870 Proposals ($373 M)
  - Proposals Sent to a Central Location (ONR in 1982, AFOSR in 1983)
  - Each Service Evaluates Every Proposal: Provide Prioritized List to OSD
  - Selection Based on Importance of Proposed Research to OSD
- FY 84/85: 452 Selected

Air Force Basic Research
Special Faculty Programs ($11.6 M)

- Summer Faculty Research Program ($3.0 M)
  - Faculty (150)
  - Mini-Grant (50) $20 K each - seed money.
  - Graduate Student Support (100 Grad Students)
- University Resident Research Program ($1.5 M – 25/Yr.)
- Post Doctoral Research Programs ($3.1 M)
  - National Research Council (25)
  - Geophysics Scholar Program – FY 83 (10)
  - Weapons Lab Program – FY 84
- Air Force Assistantship Programs ($4.0 M – 94 Students)
  - Microwave Tubes
  - Advanced Composite Structures
  - Aircraft Propulsion
  - Manufacturing Science

Cooperative Program with Industry
AFOSR - Salary
Industry - Benefits

Air Force Basic Research
University/Air Force Renewal Plan

Distribution of New Dollars

Element	FY 86	FY 87	FY 88
University Research Instrumentation	50%	35%	20%
Special Faculty/Student Programs	20%	25%	30%
Initiatives and New Research Programs	30%	40%	50%

Air Force Basic Research
University Research Instrumentation

	Proposals Received	Total Dollar Request	Funded	Unfunded
FY 83	2,500	$ 640 M	$30 M	$610 M
FY 84/85	1,870	$ 373 M	$60 M	$313 M
TOTAL	4,370	$1,013 M	$90 M	$923 M

Air Force Basic Research
Special Faculty Program Expansions

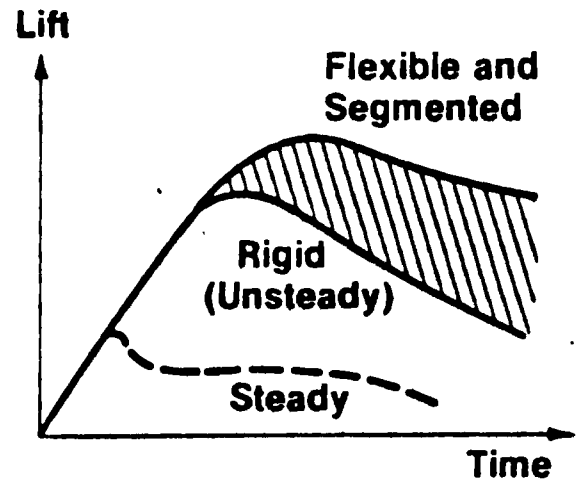
● Summer Faculty Research Program • Faculty (350) • Minigrant (175) • Graduate Student Support (250)	$7.0 M	($4.0 M Add)
● University Resident Research Program	$3.5 M	($2.0 M Add)
● Postdoctoral Research Program	$7.1 M	($4.0 M Add)
● Air Force Assistantship Programs • Microwave Tubes • Advanced Composite Structures • Aircraft Propulsion • Manufacturing Science	$4.0 M	($0 Add)
TOTAL	$21.6 M	($10.0 M Add)

Air Force Basic Research

Project	Title	FY 84	FY 85	FY 86
2301	Physics	19,618	18,999	20,680
2302	Structures	—	12,257	16,298
2303	Chemistry	18,178	19,613	22,376
2304	Mathematics	18,157	18,990	21,517
2305	Electronics	21,321	20,009	21,798
2306	Materials	22,537	23,290	25,378
2307	Fluid Mechanics	23,581	14,910	14,512
2308	Energy Conversion	10,118	12,452	11,365
2309	Terrestrial Sciences	2,460	2,848	3,122
2310	Atmospheric Sciences	11,416	12,317	13,388
2311	Astronomy & Astrophysics	5,901	7,947	8,645
2312	Biological & Medical Sciences	8,421	9,938	10,352
2313	Human Resources	6,656	6,545	7,687
2917	University Instrumentation	10,100	10,000	10,000
	Program Element Total	178,464	190,115	207,118

Air Force Basic Research
FY 86 Initiative

Maneuverability



AF NEEDS

- More Maneuverable Aircraft and Missiles
- Improve Kill Ratio/Get First Shot
- Operate Safely and Efficiently in Post-Stall

FUNDING ($M)

FY 86	FY 87	FY 88	FY 89	FY 90
1.5	1.8	2.0	2.0	1.8

RESEARCH AREAS

- Unsteady Separated Flow
- Fluid-Structure-Control Interaction
- Time Dependent Boundary Conditions
- Enhanced Performance by Flexible and Segmented Structure

Air Force Basic Research
FY 86 Initiative

Middle Atmosphere Periodic STructure Associated Radiance (MAPSTAR)

AF NEEDS

- Model IR Background Clutter for Analysis of Surveillance Systems Constraints

FUNDING ($M)

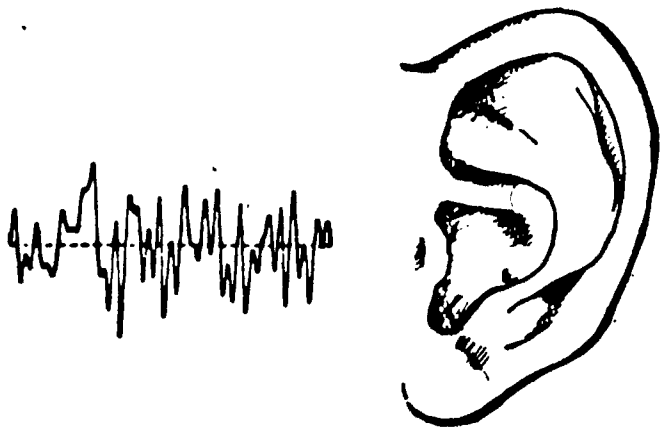
FY 86	FY 87	FY 88	FY 89
0.6	0.6	0.7	0.7

RESEARCH AREAS

- Auroral and Nuclear Backgrounds
- Natural Airglow
- Middle Atmosphere Structure and Dynamics

Air Force Basic Research
FY 86 Initiative

Auditory Pattern Recognition



AF NEEDS

- Maximize Intelligibility of Spoken Messages and Warning Signals
- Base Noise Standards on Effects on Human Performance
- Sophisticated Recognition of Speech by Machines
- Minimize Mental Workload of Human Operators in High Data Rate Environments

FUNDING ($M)

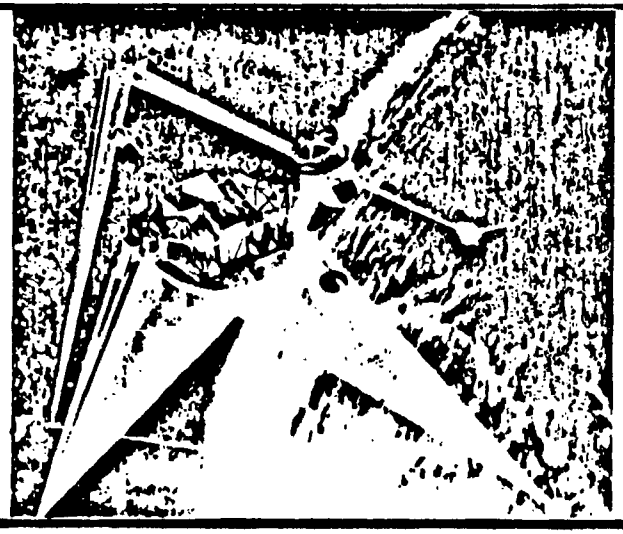
FY 86	FY 87	FY 88	FY 89	FY 90
1.0	1.6	2.0	2.0	2.0

RESEARCH AREA

- Mechanisms by Which Human Subjects Recognize and Analyze Complex Sounds

Air Force Basic Research
FY 86 Initiative

Control of Distributed Systems



AF NEEDS

- Pointing and Tracking of Space Structures
- Wavefront Control of High Power Lasers
- Space Antenna Shape Control
- Active Flutter Suppression

FUNDING ($M)

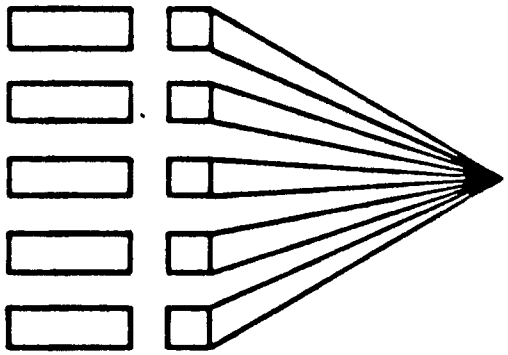
FY 86	FY 87	FY 88	FY 89	FY 90
1.5	3.0	3.5	4.0	4.0

RESEARCH AREAS

- Mathematics of Control of Partial Differential Equations
- Computational (Real Time) Methods
- Applications to Optics, Structures, Aerodynamics

Air Force Basic Research
FY 86 Initiative

Laser Research



PHASED ARRAY LASERS

AF NEEDS

- Directed Energy Weapons
- Intense Short Wavelength Coherent Light Sources
- Nuclear Weapons Simulation
- Compact and Tunable Laser Target Designators

FUNDING ($M)

FY 86	FY 87	FY 88	FY 89
0.4	0.4	0.4	0.4

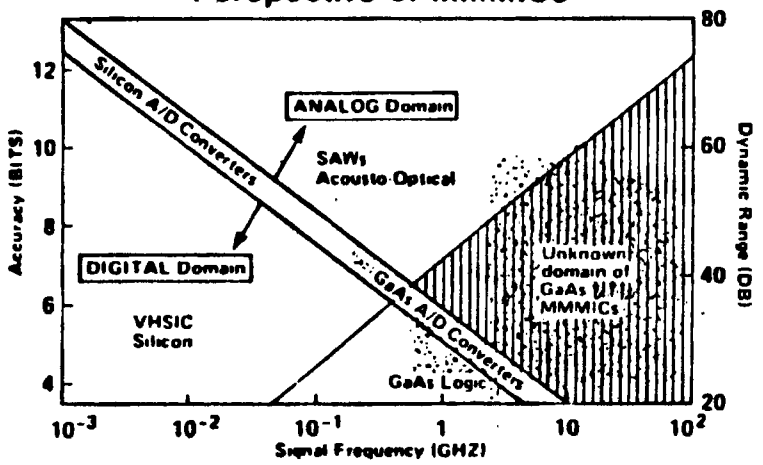
RESEARCH AREAS

- Coupled Laser Array Phasing
- Lasing Mechanisms at Short Wavelengths
- Stimulated Raman Scattering

Air Force Basic Research
FY 86 Initiative

Monolithic Millimeter Wave Integrated Circuits (MMMICs)

Perspective of MMMICs



AF NEEDS

Integrated Circuitry for MM Wave

- Surveillance
- Target Tracking
- Secure Communication
- Electronic Warfare

FUNDING ($M)

FY 86	FY 87	FY 88	FY 89	FY 90
1.0	2.6	2.8	2.9	3.0

RESEARCH AREAS

- Device/Circuit Linearity
- EM Coupling
- Novel Processing
- Modeling

Army University Initiative

OSTP INITIATIVES

FOR

NEW DOD-UNIVERSITY RESEARCH

ARMY RECOMMENDATIONS

Dr. Frank D. Verderame
Assistant Director of Army
Research and Technology
(202) 697-3558

OSTP INITIATIVES FOR NEW DOD-UNIVERSITY RESEARCH ARMY RECOMMENDATIONS

($M)

INITIATIVE	FY86	FY87	FY88	FY89	FY90
Research in Applied Mathematics	4.5	5.0	5.3	5.6	6.0
Research in New Composite Structures	5.0	5.2	5.5	5.8	6.0
Research in Battlefield Terrain Exploitation	4.3	6.8	7.3	7.9	8.4
Engineering Research in Logistics and Maintenance	7.0	7.3	7.6	8.0	8.4
Research in Soldiers Performance and Behavior	4.2	5.0	6.0	3.0	2.0
Research for Optical Warfare	7.0	7.3	7.6	7.9	8.2
Research in High Frequency Microelectronics	5.0	5.2	5.4	5.6	5.8
Research in Ultrafast Reactions in Energetic Materials	5.0	5.2	5.4	5.6	5.8
Intelligent Control Systems	7.0	7.4	7.8	8.2	8.6
Biosystem Research	2.0	2.1	2.2	2.3	2.4
Design Engineering Research in Survival Structures	2.0	2.5	2.5	2.5	2.5
TOTAL	53.0	59.0	62.6	62.4	64.1

RESEARCH IN APPLIED MATHEMATICS

Army Interests

- Applied Analysis
- Physical Mathematics
- Numerical Analysis and Computing
- Statistics and Applied Probability

Summary Description

The Army currently supports a Center of Excellence in Mathematics Sciences (CEMS) at the University of Wisconsin in Madison, Wisconsin. This center works in a diversity of areas of interest to the Army including emphasis on non-linear partial differential equations continuum theories of fluids, software for computers and computational statistics and data analysis. The new CEMS will serve as a national focal point in such areas as continuum mechanics, computational fluid mechanics, combustion and detonation physics and artifical intelligence especially applied to scene interpretation for navigation of autonomous mobile vehicles. Important statistical modelling is based upon abstract mathematical methods involving three dimensions — for example, random field theory, stochastic networks, point processes and abstract pattern theory. These are important for real time image processing in target recognition.

Program Management

Establish a Center of Excellence in Mathematical Sciences (CEMS). The CEMS will support approximately seven distinguished mathematicians in the United States and would knit together a group of other academic and industrial institutions to foster DOD-University and industry cooperation. The center would also support a steady succession of top-notch visiting faculty and would provide a site for others to study with their own funding. The steady state budget will support 35 matriculated students at the center with support for very senior researchers, established researchers, beginning post-doctoral researchers, and graduate student research assistants. Building and other physical facilities will be provided by the University.

Funding Profile ($M)*

FY 1986	FY 1987	FY 1988	FY 1989	FY 1990
4.5	5.0	5.3	5.6	6.0

* Universities must be assured of continued funding in order to commit themselves to this venture.

RESEARCH IN NEW COMPOSITE STRUCTURES AND NON-EQUILIBRIUM MATERIALS

Army Interest

- Lighter Equipment
  - Ordnance
  - Airframes
  - Propulsion
  - Armor
- Greater Mobility
- Counter Detectability

Summary Description

Advanced composites possess unique properties that can be readily tailored. These methods offer significant increases in capability while reducing weight and manufacturing costs. Nonequilibrium materials also exhibit properties that are currently unavailable to include unusually high strengths and resistance to the environment, attractive soft and permanent magnetic behavior and improved wear resistance. The research strategy in these disciplines will be to investigate rapid solidification, laser and electron-beam surface processes, and ion implantation for nonequilibrium materials. Critical issues for advanced composites include prediction, processing, reproducibility, and nondestructive characterization for life prediction and election of defects.

Program Management

A Center of Excellence for Research in Composite and Nonequilibrium Materials would be established as a cooperative venture to support permanent faculty visiting scholars, graduate and undergraduate students.

Funding Profile ($M)

FY 1986	FY 1987	FY 1988	FY 1989	FY 1990
5.0	5.2	5.5	5.8	6.0

RESEARCH IN BATTLEFIELD TERRAIN EXPLOITATION

Army Interests

- Terrain Data Bases
- Spatial Reasoning
- Computer Graphics and Image Generation
- Environmental Sensing
- Environmental Prediction

Summary Description

The Army has recognized the requirement for accurate and timely knowledge about the terrain and environment, including the atmosphere, for tactical planning and operations, via the Air Land Battlefield Environment (ALBE) thrust. ALBE focuses on near-term, computer aided interactive systems for assisting the battlefield commander. This additional new research initiative will concentrate on automating tasks in sensor fusion, spatial data base queries, and graphic product generation. The new work will focus on automating the processing and interpretation of multispectral and environmental sensor data; the relatively unaddressed issue of very large spatial data bases and spatial and temporal reasoning; procedural and artificial intelligence decision making based on terrain and environmental information; and the generation of new types of graphic products to relay this information to the user.

Program Management

A Center of Excellence will be established at a University with a strong background in computer engineering and computer geography to pull together researchers in those related but diverse areas to address the issue of very large spatial data bases. Faculty, graduate students, and researchers will make use of a flexible computer test bed, and the Center will sponsor yearly symposia on spatial data information systems. The other research in this program will be conducted at various qualified Universities through a combination of task-order contracting, block funding, and the Young Investigators Program. The goal is to establish long-term commitments by both the Army and the University, but commitments that are subject to periodic review and redirection based on performance.

Funding Profile ($M)

FY 1986	FY 1987	FY 1988	FY 1989	FY 1990
4.3	6.8	7.3	7.9	8.4

ENGINEERING RESEARCH IN LOGISTICS AND MAINTENANCE

Army Interests

- In-process control
- Critical defect detection
- Decision concepts for monitor and control
- Robotics
- Degradation prevention
- Improved reliability of integrated circuits

Summary Description

There is a clearly defined need for dramatic increases in the reliability and maintainability of Army materiel. The approach which must be taken is that of building-in quality and capability for long-term high performance, rather than depending upon repair and replacement schemes. An integrated program encompassing the science base in areas such as the following will be the method of attack: Manufacturing Science — including in-process monitoring and process control of a wide range of materials, including composites, electronic and optical materials; Nondestructive Evaluation — such as methods for detecting critical defects in systems and providing signals of precursors to the development of life-limiting defects; Artificial Intelligence — for example, decision-making concepts for continuous monitoring of critical systems parameters relating to wearer failure of electronic circuitry; New algorithms for performing precise motions and interfacing combat and logistical systems; and research into the reproducibility and life extension of metallized coatings and prevention of electromigration.

Program Management

This program would be run through block funding contracts from the Army Research Office in Research Triangle Park, North Carolina, and by Army Materiel Laboratories through the Army Research Office.

Funding Profile ($M)

FY 1986	FY 1987	FY 1988	FY 1989	FY 1990
7.0	7.3	7.6	8.0	8.4

RESEARCH IN SOLDIER PERFORMANCE AND BEHAVIOR

Army Interests

- Soldier-Machine Interface
- Factors in Cognitive Performance
- Performance in the Military Environment
- Enhancing Learning and Performance

Summary Description

This research will address issues concerned with basic soldier performance and variables that influence this performance to include stress or reactions associated with adverse environments, information overload, etc. It will also be concerned with gaining soldier performance data using displays and controls associated with advanced technologies. Research will be conducted to determine what types of decision tasks appear appropriate for computers. Information gained will be transitioned to the Army design and analysis communities through Human Factors Engineering design guidelines, briefings, and reports. The proposed program will be divided into the above four topics of Army interest.

Program Management

The research will be conducted by universities under contracts with the US Army Human Engineering Laboratory (HEL) and the US Army Research Institute (ARI). Contracts will be established for topical areas including: soldier/machine interface; man-computer task allocation; advanced auditory information displays; voice intelligibility; human factors in weapons system design; factors in weapons control and target acquisition; management of mental workload; brain hemisphericity; performance under stress and enhancing learning.

Funding Profile: $M

FY 1986	FY 1987	FY 1988	FY 1989	FY 1990
4.2	5.0	6.0	3.0	2.0

INTELLIGENT CONTROL SYSTEMS

Army Interests

- Unsupervised systems for data collection
- Automatic targeting systems
- Software reliability, portability and efficiency

Summary Description

The battlefield commander is faced with a large volume of information from many diverse sources which is usually imprecise, incomplete, contains errors, changes over time, and may arrive in the wrong time sequence. Yet the commander must use this information to make intelligent decisions in order to remain in control of the evolving battle. In addition, the Army is increasingly moving to automatic/autonomous systems for data collection, fire control and computer-aided decisionmaking.

Research will emphasize the development of novel algorithms and architectures to utilize parallel and distributed computing methodologies. Applications of this research include fast data analysis and fusion of inputs from multiple sensors, leading eventually to unsupervised sensing and targeting systems. Computer vision requires advanced algorithms for image segmentation. Intelligent systems must be capable of learning, reasoning, and problem solving. Research must concentrate on the methodologies of Artificial Intelligence, including symbolic computation, and Decision Support Systems as well as advanced computing methodologies.

Program Management

This research will be conducted by universities under contracts with the Army Research Office. The program will be managed through a steering committee chaired by ARO and having representation from Army laboratories. Coordination of research efforts will be conducted through a panel consisting of Army scientists and the directors of each project who will monitor the research project.

Further topics needing contractual studies include data fusion from multiple sensors, voice/digital integration, coupling of display and control, display hierarchy and priority determination, automated mission profile update and coupling with global positioning systems.

Funding Requested ($M)

FY 1986	FY 1987	FY 1988	FY 1989	FY 1990
7.0	7.4	7.8	8.2	8.6

BIOSYSTEMS RESEARCH

Army Interest

Many of the critical problems hampering the implementation of the Army 21 concept to include remote sensing needs, projected high data rates, and the chemical threat may lend themselves to solution by biologically-based systems.

Summary Description

Basic research will attempt to determine to what extent the architecture of protein is essential to their capacity to function as enzymes in catalyzing chemical reactions, or as membrane receptors for electro-chemical gating. Attempts will be made to mimic and improve on some of the known functions of proteins and other macromolecules, particularly in terms of biologically based microelectronic devices or novel materials. Studies of compantmentalized and membrane-interfaced subcellular chemical processing offer the potential of novel sensors containing a biochemical-physical instrument interface. Research into the molecular events of transmembrane signalling might yield knowledge essential to advanced robotics designs. More study of brain mechanisms and connectivities and of biological information storage has great potential in Artificial Intelligence applications.

Program Management

Since the available talent in this area is so widespread, funding of individual principal investigators would be the management strategy.

Funding Profile ($M)

FY 1986	FY 1987	FY 1988	FY 1989	FY 1990
2.0	2.1	2.2	2.3	2.4

able

DESIGN ENGINEERING RESEARCH IN SURVIVAL STRUCTURES

Army Interests

- Lightweight air/armor structures
- Survivability of structures to battle damage

Summary Description

Topics that would be addressed under this program would include:

Dynamic adaptive structures — multi-connected structures with adaptive control (built-in servos, controls, etc.) which are able to dynamically alter the load paths through the structure. This can be used to change the function of the structure, its operation, or to compensate for structural damage.

Shock and impact-resistant concepts — new analytical methods and materials concepts which optimize dissipation of impact or blast energy.

System integrity under adverse environmental conditions — design and materials approaches to protect structures against thermal, erosive, and corrosive environments.

Design of structures for damage tolerance — design of structural redundancies with minimum weight penalty.

Life prediction — new concepts combining stochastic structural behavior and modern life testing techniques.

Program Management

Four Army Research Office Divisions (Materials, Engineering, Chemistry, and Mathematics) would be involved in managing this contract program. In addition, a Center of Excellence with links to industry and Army laboratories, would be appropriate — the latter would also be interdisciplinary, among mechanics, materials, mathematics.

Funding Profile ($M)

FY 1986	FY 1987	FY 1988	FY 1989	FY 1990
2.0	2.5	2.5	2.5	2.5

Personnel Legislation -
DOD Response

WHITEHEAD
Completed
8 FEB 85

THE DEPUTY SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301

13 FEB 1985

Honorable G. A. Keyworth, II
Science Advisor to the President
The White House
Washington, D.C. 20500

Dear Jay:

Thank you for the opportunity to review and comment on the legislative proposal package of the Federal Science and Technology Revitalization Act of 1985. We in the Department of Defense are highly encouraged by your efforts to revitalize the laboratories as well as science and technology activities of the Federal Government.

In a letter we sent to OMB in November 1983, we expressed concern about personnel management problems - particularly problems affecting the scientific and technical staff. DoD needs to attract, retain, and motivate the highest quality scientists and engineers. It is particularly important to DoD since our defense strategy relies on the leverage provided by superior technology. Study after study has recommended a separate personnel system for DoD scientists and engineers.

We have reviewed the proposed legislative package forwarded by your letter of November 9, and we fully support its purpose and major features. The package was widely distributed within DoD. Copies were sent to OSD offices, to the three Services, and to all Defense Agencies. In most cases, comments were solicited from the research and engineering offices, the personnel offices, and the legislative liaison offices. In addition, the Under Secretaries of the Services were requested to give their personal attention to the comments generated within their Service.

An analysis of the responses indicates a broad-based DoD support for the proposed legislative package. This was expected since it enables DoD to cover all of its scientific and technical personnel in the hard sciences. Many favorable comments were received on the provision for a Senior Scientific and Technical Personnel Service, the manner in which the pay cap issue was addressed, and the inclusion of the option for a "401(k)" pay set-aside. Extending the probationary period for new employees to three years is especially appropriate for the research positions in DoD. In short, the comments on the overall bill and many of its individual features were favorable.

It was hardly expected to reach complete agreement on all of the features included in the proposal. In fact, some concerns were expressed about the costs associated with two of the features of the proposed system: (1) the additional cost associated with maximum permissible salary for key positions and allowing a maximum of five percent of the employees covered to be excluded from the pay cap, and (2) the provision of a "401(k)" pay set-aside for scientific and technical personnel only. Our position is that the flexibility provided each agency should enable it to tailor a system suitable for its mission. (Enclosed for your further consideration is a summary of the most significant comments received from the three Services and other DoD components.)

We note that the medical and dental services and behavioral science professionals that would meet the coverage definition have not been specifically included in the coverage. To include them would make the bill even more attractive to DoD (and other agencies). We would also prefer to see the demonstration project at the two Navy laboratories allowed to continue. This project is considered to be quite successful and worthwhile.

We appreciate your sponsorship of this proposed legislation. We concur with the proposal and are ready to provide whatever support you feel necessary to move it forward early this year.

Sincerely,

William H. Taft

William H. Taft, IV

Enclosure

Significant Comments on the Proposed Legislation from the Three Services and the Defense Agencies

1. Concur with the proposal but with the following recommendations:

   a. The definition of scientific and technical personnel should explicitly include employees who do scientific and technical work in the medical, biological, behavioral, and social science fields.

   b. The agency head recruitment and appointment authority should be expanded to insure that it will clearly be direct and an exception to OPM competitive service examination and register requirements.

   c. The definition of laboratory should be expanded to include all facilities where scientific and technical work is carried out.

2. Supports proposal with coverage of all scientific and engineering personnel but expressed the following concerns:

   a. Would prefer coverage of all occupations under the General Schedule.

   b. Would prefer income sheltering option for all employees.

   c. Because of flexibility allowed agencies, all features are viewed as negotiable. Legislation should clearly provide management the continuing right to set wages and benefits for the work force.

3. Strongly endorses or concurs in principle with the major features of the bill with certain reservations such as:

   a. There are significant cost implications.

   b. A clause should be added to permit agencies to extend alternative personnel systems to other occupational groups at a later time.

   c. As written, there will be a conflict with 5 U.S.C. 4302 which requires application of Uniform Guidelines on Employee Selection Procedures (UGESP).

   d. Executive Level IV pay limitation should be maintained only for SSTP's. Executive Level V should be maintained for all other positions for equity among the senior positions in the Federal Government.

   e. Agencies within the same geographic area may begin to compete against each other using the discretionary authority delegated to them.

4. Proposes adding a section to the proposed Chapter 56 of title 5 that would authorize the Secretary of Defense or his designee to establish separate cryptologic scientific and technical personnel management systems for National Security Agency (NSA).

5. The Defense Intelligence Agency (DIA) was granted (through the Secretary of Defense) separate statutory appointing authority (10 USC 1604) which exempts the Agency from competitive service laws and regulations on recruitment, qualifications and appointment. The draft language of the proposed bill ties appointments to civil service law and thus would exclude DIA from effective coverage. To overcome this exclusion it is suggested that the language of Section 5603(d) be modified as follows:

> "The head of an agency may employ scientific and technical personnel within a system established pursuant to this chapter subject to the civil service laws and regulations or, in the case of an agency with separate statutory appointing authority, subject to promulgated agency regulations. . ."

Personnel Legislation
Justification

DRAFT

STATEMENT OF PURPOSE AND JUSTIFICATION

To accompany a draft bill "To amend title 5, United States Code, to authorize alternative personnel management systems for scientific and technical personnel in the Federal government."

PURPOSE

The purpose of this draft bill is to provide a statutory basis within title 5, United States Code, for permitting agencies to establish alternative personnel management systems for scientific and technical personnel. The objectives of the draft bill are to improve the quality of government-operated Federal laboratories in order that the laboratories may fulfill efficiently and effectively their agency-assigned mission and become and remain centers of scientific excellence; to attract, retain, motivate, and improve the quality of Federal scientific and technical personnel; and to improve the overall ability of the Federal government to perform scientific and technical work. The major provisions of this draft bill are as follows:

- permit agencies to include scientific and technical personnel in the new personnel management systems;

- simplify job evaluation and remove covered positions from the position classification requirements of 5 U.S.C., chapter 51;

- provide flexibility to develop salary structures which ensure a competitive position in the labor market and which reflect the hiring and pay policies needed to attract, retain, and motivate a highly qualified scientific and technical work force;

- base pay increases on performance, not longevity;

- allow waiver of pay cap for up to five percent of specially qualified scientific and technical personnel;

- provide for performance and special awards and remove pay cap for lump-sum awards; and

- create a Senior Scientific and Technical Personnel Service.

No employee's basic pay would be reduced as a result of being included under an alternative personnel management system.

To achieve our purpose, the draft bill proposes to establish a new chapter 56 of title 5, United States Code. Required conforming and technical amendments to title 5 are also included in the draft bill.

JUSTIFICATION

The White House Science Council's Federal Laboratory Review Panel was asked by Dr. George A. Keyworth, Science Advisor to the President, to review the Federal laboratories and to recommend actions to improve their use and performance. The panel was specifically charged to look at laboratory missions, identify any systemic impediments to performance, and determine whether this nation is receiving an optimum return on its substantial investment in talent and facilities at the Federal laboratories.

In May 1983, the Panel, chaired by David Packard, reported that Federal laboratories have several serious deficiencies and, consequently, a number of the laboratories do not meet the quality and productivity standards that can be expected of them.

Specifically, the Panel reported that salaries at Federal laboratories are noncompetitive with the private sector at entry and senior levels. In addition, it found that Federal laboratories must deal with a personnel management system that is cumbersome and has little flexibility. As a result, there exists what the Panel referred to as an alarming "inability of many Federal laboratories--especially those under Civil Service constraints--to attract, retain, and motivate qualified scientists and engineers...." "[T]his situation," warned the Panel, "limits the productivity of the laboratories... [and,] [i]f not corrected,...will seriously threaten their vitality." For, as the Panel observed in its report, "[t]he key to a laboratory's success is a high quality and properly motivated scientific staff."

The Panel concluded that "administrative and legislative actions should be initiated...to create, at government-operated laboratories, a scientific/technical personnel system that is independent of current Civil Service personnel systems."

In November 1983, the Task Force on Research and Development, President's Private Sector Survey on Cost Control, similarily reported that administrative and legislative actions should be initiated to create, at government-operated laboratories, a scientific and technical personnel system independent of the current Civil Service personnel system. The Task Force was one of 36 task forces formed by the Executive Committee of the President's Private Sector Survey on Cost Control, which was established by executive order on 30 June 1982. It was charged with:

- identifying opportunities for increased efficiency and reduced costs achievable by executive action or legislation.
- determining areas where managerial accountability can be enhanced and administrative controls improved.
- suggesting short- and long-term managerial operating improvements.
- specifying areas where further study can be justified by potential savings.
- providing information and data relating to governmental expeditures, indebtedness, and personnel management.

The Task Force's mission was to review the operations and management of major research and development agencies throughout the Government, including the Department of Defense, Department of Energy, Department of Health and Human Services, National Aeronautics and Space Administration, and National Science Foundation as well as to identify opportunities for improvement.

The Task Force reported that most DoD personnel interviewed said that the ceiling on civil service salaries made it difficult to hire or retain top civilian researchers. It found that Federal laboratories report a gradual loss of technical personnel to industry. Furthermore, entry level salaries are not sufficiently competitive with private industry to attract the top college graduates.

The Task Force further reported that the current Federal pay schedules significantly handicap the laboratories in recruiting and retaining well qualified scientists and technicians. It said that Federal pay rates and policies for personnel in the science and engineering disciplines are not comparable with private sector pay for the same level of work.

The Task Force felt that creating scientific and technical personnel systems independent of the current Civil Service personnel system would alleviate to some degree the disadvantages now faced by the Government laboratories and would permit the laboratories to attract, retain, and motivate scientific and technical personnel required to fulfill efficiently and effectively their agency-assigned missions. In its report, the term "laboratories" is a generic term and includes facilities that are actually known as bureaus, centers, facilities, divisions, institutes, activities, offices, museums, stations, research units, or observatories.

These two studies have formed the basis for this draft legislation. The Administration feels strongly that it is of utmost importance to increase the quality of the scientific and technical work force in the Federal government.

The basic thrust of the draft legislation is to provide authority for agencies to construct alternative personnel systems which are appropriate to the scientific and technical personnel employed by the Federal government. The legislation does not attempt to define the personnel systems beyond establishing some very general guidelines. It is believed that this approach will provide the Government the greatest flexibility in dealing with a very complex problem.

The draft legislation provides, however, that agency alternative scientific and technical personnel management systems must be submitted to the Office of Personnel Management (OPM) for review and approval. This review will ensure compliance with applicable laws and regulations and will provide an opportunity for OPM to ensure that systems contribute to cost-effective and efficient personnel management. In addition, OPM and the General Accounting Office must evaluate implementation of the systems.

Accordingly, we are asking the Congress to provide authority for establishing alternative scientific and technical personnel management systems which will enable the Federal government to attract, retain, and motivate qualified scientific and technical personnel.