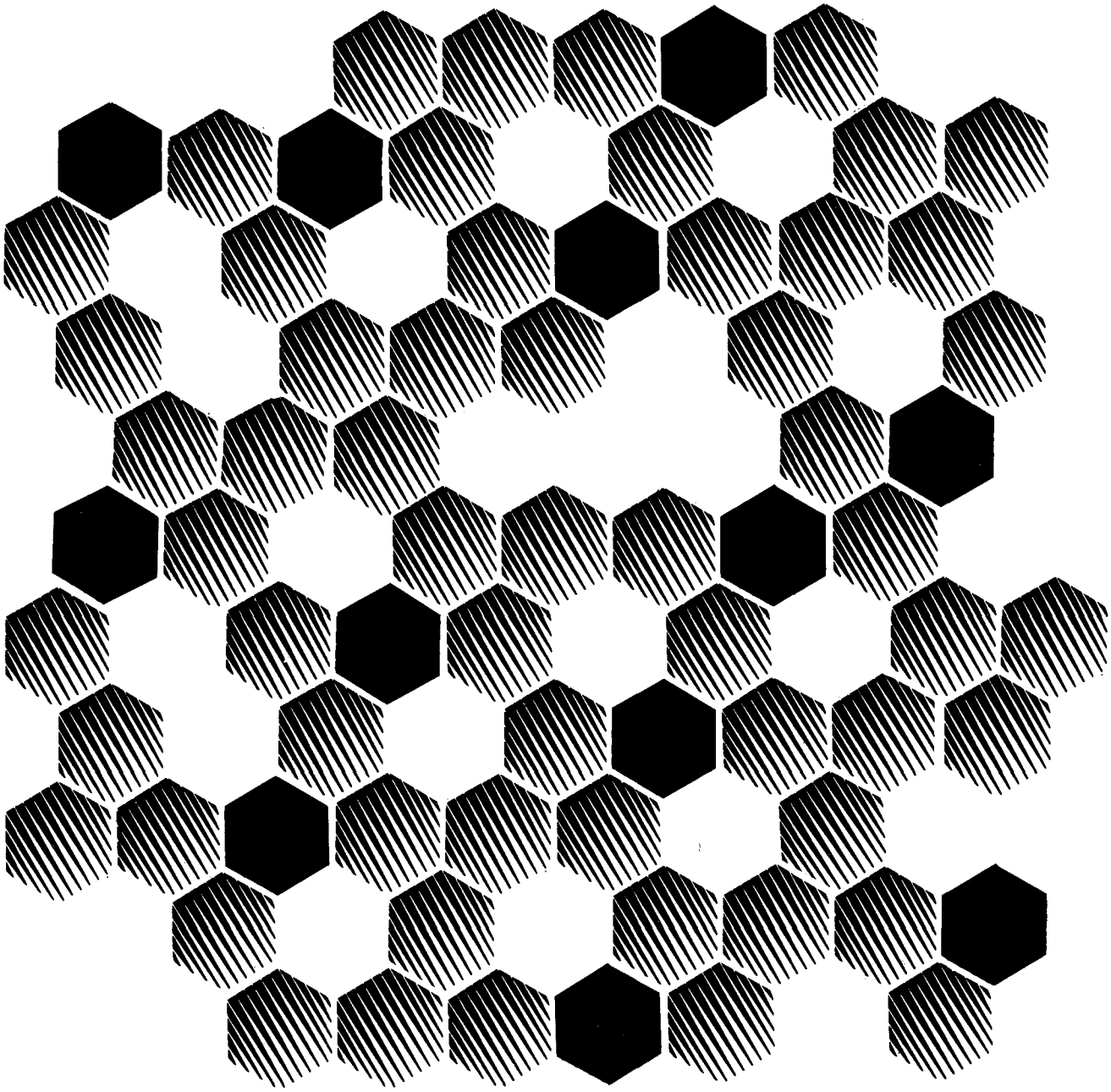
Progress Report
ON
Implementing the Recommendations of the White House Science Council's Federal Laboratory Review Panel

VOLUME II—STATUS REPORTS BY AGENCIES **JULY 1984**



OFFICE OF SCIENCE AND TECHNOLOGY POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20506

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DEPARTMENT OF AGRICULTURE

MISSION

Recommendation 1-1: Mission Review

In February 1983, the Agricultural Research Service (ARS) announced new directions for agricultural research in the 1980s with emphasis on research on critical national needs up to 1990 and projected over the next 20 to 50 years. Some 500 ARS scientists and members of the National Program Staff (NPS) were asked to devise a strategy that would provide, through research, the means by which U.S. agriculture could meet these needs. In response, they developed a document, the ARS Program Plan. The plan records the best thinking of these scientists and NPS members on how ARS can meet the Department of Agriculture's (USDA's) short- and long-term needs most effectively and efficiently.

ARS is redirecting its scientific talent and resources in line with Secretary of Agriculture Block's policy to focus research on national goals. The ARS is projecting that $75 million of its current budget be redirected over 6 years, from 1984 to 1990. A revised program of Forest Service (FS) research under the provisions of the Renewable Resources Planning Act is now in preparation and will be submitted in December 1984.

Recommendation 1-2: Size of Laboratory

The Program Plan includes programs for meeting future, as well as present, needs of U.S. agriculture. On the basis of recommendations by the scientists and the NPS, and guided by USDA policies, a 6-Year Implementation Plan was prepared. In it are identified the programs of highest priority that ARS will support first. The projected resource allocations for those high-priority research programs are being developed. This information will guide decision making by management at all levels in ARS. Programs will be evaluated systematically to identify areas of significant progress, major constraints to further progress, emerging research problems and opportunities, and research that can be discontinued.

The ARS continues to seek ways to improve the efficient use of its facilities and to give increasing emphasis to the optimum use of facilities as redirections prescribed in the 6-Year Implementation Plan are carried out.

The total Forest Service research program is reviewed annually, and assignments to the eight Regional Forest and Range Experiment Stations and the Forest Products Laboratory (Madison, Wisconsin) are adjusted in accordance with long-range research plans and Congressional action.

FUNDING

Recommendation 3-1: Multiyear Funding

From 1975 through 1984, the Agricultural Research Service received steady increases from $218 million to $453 million. In constant 1984

dollars, the increase was from $425 to $466 million. During that time, yearly effort was approximately constant at 2,800 scientist-years while total employment decreased from 9,350 to 8,546. Thus, stable funding appears to have been provided. However, late funding of pay raises caused a significant impact on planning. The USDA's experimental research organizations are primarily in-house with salary costs typically ranging from 65% to 85% of total funds available. A 5% pay raise that must be funded from nonsalary funds reduces those funds from 9% to 28%. Current timing of pay raise decisions requires fundholders to "set aside" those amounts, often until one-half to three-quarters of the fiscal year is over, before they can make final funding decisions. Late appropriations cause similar uncertainties which impact final decisions.

The primary Federal research laboratories in the USDA are in the Agricultural Research Service and the Forest Service. Both receive appropriations directly with no "overhead" taken at the Department level. Both agencies have planning systems that enable proper, predictable multiyear planning except for the impact of late appropriations and unfunded or partially funded pay raises. Neither agency has the flexibility to "absorb" unfunded pay raises except from all other funds that directly affect planned experiments. Thus, the USDA supports the recommendation. If a 2-year budget is not appropriated, full funding of pay raises and a 2-year budget or carry-over authority of unobligated funds would greatly contribute to the proper planning of the Department's research efforts. Full funding of pay raises is by far the most critical aspect, followed by a 2-year budget or carry-over authority.

The Office of Management and Budget (OMB) must request and Congress must fund pay raises; Congress must grant carry-over authority and appropriate funds accordingly, or Congress must appropriate a 2-year budget. If government-wide authority is not obtained, the appropriation committees of the Congress will be requested to fully fund all pay raises for personnel in the Department.

Recommendation 3-2: Discretionary Funds

The USDA laboratories do not have any formal discretionary funds. USDA Federal laboratory directors, however, have authority to decide the subject matter and methodology of research activities and, in exercising this authority, have some freedom to undertake exploratory research. As a result, the decision making authority of USDA managers allows for a degree of discretionary use of funds. The only review of these discretionary decisions occurs in general program reviews or in managers' performance ratings.

The Department supports the recommendation but believes it can accomplish the intent without establishing a formal discretionary fund. A policy statement will be issued by agency heads on the equivalence to formal discretionary funding authority of 1) determining research goals and approaches, and 2) freedom to do exploratory research. The statement will also establish guidelines on the amount of permitted exploratory

research and a review system so that the amount of equivalent discretionary funding authority can be raised or lowered depending on the effectiveness of its use.

USDA will charge appropriate staff or a special committee in the Forest Service and Agricultural Research Service to develop the policy statements. After appropriate review, the Chief of the Forest Service and Administrator of the Agricultural Research Service will issue the policy statements.

Selected Department officials have been briefed on the concept and have concurred in the general approach.

Recommendation 3-3: Carry-Over Funding

P.L. 95307, "The Forest and Rangeland Renewable Resources Research Act of 1978," provides basic guidance to Forest Service research. Section 7 of this Act states, "There are hereby authorized to be appropriated annually such sums as may be needed to implement this Act. Funds appropriated under this Act shall remain available until expended." However, this authority has never been extended by Congress to the Forest Service during the annual appropriation process. Therefore, to date, Forest Service research funds have been appropriated only as annual funds. The Agricultural Research Service has no authority to carry over unobligated funds except for construction and rare special programs of a temporary nature.

The USDA supports the recommendation. If the predictable funding recommendation is not implemented (2-year budget), the Department will request that a minimum of a 120-day grace period be permitted to carry over expiring appropriations.

If the predictable funding recommendation is implemented, no action is required. If not, the Department must request carry-over authority through OMB, and the Congressional appropriation committees must grant carry-over authority.

MANAGEMENT

Recommendation 4-1: Oversight Function

ARS reviews each research project at least once every 3 years. Review panels include research leaders from the laboratories under review and scientists from other government agencies, the academic community, and industry. The review and evaluation of research programs at many levels in ARS serve to identify areas of significant progress, major constraints to further progress, emerging research problems and opportunities, and research that can be discontinued. That information is used in setting priorities, planning and implementing redirection, developing budgets, and revising the 6-Year Implementation Plan and the operational plans. The National Program Staff is responsible for reviewing national programs and for evaluating their progress and consistency with the 6-Year Plan.

A continuing schedule of technical review of Forest Service research units monitors performance and productivity. These reviews include peer specialists from universities, private industry, and state forest agencies.

Recommendation 4-2: Greater Reliance on Peer Review

A system is in place that provides for peer review of each research project before implementation.

In the application of the Research Grade-Evaluation Guide, grade levels for scientific positions are determined by committees (often referred to as peer panels) rather than by a single classification specialist—the usual practice in the Federal Government. Scientists prepare written material describing their research assignments and their accomplishments, and an appropriate panel periodically reviews the position. Panels consist of a committee chairperson (usually a research manager), an executive secretary (a classification specialist), and five scientists.

The peer review and evaluation systems will be reviewed periodically and revised when necessary.

Recommendation 4-3: Finite Term for Laboratory Director

Funds are appropriated by Congress for specific research programs. ARS headquarters allocates those funds to Area Directors (AD's). Each AD is responsible for controlling allocated funds and for assuring that the research program is carried out. Performance of ARS managers is evaluated annually.

A major reorganization of ARS has just been put in place that reduces the number of AD's to 11, (one of whom is director of the Beltsville Agricultural Research Center), eliminates one layer of administrative management, and provides for more direct interaction between research managers in the field and the National Program Staff at Headquarters. The AD's have primary responsibility for the quality of their research programs and work with the NPS in assuring program relevance and conformity with the ARS Program Plan and 6-Year Implementation Plan. The AD's are formally evaluated annually for their effectiveness in fulfilling these responsibilities, and, as members of the Senior Executive Service (SES), they can be reassigned as appropriate to improve program leadership and management.

Forest Service funds are appropriated annually by Congress for specific research subjects as enumerated in the Renewable Resources Research Act of 1978. These funds are allocated to the eight regional experiment stations and the Forest Products Laboratory (FPL) pursuant to their assigned missions and respective roles in the total FS research program. Like AD's, FS experiment station and FPL directors are in the SES.

INTERACTION WITH UNIVERSITIES, INDUSTRY, AND USERS OF RESEARCH RESULTS

Recommendation 5-1: Access to Federal Laboratories

In 1983, USDA issued a Departmental Regulation on Research and Education Policy which states that it is the policy of the Department to:

". . . enhance and preserve partnership relations among research and education performers within the total State, Federal and private system."

USDA policy and practice have always been to promote access to research laboratories. This has been successful. For example, in 1981-1982, approximately 2,000 persons visited nine Agricultural Research Service laboratories seeking information and scientific advice. Joint use of equipment and facilities by university and USDA personnel is also practiced at numerous locations—about 50 percent of ARS scientists are located at or adjacent to university facilities. ARS scientists devoted approximately 3.6 percent of their time in 1983 to make more than 60,000 contracts with users of ARS research results. These users included action and regulatory agencies, extension services, farmers and ranchers, agricultural industry, state and local governments, and consumer groups.

Forest Service research results are communicated by means of technical publications, articles in scientific and user journals, workshops, and responses by scientists to individual requests for technical information. Since much of the research is used in the management of the 191 million acres of National Forests, particular attention is given to internal communication of research results within the Forest Service. This takes many forms, including workshops and preparation of concise management guides based on research findings. The State and Private Forestry Branch of the FS has the responsibility to supplement the technology transfer of applied research to the state forest land management agencies and to private forest landowners. This is done through technical meetings, special workshops, and joint efforts with state forestry agencies and others. In total, FS technology transfer utilizes a variety of avenues to communicate research results to the scientific community, within the agency itself, and to other research users. Also, forestry research cooperation with university and private sectors is fostered through joint research planning between the FS, the Cooperative State Research Service, and the Association of State College and University Forestry Research Organizations.

Published technology transfer plans are in place to broaden the clientele accessing USDA laboratories. Included will be targeted groups, such as Small Business Development Centers.

Recommendation 5-2: R&D Interaction Between Federal Laboratories and Industry

Many USDA researchers maintain close rapport with representatives of industrial firms relevant to their research. This interaction is encouraged and taken into account as part of the scientists' evaluations. At other levels, industry representatives serve in many formal and informal

advisory roles to departmental, agency, and program managers. Industry groups also contract with USDA agencies to conduct specialized research projects within established guidelines. In 1983, ARS scientists made an estimated 15,000 contacts with industry personnel to plan and conduct research and to transfer technology.

Funds allocated by USDA for competitive research grants total $17 million in fiscal year 1984. All universities and industrial R&D organizations are eligible to compete for these grants. Increased utilization of sabbatical assignments and non-competitive temporary Federal appointments will be explored for increasing exchange of personnel between USDA and industry.

DEPARTMENT OF COMMERCE:
NATIONAL BUREAU OF STANDARDS (NBS)
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

MISSION

Recommendation 1-1: Mission Review

NBS:

The Department of Commerce (DOC) held strategic Planning Reviews for the National Bureau of Standards (NBS) in September 1982. The NBS mission was thoroughly reviewed and the programs were grouped in three categories: providing a basis for measurements throughout the United States; providing technical assistance to the Federal Government as mandated by Organic Act or legislative assignments; and assisting in solving technological problems that are measurement and test-method intensive.

NBS receives authorization each year by separate Act of Congress. Its mission is therefore updated annually. In addition, NBS testified at Congressional hearings on the NBS Organic Act held in June 1981. The hearings were held "to examine how well the Bureau's present charter serves present needs and covers the activities actually performed by the Bureau; and to determine how the Bureau can and should serve these and other Federal and national needs for research and development by government, industry, and the universities in future years." Following the hearings, DOC/NBS prepared a revised version of the Organic Act for consideration by Congress. The draft clarifies and modernizes the basic functions and activities of NBS.

NOAA:

In the fall of 1982, the Administrator of the National Oceanic and Atmospheric Administration (NOAA) initiated a long-term planning process, the first step of which included consideration of roles appropriate to Federal laboratories and the Federal Government. National needs were listed, and from these candidates future programs and activities were recommended. In response to the report of the White House Science Council's Federal Laboratory Review Panel, the Administrator had the mission statements of all NOAA laboratories and Fisheries Centers revised and updated. The Administrator also conducts, over a cycle of about 18 months, reviews of program areas (e.g., marine quality, marine resources, etc.) that involve more than one laboratory and organization element within NOAA. These reviews are part of the basis used for reassigning responsibilities and priorities within the agency.

Recommendation 1-2: Size of Laboratory

NBS:

Compared with similar laboratories in other industrialized countries, NBS is substantially smaller relative to the size of Gross National Product. In

addition to those activities defined under the Organic Act, NBS has been assigned 22 Congressionally mandated programs. NBS is rebuilding the basic competence that has been eroded due to combined budgetary and personnel constraints and added Congressionally mandated programs. A competence building program initiated in fiscal year 1979 and continued through fiscal year 1983 is currently funded at $7.0 million/year.

The institutional planning process of the Department of Commerce during the budget formulation and review process and the strategic planning objective exercises—coupled with external review processes by peer groups, Statutory Visiting Committee and Evaluation Panels—ensure the quality, importance, and priority of programs, quality of staff, equipment needs, finances, and appropriateness of the program to NBS mission. In addition, the Director and heads of the major operating units reprogram resources to answer the identified priority needs of science and technology. This reprogramming has resulted in a 40% turnover in NBS projects during the last 5 fiscal years.

NOAA:

NOAA has produced a draft long-range plan for research which is to be updated annually. The planning process begins with an analysis of national needs, of the appropriate Federal role in meeting them, and of NOAA's responsibilities. The Administrator makes program direction decisions on the basis of options in the plan, and these are promulgated to the laboratories with relevant missions. The funding and personnel allotments are adjusted accordingly after Congressional appropriations.

As a result of this DOC/NOAA process, the size of the laboratories is adjusted automatically each fiscal year to be compatible with the funding approved by the President and appropriated by Congress for their respective program areas.

FUNDING

Recommendation 3-1: Multiyear Funding

NBS:

NBS receives separate designated appropriations from Congress. NBS currently has appropriations for a 1-year period with unlimited carryover authority.

NBS supports R&D funding on a 2-year basis if that funding is predictable. The appropriation would have to allow for increases for pay raises, cost of living allowances, and supplementals for unforeseen circumstances of a significant nature.

All Congressional authorizing and appropriations committees would have to approve the changes. Departmental and Office of Management and Budget (OMB) policies would have to be brought into line with this method of funding.

NOAA:

Funds are appropriated on an annual basis, with no separate appropriation for research. Base budget is very stable at the laboratory level.

Instability due to annual appropriation is not a problem. No recommendation is made for multiyear funding or for a separate research appropriation.

Recommendation 3-2: Discretionary Funds

NBS:

NBS currently has "competence funding" for use in the long-term research mission. This can be considered discretionary funding, and constitutes 7% of total funds. These funds are used to develop research competence in areas that management views as potentially important in the long-term mission of NBS. The use of these funds is reviewed by the National Academy of Sciences (NAS). NBS has full liberty to execute its program as it deems appropriate, whether in-house or contracted through academia or industry.

No change in funding is necessary to meet the recommendation.

NOAA:

NOAA laboratories currently have no discretionary funds. If urgent needs for new programs on the frontiers of science arise, the agency will reprogram to make funds available. Provisions for discretionary funds would be helpful in meeting this recommendation.

NOAA will request discretionary funds as part of future budget initiatives.

Recommendation 3-3: Carry-over Funding

NBS:

NBS currently has carry-over funding authority.

NBS concurs in need for carry-over authority. Many programs that are delayed need carry-over authority to properly fund the completion of the mission.

NOAA:

NOAA has no-year funds, with no restriction on obligation rates. No change in funding is necessary to meet the recommendation.

MANAGEMENT

Recommendation 4-1: Oversight Function

NBS:

NBS reports its program annually to a two-tiered external oversight function: the Statutory Visiting Committee appointed by and reporting to the Secretary of Commerce and, for each technical program, a Board of Assessments administered by the National Academy of Sciences. During 1981, Secretary Baldridge requested a critical review of all advisory committees within the Department to determine which ones could be terminated. The review covered a total of 89 committees and considered funds expended and products produced. None of the committees was terminated. However, several cost reduction measures were put into place. The formation of another advisory committee appears inconsistent with the

Secretary's actions. Moreover, a proposed Project Evaluation Committee (as recommended in the Grace Commission Report) is redundant with the existing Visiting Committee/Evaluation Panel structure and would be an unnecessary duplication of effort.

NOAA:

NOAA conducts regular reviews both of laboratories and of program areas. Members of industry, academia, and user groups are represented on the review committees. These members are invited on a case-by-case basis. In response to the report of the White House Science Council's Federal Laboratory Review Panel, the process of including outside reviewers and requesting their written reviews has been documented and formalized. The National Marine Fisheries Service (NMFS) is also subject to external oversight by two formally established advisory committees which scrutinize the quality and relevance of the laboratories' activities. These are the National Committee on Oceans and Atmosphere (NACOA), which has oversight for all of NOAA, and the Marine Fisheries Advisory Committee (MFAC), which has oversight for the NMFS. The question of external reviews was discussed at the NMFS Research Council in May 1984, and it was decided that the present system is adequate and that additional processes for accomplishing external oversight are not needed. Plans are to establish a group of advisors to review both the laboratory programs and the research programs across NOAA line organizations.

Recommendation 4-2: Greater Reliance on Peer Review

NBS:

Continuous peer review of NBS activities is assured by a variety of methods.

The Director and the major operating units use the annual reports of the Statutory Visiting Committee and NAS-administered Board of Assessments of NBS programs to assess fundamental long-range research plans and activities. This research must satisfy one or more of the following criteria: furthers the development of standards, data and/or measuring techniques; serves a national need such as defense; answers a technological need.

Industrial, academic, and standards groups advise NBS on technological, measurement, and data needs.

NBS uses advice from ad-hoc industrial, government, and academic groups in assessing its future role in specific long-range research initiatives.

An internal peer review process is used to target new areas of fundamental research for competence building. The advice of outside scientists is also sought as to the merits of these proposed long-range fundamental research programs.

The planning of large facilities (e.g., cold neutron facility and cw-accelerator) to meet the needs of industry, academia, and other government agencies is accomplished in coordination with potential user groups

and other interested parties (e.g., the National Science Foundation, the Office of Science and Technology Policy,and the Department of Energy).

NOAA:

Peer review has always been accomplished to a significant degree, and by the usual processes, i.e., of publication in peer-reviewed scientific journals, attendance and presentation at professional meetings, interaction with other scientists in committees and working groups, and exchanges of personnel. However, feedback has not been assured in all cases. Partly as a result of the White House Science Council's report, the NOAA Administrator has had his personal staff investigate the peer review process in NOAA. The outside review process will be strengthened by giving the outside reviewers of both laboratories and program areas a written charge and obtaining written feedback. In addition, a small "board of visitors" will assist the Assistant Administrator for Research to provide advice and broad overview.

Recommendation 4-3: Finite Term for Laboratory Director

NBS:

DOC has instituted a management by objectives system by which an agreed upon set of strategic planning objectives (SPO's) with their specific measurable milestones constitutes the individual performance plan of the NBS Director. As a Presidential appointee, the Director's tenure will continue to be at the pleasure of the President, and his performance will be evaluated on a regular basis by the Visiting Committee and by the Secretary of Commerce. The Director will be held accountable in fiscal year 1984 by the Secretary of Commerce for the accomplishment of a set of 10 SPO's, each of which has a number of milestones with measurable outputs.

NOAA:

Laboratory and Fisheries Center directors are members of the Federal Senior Executive Service (SES), serving under contracts reviewed twice a year. These contracts require adherence to predetermined standards in laboratory performance. The SES contract and review process thus provides the opportunity to terminate contracts if laboratory performance is not acceptable. Although not related to performance, the directors of seven laboratories and centers have changed in recent years, illustrating the flexibility of the personnel system.

INTERACTION WITH UNIVERSITIES, INDUSTRY, AND USERS OF RESEARCH RESULTS

Recommendation 5-1: Access to Federal Laboratories

NBS:

As a matter of mission, and in compliance with legislation of 1901 responsive to Alexander Graham Bell's proposal, the NBS makes its laboratory facilities readily accessible. About 750 guests are currently acquiring "hands-on" experience in NBS facilities under various formal programs. NBS brochures describe about 100 special technical facilities

and several hundred research topics to attract researchers. NBS facilities are generally designed to provide space for guest investigators. Examples follow.

The Experimental Nuclear Reactor has 25 ports providing 125,000 instrument-hours per year to more than 50 guest groups for research involving neutron scattering, measurement standards, dosimetry, trace analysis, isotope production, and radiation.

The Synchrotron Ultraviolet Radiation Facility (SURP) provides 280 MeV highly collimated, nearly polarized radiation of calculable intensity in 6 beams.

The Linear Accelerator (LINAC) accelerates electrons to energies between 1 and 10 MeV in a beam directed to either of two heavily shielded underground target rooms or to an above-ground target room where secondary neutron beams are produced for time-of-flight meausurements across distances up to 200 meters.

NBS has a variety of arrangements for joint research with universities. At the Joint Institute for Laboratory Astrophysics (JILA) in Boulder, for example, 13 NBS staff members join with 11 faculty members of the University of Colorado to conduct research involving precision measurement in physics, chemistry, and astro-geophysics. One hundred and forty three additional invited scientists and students join in the research on a revolving basis. NBS facilities are continually being upgraded and new arrangements made for joint research with institutions of learning.

NOAA:

NOAA provides access to its Federal laboratories through a variety of mechanisms: cooperative institutes with state and local universities, reimbursable programs, Intergovernmental Personnel Act (IPA), postdoctoral program, visiting scientists, and direct access to special facilities. Cooperative institutes between NOAA and universities have been established in Hawaii (JIMAR—Joint Institute for Marine and Atmospheric Research), Washington (JISAO-Joint Institute for Study of the Atmosphere and Ocean), Colorado (CIRES—Cooperative Institute for Research in Environmental Sciences and CIRA—Cooperative Institute for Research in the Atmosphere), Oklahoma (CIMMS—Cooperative Institute for Mesoscale Meteorological Services), and Florida (CIMAS—Cooperative Institute for Marine and Atmospheric Studies); and a cooperative program has been established in New Jersey. On the average, NOAA has around a dozen IPA's that range from 1-year to 4-year assignments, but the number varies from year to year. Guest worker arrangements are made between the individuals and the NOAA laboratories, but on the average about 50 guest workers per year work in the laboratories. Arrangements for direct access to laboratory facilities are usually made directly by the laboratory and the user; these are not long-term arrangements. Examples of direct access to special laboratory facilities include the Boulder Atmospheric Observatory studies, the Coastal Ocean Dynamics Applications Radar (CODAR) Program, and the Hurricane Program.

Direct access to laboratory facilities is demonstrated by a wide variety of examples. NOAA aircraft and ships are available for researchers and

investigators from external agencies and groups. Flights and cruises are often composed of NOAA researchers augmented by university, other agency, and private sector scientists. These field programs are planned through proposal submissions from various researchers, one year in advance. Once preliminary agreement has been achieved and a set of field programs has been scheduled, additional pieces of research are added to each of the field programs to fully utilize the capacity of the ships or aircrafts. For example, in fiscal year 1983 the Arctic Gas and Aerosol Program grew into a research program composed of scientists from 3 Federal agencies, 10 universities, 2 Federally sponsored private laboratories, Canada, and Norway. The program consisted of research on air pollution sources and content of the "arctic haze," on the development of polar lows over the North Atlantic, on the stratospheric-tropospheric exchange of particles from El Chichon, and on the extent and movement of ice in the polar region. In addition to these moving platforms, NOAA has fixed laboratory facilities that are accessible to universities, industry, and users of research—the Boulder Atmospheric Observatory (BAO), the National Severe Storms Laboratory's radar and lightning net, the Program for Regional Observing and Forecasting Services, the Space Environment Service Center, and the NOAA Undersea Research Program (NURP) are examples. Each of these facilities is available for cooperative programs, can provide direct services, and is accessible to outside users.

Recommendation 5-2: R&D Interactions Between Federal Laboratories and Industry

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Department of Commerce (Productivity, Technology, and Innovation)

As the agency with lead responsibilities for Federal patent policy and the Stevenson-Wydler Technology Innovation Act, the Department of Commerce has been working to develop several government-wide policies that are consistent with the Packard Report recommendations.

The Department helped draft legislation allowing nearly all government R&D contractors to own inventions that result from Federal funding. This would automatically transfer ownership of technology developed by contract operators of government-owned laboratories to the contractors. Experience with universities shows that contractor ownership is a particularly effective form of technology transfer and leads to closer interaction with industry.

In addition, the Department has proposed legislation that would allow agencies to protect their procurement interests in Federally developed technology through use of a "Statutory Invention Disclosure." With this technique available for defensive use, agencies would only file for conventional patents on inventions—mostly from laboratories—that have commercial potential. This would reduce the government patent portfolio to the relatively few inventions most likely to be useful to industry. Again, the university experience shows that concentrating on valuable inventions leads to many forms of industry cooperation.

The Department also is developing a plan for managing Federal technology, particularly that developed in the laboratories. Key elements of the plan include incentives for closer cooperation with industry and provisions for laboratory inventors to assist in commercialization efforts.

Further, the Department has fostered use of Research and Development Limited Partnerships by the private sector to fund major technological advances. It is hoped that the facilities and staff of Federal laboratories may be involved in significant partnership developments.

The Department, through its Center for Utilization of Federal Technology, is providing several important aids to help industry identify useful Federal laboratory expertise.

NBS:

As the U.S. Central Reference Laboratory, NBS collaborates with U.S. industry in developing the measurement services needed to create, make, and sell competitive products and services. The NBS Statutory Visiting Committee, composed of five leaders of U.S. science and technology, is assisted by more than 200 leading industrial and university scientists and engineers in overseeing NBS plans, programs, and services.

NBS is currently improving its traditionally strong links to industry. For example, NBS joined with the Industrial Research Institute (IRI, whose members carry out 85% of U.S. industrial R&D) and the Commercial Development Association (whose members commercialize most of the U.S. R&D) in a survey to determine the extent of their interest in Federal R&D, how they acquire knowledge of such R&D, and how they would like to be kept informed of it—particularly the R&D carried out at NBS.

NBS recently assessed industrial interest in NBS research and development and found 219 relevant projects. These projects were test-marketed among industrial firms; NBS top executives also increased their presentations to various industrial groups. NBS developed a "How-To Primer" for Federal laboratory technology transfer and a "Federal Laboratory Directory" under the auspices of the Federal Laboratory Consortium. NBS arranged and participated in workshops in which Federal laboratories and industrial firms presented discussions of emerging technological developments. NBS has placed emphasis on the development of measurement services for high-performance semiconductor electronics, flexible automatic manufacturing, chemical engineering, materials processing, and biotechnology. Quality-control training seminars are being held throughout the United States in important industrial-process areas sensitive to measurements. Examples of external interactions not previously mentioned are:

NBS provides technical advice to 1,497 national and international standards committees and answers 5,000 inquiries about national and international product standards and practices each year.

40,000 certified samples of materials are supplied to 10,000 clients yearly.

7,000 instruments are calibrated each year.

2,000 energy-related inventions are evaluated yearly and inventions expositions are hosted throughout the Nation.

280 construction-material test laboratories are evaluated each year.

NBS has formal cooperative R&D programs with 16 industrial firms and 24 trade associations.

NBS has received approval to make its facilities available to private sector users on a controlled basis for conduct of research of a proprietary nature.

NOAA:

NOAA provides access to its Federal laboratories by industry through several mechanisms: the Office of Research and Technology Application (ORTA), guest workers (described in recommendation 5-1), laboratory outreach programs, and cooperative programs.

The ORTA, established in compliance with section 11 of the Stevenson-Wydler Technology Innovation Act of 1980, has appointed contacts in each of NOAA's laboratories. The ORTA serves as a focal point for the collection and distribution of information products about technologies developed in NOAA laboratories. In cooperation with laboratory personnel, Technology Briefs are written and distributed through a growing network of technology transfer organizations. These include the DOC Center for the Utilization of Federal Technology, the Federal Laboratory Consortium, the Sea Grant Marine Advisory Service, NOAA extension services, the non-Federal Technology Transfer Society, and state organizations such as the Ohio Technology Transfer Organization (OTTO).

Laboratory outreach programs include individual laboratory efforts to move their technology or products to the marketplace. Specific examples are the Coastal Ocean Dynamics Applications Radar (CODAR), the Doppler radar and lightning data, the NOAA Undersea Research Program (NURP), the Hurricane Program, and the data from the Geophysical Monitoring for Climatic Change (GMCC) Program. CODAR is a high-frequency radar technique developed in NOAA's Wave Propagation Laboratory to measure wave and current information from coastal sites. This technology was made available to industry, and at least one company was formed to manufacture and use this system.

The fishing industry is directly involved with the NMFS specialized facilities for new product development, product storage and handling, product quality and safety, and fishing gear development. Through these specialized research facilities the NMFS has cooperative agreements, exchange of personnel, and exchange and sharing of equipment with industry.

NOAA has attempted to expand the interaction between the laboratories and industry where appropriate. New technology for remote sensing in the atmosphere and the oceans is being developed in the research laboratories. Passive and active sensors to measure wind, temperature, humidity, and total water content are being developed. Industry, through joint programs, will be called on to develop operational prototypes for these devices. New techniques for gathering and displaying various data sets and combinations of data sets are being developed. Industry, again through joint programs, will be called upon to move these concepts into prototype systems for evaluation by NOAA service organizations.

The Geophysical Monitoring for Climatic Change Program maintains a long-term record of various atmospheric constituents that are considered a measure of the "health" of our atmosphere (e.g., carbon dioxide and ozone). These data are made available, on a regular basis, to industry and other users.

Recommendation 5-3: Simplification of Federal Procurement Procedures

The Department of Commerce has been working to extend the right of invention ownership to all classes of R&D contractors. Experience with universities shows that contractor ownership simplifies R&D procurement procedures and is a particularly effective form of technology transfer. The Department drafted and coordinated the President's February 18, 1983, Memorandum that established contractor ownership as the Administration's policy. The Department assisted in re-writing the patent section of the new government-wide Federal Acquisition Regulation (FAR) to make it conform with statutes and the Presidential Memorandum. The Department has also assisted in drafting new patent-ownership legislation.

DEPARTMENT OF DEFENSE

MISSION

Recommendation 1-1: Mission Review

The missions of Department of Defense (DOD) laboratories clearly define their role as that of performing basic and applied research for the development of military technology and equipment. These are recognized by the Packard Report as appropriate roles for Federal laboratories and are two of the major functions listed in a DOD study of required in-house capabilities for research, development, test, and evaluation (RDT&E).

Following a recent review of its labcratory organization study, the Air Force has reorganized its laboratories, placing them in product divisions to promote closer ties between the research community and the research users. The Navy completed a study in 1983 of the mission statements of the 13 laboratories that account for over 95% of the Navy's laboratory work force. The Army Materiel Development and Readiness Command (DARCOM) initiated a comprehensive review of its 20 laboratories, including their roles and missions. These laboratories account for approximately 75% of the funds that go to Army laboratories. The review is expected to be completed in 1 year.

Recommendation 1-2: Size of Laboratory

DOD laboratories are sized to accomplish their mission. Whereas doing good science may justify an increase in size of a university science department, DOD cannot justify changing the size of a laboratory based on the quality of its work alone. The quality of work is extremely important and is assessed by management and sponsors at various levels. Improving quality is always a goal.

DOD will continue to review the roles and missions of its laboratories using the results of its "Required In-House Capabilities" study as a guideline. Laboratories will continue to be sized based on mission requirements. Quality of work will be continuously reviewed by management, sponsors, and the external advisory groups being set up in response to recommendation 4-1.

FUNDING

Recommendation 3-1: Multiyear Funding

ARMY:

RDT&E funds are appropriated on an annual basis. Civilian pay raises are paid out of the RDT&E budget; there are no separate appropriations to cover such raises.

There is no evidence that a 2-year budget would provide stability to technology base funding. Supplemental RDT&E funds are needed to cover civilian pay raises to minimize turbulence in R&D mission areas.

The Office of the Secretary of Defense (OSD) must submit a pay supplemental that includes RDT&E appropriations to cover civilian pay raises for all Services. The Office of Management and Budget (OMB) should approve and forward these requests for Congressional action.

NAVY:

Funds are appropriated on an annual basis.

The Navy supports across the board R&D funding on a multiyear basis.

OSD/OMB/Congress must approve and implement multiyear appropriations.

AIR FORCE:

Funds are appropriated on an annual basis The Air Force currently funds civilian pay raises out of non-technical resources.

The Air Force does not consider instability to be a problem. It can support basic and applied research multiyear funding but prefers to deal on a year-to-year basis for big projects. The Air Force would be pleased if Congress appropriated funds to cover the pay raise.

Congressional action is required to effect a pay-raise appropriation.

Recommendation 3-2: Discretionary Funds

ARMY:

Discretionary funds constitute 10% of the Army's basic research programs; no such funds are available in the applied research program. Laboratory directors report annually, reviewing program progress, to support future funding. Laboratory directors have unrestricted use of these funds. However, in-house research is strongly encouraged. As a result, approximately 20% of these funds are used for contractual effort; 80% are used for in-house research.

No change in funding is necessary to meet the recommendation.

NAVY:

Discretionary funds have been available to Navy research activities under basic research since the mid-1950s. Applied research discretionary funding was started in the mid 1960s. The laboratory directors are given wide latitude in the use of discretionary funds to enable them to perform innovative, promising work without the procedure of formal and prior approval. The laboratory director has the authority to contract out to universities and/or industries research work that supports in-house efforts. The Navy's discretionary programs are evaluated after the fact, based primarily on biennial site reviews by the Chief of Naval Research review teams. These reviews are interspersed in alternate years by laboratory presentations to other laboratory directors and a selected panel of high level Navy research officials. A recent unpublished study of the Chief of Naval Material research centers' discretionary program (fiscal year 1966-fiscal year 1981) has revealed a sharp decline in discretionary funding while

the number of scientists and engineers engaged in discretionary programs has been cut in half since fiscal year 1967 due to decreased funding.

The Navy supports the recommendation as written. This recommendation is supported to a degree by the DOD budget guidance regarding funding of discretionary programs, which states: "However, no more than 5% of a given laboratory's funding will be in the form of In-house Laboratory Independent Research and Independent Exploratory Development (discretionary) funds." The Navy laboratories' funding for discretionary programs amounts to less than 2% of total laboratory funds. An increase to 5% would be in line with laboratory directors' needs based on a recent Navy study. It has been proposed that the "annual funding" portion of the recommendation be interpreted to mean "technology base" funding. This interpretation is considered too restrictive and it is not in line with existing DOD budget guidance for the discretionary programs.

Due to the large decrease in funding for the Navy's discretionary programs, the Director of Navy Laboratories is seeking to stem the continued down-slide by trying to establish some policies that would provide growth to the discretionary programs with particular emphasis on sizable growth in applied research in the near future. The study of the Navy laboratories' discretionary programs, cited earlier, stated that laboratory funding needs for the discretionary program amount to over 4% of the laboratories' total annual funding. Currently the Navy laboratories' discretionary program amounts to less than 2% of their total funds. Therefore, the laboratory directors feel that a significant increase in discretionary program funding is required to maintain the Navy's efforts at a reasonable level to attract highly qualified scientists and engineers and to help develop and retain a sound core of in-house expertise.

The Office of Naval Research has agreed to maintain discretionary funds as a constant percentage of basic research funds (about 7%). The Office of Naval Technology has agreed to increase the percentage of discretionary funds as a part of applied research funds (from 2% to about 5%).

AIR FORCE:

The Air Force currently maintains discretionary funds in basic research equal to 7% of the basic research budget. The Office of the Assistant Secretary of the Air Force reviews the results of basic research once a year. Laboratory directors may use basic research discretionary funds both for work done in-house and through contracts with academia and industry.

The Air Force will maintain basic research discretionary funds and initiate applied research discretionary funds.

The Air Force Systems Command will initiate and administer discretionary funds for applied research.

Applied research discretionary funds equal to 0.5% of each laboratory's applied research budget will be available for use by the laboratory director in fiscal year 1985. The percentage will increase gradually to 4% of total applied research in fiscal year 1989 and thereafter. These funds will be used for unplanned opportunities and will not be available to cover

cost growths or other problems in the planned portion of the laboratory programs. Performance of discretionary funded programs will be a factor in distribution of future discretionary funds among Air Force laboratories.

Recommendation 3-3: Carry-over Funding

ARMY:

The Department of the Army has 2-year R&D obligation authority. However, because of incremental funding guidance, the Army attempts to obligate in excess of 96% of its funds in the first year and 100% in 15 months.

There are no major problems with execution of technology base programs within the time limits as related to ongoing contracts. However, with new procurement regulations, obligation goals under Continuing Resolution Authority may not be realistic. No change in funding, however, is necessary to meet the recommendation.

NAVY:

In accordance with regulations in NAVCOMPT manual, Volume 7 paragraph 074403, RDT&E,N funds are incrementally funded to government installations (Federal laboratories) during the first year of this 2-year appropriation. The planned increment may extend up to 3 months into the following fiscal year per the authority of the Assistant Secretary of the Navy (Research, Engineering and Systems). New obligations are limited to the period of October 1 of the first fiscal year to December 31 of the second fiscal year.

If an extension of Obligational Authority is needed beyond December 31, an extension may be requested of the Assistant Secretary of the Navy (Research, Engineering and Systems). The RDT&E,N annual obligation rate established by OSD is 94%. In the first year of the appropriation, technology base funds normally reach this goal within the Navy. Therefore, due to the aforementioned, few problems are encountered concerning carrying remaining technology base funds forward into the next fiscal year.

No change in funding is necessary to meet the recommendation.

AIR FORCE:

Air Force RDT&E funds are 2-year appropriations. To assure timely appropriation and distribution of funds, the general objective is to obligate and expend current fiscal year funds for work to be done in the current year. Specific OSD goals are 94% for obligation and 61% for expenditure by the end of the first year. Contracts are incrementally funded, i.e., work done in second and subsequent years is paid for with funds appropriated in those years. However, laboratory directors have authority to obligate and expend funds in the second year of an appropriation for programs that have been delayed. After December 31 , Headquarters Air Force Systems Command determines the status of laboratory funds that have not been committed to procurement, and may reallocate funds between laboratories to assure that the funds are appropriately obligated by the end of the second year.

MANAGEMENT

Recommendation 4-1: Oversight Function

Implementation of this recommendation is in process at DOD. The Services were requested to form external advisory groups for their laboratories under the aegis of their Scientific Advisory Boards and to provide plans for how these groups would operate to perform the oversight functions. For the most part, the advisory groups will be constituted under the Naval Research Advisory Committee (NRAC), the Army Science Board (ASB) and the Air Force Scientific Advisory Board (SAB). The Army Medical R&D Command already has a separate advisory board for its laboratories. The Office of the Secretary of Defense has received implementation plans from the Services.

Recommendation 4-2: Greater Reliance on Peer Review

In the case of basic research, the involvement of DOD laboratories is small—about 4% of their total funds or roughly $240 million out of $6 billion worth of RDT&E. About $60 million or 1% of the total funds are provided to laboratory directors as discretionary funds to be used for investments in scientific areas the directors deem important, or to increase laboratory expertise in selected technical areas. In this latter case, the quality of completed work is used as a factor in distributing new discretionary basic research funds.

Peer review will continue to be used to evaluate the quality of completed basic research projects. Quality is a factor but not the only factor in determining whether or not new basic research projects will be funded. Relevance to mission as well as success in transitioning research results to further development are also factors that will be considered.

Recommendation 4-3: Finite Term for Laboratory Director

Most DOD laboratory directors are military personnel. They normally serve 3-year terms. The civilian laboratory directors are members of the Senior Executive Service (SES) and already can be (and frequently are) moved to another position as management sees fit. The performance of the director and the laboratory are significant factors in such decisions.

This recommendation has been implemented to a great extent but is still reviewed periodically. A study of the Army laboratories had two specific recommendations regarding the appointment of directors. These are being reviewed by senior Army management.

INTERACTION WITH UNIVERSITIES, INDUSTRY, AND USERS OF RESEARCH RESULTS

Recommendation 5-1: Access to Federal Laboratories

Present DOD policy is to encourage the use of its unique laboratory facilities by universities when they are not being used to perform the laboratories' missions. The manner in which these facilities can be used

by non-DOD investigators is prescribed by DOD Directive 3202.1 and DOD Instruction 7230.7. Work will be performed for private industry when a DOD laboratory possesses unique facilities not available in the private sector. (See DEPSECDEF Memo, January 21, 1972.)

Extensive efforts are under way to facilitate DOD-university-industry interactions in both research and education. Over the past 4 years, more than 2,000 high-school students have had summer research experiences/apprenticeships in DOD laboratories or with university research under contract to DOD. In the summer of 1984, DOD will test a new program, modeled after the DOD High School Apprenticeship Program, to enable high-school science and mathematics teachers to have summer research experiences in DOD laboratories to enhance their teaching skills.

DOD has established a formal advisory body, the DOD-University Forum, which discusses issues of mutual interest to DOD and academia. One of the Forum's working groups recently completed a major report on engineering and science education. The report examined DOD's needs for trained technical personnel and made recommendations of importance to scientific and engineering personnel employed in DOD laboratories. At the undergraduate and graduate levels, DOD laboratories employ approximately 800 co-op students a year. DOD is currently examining the feasibility of providing scholarship support to co-op students. DOD's basic research programs support approximately 4,000 graduate assistants each year. In addition, each Service has established graduate fellowship or assistantship programs which this year will support almost 200 students pursuing advanced degrees in disciplines important to the defense mission. Many of these students also have summer DOD laboratory research experiences.

DOD also sponsors summer faculty research opportunities in DOD laboratories for university researchers. In 1983 more than 300 faculty members as well as some 50 graduate students conducted summer research in DOD laboratories. Participants in Air Force programs are also eligible to apply for mini-grants to continue DOD-related work during the school year.

The DOD University Research Instrumentation program will help universities buy $150 million in research equipment by fiscal year 1987. DOD, together with several major corporations, is also supporting the new National Technological University, a consortium of 24 major engineering schools, which will deliver advanced engineering degree coursework via satellite to industrial and DOD laboratories by 1985. DOD will continue to encourage use of its facilities by universities and will continue to strengthen its interactions with education at all levels.

Recommendation 5-2: R&D Interaction between Federal Laboratories and Industry

R&D interactions between DOD laboratories and industry are commonplace. Industry supplies the Nation's weapons and works with DOD labo-

ratories as a matter of course in producing the means for our defense. This buyer-seller relationship with industry makes industry funding of DOD laboratories inappropriate, because DOD laboratories must evaluate the seller's products. Industry funding in DOD laboratories would create a potential conflict of interest, and the appearance of a conflict would always be present.

There are now several DOD activities aimed at improving interactions and information exchange between DOD and private industry. Information liaison offices have been set up by the Services nationwide to provide information on DOD operations and interests to DOD contractors. In response to the Stevenson-Wydler Act, every DOD laboratory now has an Office of Research and Technology Application (ORTA). The ORTA is a point of contact which provides information on the laboratory's technical activities to those outside of DOD and is responsible for assisting in technology transfer to state and local governments and to private industry. DOD representatives also interact closely with industry researchers in reviewing industry's Independent Research and Development (IR&D) Program. Through the Defense Technical Information Center and DOD's Information Analysis Centers, DOD research results are made available to DOD's present and potential contractors.

The Small Business Innovative Research Act requires that a percentage of all DOD research funds be set aside for this highly innovative segment of private industry. Funding decisions on small-business research proposals are made at the project-manager level, thus encouraging additional interactions.

Other examples of DOD activities promoting interactions include the tri-Service Information for Industry offices in Alexandria, Virginia, Dayton Ohio, and Pasadena, California, and the participation of both industry and university personnel on the Defense Science Board and the Scientific Advisory Boards of the Services. The latter are being given the additional role of evaluating the performance of DOD laboratories. DOD is committed to continuing its extensive interaction with private industry.

Recommendation 5-3: Simplified Federal Procurement Procedures

A permanent working group of procurement specialists has been established within the DOD Laboratory Management Task Force (LMTF) to simplify procurement procedures on a continuing basis. Another group is concentrating on simplifying the contracting procedures for the Small Business Innovation Research Program with the aim of using the procedures as a model for other procurements. In addition, a report has been prepared entitled, "Actions Required to Improve Research and Development Procurement and Contracting."

Recommendation 5-4: Support to Military Operating Forces

A task force formed by the Office of the Secretary of Defense is considering new approaches to provide closer coupling of the Service labora-

tories with the operating forces. The task force has identified a number of Service programs wherein the laboratories provide support to the operating forces.

The Army Materiel Development and Readiness Command (DARCOM) has a number of programs to identify requirements for R&D support of the operating commands. Teams of DARCOM scientists regularly conduct fact-finding missions to field units for the purpose of identifying problems in the operational use of communications equipment requiring R&D solutions. DARCOM maintains 19 detachments of on-site liaison representatives at Army training centers and schools to identify problems requiring R&D support. These needs are communicated directly to the appropriate DARCOM laboratories.

The Naval Material Command co-locates approximately 30 scientists and engineers on a rotating basis with their operational commands under the Navy Science Assistance Program. The rotational assignments provide the scientists and engineers with operational experience and improve communications with the laboratories in operational problems.

The Air Force has a variety of procedures for identifying the R&D needs of the operating commands. Formal documents to identify logistics needs, research needs, and R&D objectives are developed through cooperation among the Air Force Logistics Command, the Air Force Systems Command, and the operational commands. The Strategic Air Command hosts an annual, week-long conference with laboratory participants to identify R&D objectives and to foster informal cooperation. The Tactical Air Command has a point of contact for each development-program element and is consulted for comments on relevant exploratory and advanced development programs. The Chief Scientist of the Air Force has initiated a program whereby the chief scientists of Air Force organizations meet twice a year at locations of the operating forces. The goal of these meetings is to enhance interactions between the operating forces and the Air Force R&D community.

The laboratories' External Advisory Groups will be requested to include support of operating forces among the important criteria against which they measure the performance of the DOD laboratories.

MISSION

Recommendation 1-1: Mission Review

On July 28, 1983, as part of the institutional planning process for fiscal year 1984-fiscal year 1989, Secretary Hodel issued the Department of Energy's (DOE's) policy guidance on the role and missions of the multiprogram laboratories. The Secretary's policy guidance is based on his Congressional statement on the Federal role in energy R&D and is consistent with the National Energy Policy Plan.

On February 15, 1984, the Laboratory Management Council (LMC) developed a generic laboratory role statement and reviewed and revised all proposed laboratory mission statements with special attention to their clarity and specificity. In addition, the programs have been urged to develop 5-year program planning guidance and mission area assignments for the laboratories and to appraise laboratory program performance regularly.

Beginning in 1984, annual laboratory appraisals will be carried out by the cognizant Operations Office to evaluate overall laboratory performance in carrying out their assigned missions. The Headquarters program performance review will be part of the overall laboratory management appraisal.

Recommendation 1-2: Size of Laboratory

The institutional planning process of the Department results in review of laboratory workload consistent with missions and quality of work. The budget process determines increases or decreases in laboratory work depending on the quality of the past year's work, and any overall change in missions or directions made as a result of Administration or departmental policy. For example, recent mission redefinitions have resulted in significant decreases in laboratory size in the area of applied technologies, particularly those viewed as having near-term commercial benefits.

The multiyear program plans will provide an appropriate foundation for long-term mission area assignments to laboratories, justification for stable multiyear budget authorizations, and a sound basis for a more effective 5-year institutional planning process. Although they are limited in controlling fluctuations in budgets, the Assistant Secretaries will encourage long-term mission area commitments to laboratories and continue to give high priority to minimizing budget fluctuations. DOE's Internal Review Budget crosscuts will be used to control fluctuations in the planning stage, and ensure proposed laboratory program budgets do not fluctuate randomly without management attention.

The Laboratory Management Council, as part of its consideration of laboratory 5-Year Institutional Plans will review the proposed size of laboratories based on approved missions. As part of the Internal Review Budget procedures, the LMC also reviews proposed budgets of multi-

program laboratories to encourage stability consistent with mission needs and resources, and for consistency with mission statements, and appraisals of performance. The LMC will bring problems to the attention of the Secretary for resolution.

PERSONNEL

Recommendation 2-2: Independent Salary Administration for Government-Owned Contractor-Operated (GOCO) Laboratories

DOE laboratories are responsible for exercising management judgment and discretion in the administration of employee wage and salary programs. DOE retains only the right to approve a limited number of top level salaries and annual salary increase funds before such actions are implemented. DOE approval is based on data that the contractor itself develops as basis for its decision making purposes and that show the action to be consistent with programs in the private sector.

DOE now plans to delegate approval authority to the laboratories for salaries up to $60,000.

DOE develops internal guidance to be used in determining the reasonableness of laboratory personnel compensation costs. Such guidance was recently updated and will continue to be revised to reflect current compensation trends for employees with comparable jobs in appropriate labor markets. Experience in the private competitive economy is used as the primary standard of reasonableness with no reference to Civil Service compensation levels.

DOE will periodically review the threshold levels for individual salary approvals to ensure there is no increase in the percentage of total salary actions reviewed. DOE will also continue to refine and clarify criteria for market-basing of salary structures, so that laboratories will be able to make periodic adjustments with only minimal discussions with DOE.

FUNDING

Recommendation 3-1: Multiyear Funding

Taken literally, the recommendation does not call for funding stability but for funding *predictability,* so that staffing and research levels at laboratories can be properly planned. Much of the apparent instability in DOE laboratory funding in recent years has been a direct result of the Administration's effort to focus the laboratories on longer term programs and projects more appropriate to DOE's R&D mission, and away from near-term, more developed technologies that are properly the responsibility of the private sector.

Greater predictability of funding could be enhanced by multiyear authorization and appropriation of funding. Failing that, funding predictability could be improved by measures to better ensure the passage of annual Congressional appropriation bills prior to the end of the fiscal year.

The DOE has secured multiyear authorizations from Congress and hopes to do so again. However, the House Rules Committee and the

Senate Government Affairs Committee may recommend a 2-year authorization and appropriation cycle to the Congress, presumably as amendments to the Budget and Impoundment Control Act of 1974. If the Congress does not approve the proposed action, some improvements could be gained through greater use of multiyear program planning documents, cleared by the Office of Management and Budget and sent to Congress for comment and "approval," or inclusion of report language with the annual appropriation bills that would explain the position of the Appropriations Subcommittee regarding the future direction and funding profile of certain basic and applied research programs. Unlike multiyear appropriations, neither of these partial solutions would provide funds or have the force of law, but they would at least be expressions of Congressional intent and might provide some additional measure of predictability to the management of R&D.

Recommendation 3-2: Discretionary Funds

In a policy statement issued on December 13, 1983, Secretary Hodel clearly established policy for use of funds for exploratory development at multiprogram laboratories. Under this policy, laboratories are allocated reasonable amounts of funds, and laboratory directors exercise authority in choosing projects for funding. Laboratory work is scrutinized at an annual review of institutional planning, where the highest management level looks at both the process and the results of such funding. Those laboratories that do well in carrying out the general goals of exploratory R&D funding (e.g., spurring research vitality, generating new ideas, attracting talented scientists) receive increased funding.

Prior to the issuance of this policy statement, there were similar discretionary funded efforts, but without central and consistent guidance. The current procedure for such funding is clear and consistent with the Packard Report recommendations. The percentage of exploratory R&D funds is expected to range from about 1% to 5%.

Recommendation 3-3: Carry-over Funding

DOE appropriations for research and development are no-year funds. Therefore, no change in funding is necessary to meet the recommendation.

MANAGEMENT

Recommendation 4-1: Oversight Function

The Laboratory Management Council is reviewing ways of implementing the recommendation by utilizing existing mechanisms where effective and modifying processes where necessary. Oversight panels exist for Argonne National Laboratory (ANL) and Brookhaven National Laboratory (BNL), and one was recently included in the new Oak Ridge National Laboratory (ORNL) contract. Weapons laboratories have similar panels reporting to the University of California. Plans are being developed to

ensure that these groups can and will effectively perform the required oversight functions.

Recommendation 4-2: Greater Reliance on Peer Review

The proposal preparation and approval process within the laboratories has many elements comparable to traditional peer review, including review by advisory committees to the laboratories. Areas such as high-energy physics have extensive peer review of research results prior to and including the publication process. Furthermore, DOE carries out results-oriented peer reviews of major laboratory research programs compared to similar research in universities (e.g., the 1982 Assessment of Basic Energy Sciences Programs). Several efforts have also been made toward relying to a greater extent on peer review evaluations in funding specific energy research programs at the laboratories.

In addition, a working group of affected program offices has been established to propose guidance on how best to accomplish peer review of basic research at the laboratories. The Laboratory Management Council will review the proposed actions in 1984 and recommend any necessary changes in departmental policy in this area.

Recommendation 4-3: Finite Term for Laboratory Director

A DOE Order on uniform laboratory appraisal was issued on October 6, 1983. It requires annual, results-oriented appraisals at all the major multiprogram laboratories. The Operations Office appraisals will include laboratory director accountability, but the prime responsibility for laboratory performance will continue to remain with the contractor. Review of director's accountability when coupled with contact extend/compete decisions (which occur every 5 years) will result in a process that meets the objective. In the last 5 years, new directors have been appointed at 7 of the 9 major multiprogram laboratories.

Recommendation 4-4: Congressional Oversight of DOE

Compared to other departments, DOE has had the most changes in missions in the past 7 years evolving from the Atomic Energy Commission, to the Energy Research and Development Administration, to the Department of Energy. In a letter on July 28, 1983, Secretary Hodel issued the Department's policy guidance on the missions of DOE and its multiprogram laboratories. The Secretary's policy guidance is based on his Congressional statement on the Federal role in energy R&D and on the National Energy Policy Plan IV which was published and forwarded to Congress in October, 1983.

Recent stabilization in renewable energy programs and reductions in commercialization-related activities, coupled with the National Energy Policy Plan and the Secretary's statement on Federal and DOE labora-

tories roles, have put the Department in the best position to date to communicate and affirm DOE missions and to participate in discussions with Congress regarding DOE oversight and reduction of the number of Congressional committees with budget and oversight responsibilities for DOE programs.

INTERACTION WITH UNIVERSITIES, INDUSTRY, AND USERS OF RESEARCH RESULTS

Recommendation 5-1: Access to Federal Laboratories

Secretary Hodel's policy guidance to the laboratories endorses the recommendation and encourages the laboratories to improve accessibility to facilities by universities and industry. The Secretary has assigned a generic role to the laboratories to provide appropriate use of the laboratories' major capital-intensive facilities to the scientific community.

The laboratories continue to be important complementary resources to university-based research and education. About 5,000 university faculty members and students participate each year, generally during the summer, in laboratory-sponsored research and training programs. The budget for the DOE University Laboratory Cooperative Program has been significantly increased in fiscal year 1985 to support additional faculty/student research appointments. Significant funding continues for operation of major user-oriented research facilities at the laboratories; for example, about 40% of the Basic Energy Sciences budget in fiscal year 1985 will support laboratory research facilities which are used by university scientists. In fiscal year 1985 the number of undergraduate students in summer programs at the DOE laboratories will double, from 600 to 1,200. In addition, the laboratory directors have been encouraged to increase support for post-doctoral research appointments and for faculty "sabbatical" year research.

A "User's Guide to DOE Facilities" was published in March 1984 to provide information about unique laboratory facilities available to industry and universities for conducting their own research on-site at the laboratories using equipment available only at DOE laboratories. There are significant examples of industry and university participation in the planning for and use of the facilities such as the Combustion Research Facility at Sandia National Laboratories (Livermore), and the National Synchrotron Light Source at Brookhaven National Laboratory. To further encourage use of DOE facilities by universities and industry, the Department has issued a class patent waiver covering data and patent rights to discovery and inventions made by users of such facilities. The response has been an increase in user interest and participation.

Recommendation 5-2: R&D Interaction Between Federal Laboratories and Industry

DOE has implemented an R&D Technology Transfer Program responsive to the Stevenson-Wydler Act (P.L. 96-480). This program establishes DOE policy that technology-transfer activities, as required by P.L. 96-480, are legitimate functions of the R&D laboratories and will be conducted. To

meet both the spirit and the intent of P.L. 96-480, the Department has also issued guidance to the laboratories encouraging consulting by laboratory personnel. Such activity has increased as a result. Also as a result, technology-transfer activities at the laboratories have increased, and the Department, in consultation with the laboratories, has identified barriers to technology transfer and has addressed them. The Department will continue to identify barriers to technology transfer and to resolve them in the future. A senior-level working group has been established to review the Department's work-for-others policy and procedures to facilitate interactions with industry.

Secretary Hodel has assigned generic roles to the laboratories as follows: (1) to provide for and encourage the transfer of technology developed at the laboratories to the private and public sectors, and facilitate an interactive climate among the national laboratories and industry; and (2) to make special capabilities available for public and private sectors on a reimbursable basis. Personnel exchange programs between industry and laboratories, as well as industry-funded work-for-others projects, are being encouraged.

The laboratories have established a close relationship with the Industrial Research Institute (IRI) to stimulate interactions. A series of "Spotlight on a Laboratory" reports in cooperation with IRI has been initiated to encourage industry access to facilities and to communicate work of potential commercial interest. Industry reaction has been quite favorable so far. To further encourage R&D interactions, DOE has issued a class patent waiver for inventions arising from reimbursable work-for-others and for work at DOE user facilities. The response has been an increase in interactions with industry.

Recommendation 5-3: Simplifying Federal Procurement Procedures

Regarding university contracting procedures used in DOE, a working group has been established to recommend ways to simplify these procedures. As part of this process, DOE is converting many university awards from contracts to grants. Also, emphasis has been placed on consistent interpretation of DOE university procurement regulations and procedures by all field elements.

In the contracting area, the Operations Offices, not the GOCO laboratories, are agents for the Department. Special attention is paid to ensuring that the laboratories are not used as "pass-through" mechanisms or as a way to bypass the Federal procurement process. The laboratories do, when assigned, act as technical managers for projects, which includes appropriate subcontracting to industry and universities. Subcontracting by the laboratories in 1983-1984 was approximately $1 billion.

DEPARTMENT OF HEALTH & HUMAN SERVICES: NATIONAL INSTITUTES OF HEALTH

MISSION

Recommendation 1-1: Mission Review

The mission of the National Institutes of Health (NIH) is to improve the health of the Nation by increasing the understanding of processes underlying human health, disability, and disease; by advancing knowledge concerning the health effects of interactions between man and the environment; and by developing and improving methods of preventing, detecting, diagnosing, and treating disease.

NIH accomplishes this mission through: support of biomedical research in universities, hospitals, and research institutions in this country and abroad; conduct of biomedical research in its own laboratories and clinics; support of training for promising young researchers; development and maintenance of research resources; identification of research advances that have significant potential for clinical application, and the facilitation of the transfer of such advances to the health care system; and promotion of effective ways to communicate biomedical information to scientists, health practitioners, and the public.

New organizational or administrative entities have been established in response to changing aspects of the NIH mission; notable examples are the Office for Medical Applications of Research (OMAR) in 1977, and the National Toxicology Program (NTP) in 1978.

The Director of NIH, utilizes the Advisory Committee to the Director as a high-level outside consultative body to discuss management issues. Currently, the elements encompassed in pursuit of the primary NIH mission are being examined by a committee of the Institute of Medicine of the National Academy of Sciences, which is conducting a "Study of the Organizational Structure of the National Institutes of Health." Three panels are addressing the following aspects: historical issues, current organization, and alternatives. The Alternatives Panel's considerations include (1) "scientific opportunity" and "burden of illness" as criteria for setting research priorities, (2) the balance between basic and targeted research, (3) the balance between intramural and extramural research, (4) the balance between funding mechanisms such as grants and contracts, and (5) how to promote and stimulate priority or neglected research areas.

Recommendation 1-2: Size of Laboratory

The NIH is composed organizationally of 11 different institutes and several research divisions. These components support research extramurally through grants and contracts to outside organizations, principally universities. Most also conduct an in-house research program, called intramural research. The latter accounts for 13 percent of the R&D budget.

The emphasis, intramurally, is in basic research, which has possibilities of ultimate payoffs far in the future (e.g., advances made possible by the recombinant DNA biotechnology revolution), and on research better adapted to an in-house type of operation (e.g., long-term research on slow viruses and follow-up of an aging population over a lifetime). Such basic research is essentially limited by the magnitude of resources available.

A variety of indicators of quality of research effort all point to the premier status of the intramural program. There is the recognition by outside awarding bodies (4 Nobel Prizes, numerous Lasker Awards, etc.), the highly favorable citation and publication analysis, and the disproportionately large number of academic and investigative leaders throughout this Nation and the world who received research training at NIH (NIH "graduates").

While it is regarded that the intramural program has achieved a reasonable size for the present, there will from time to time be limited expansion dictated by external factors, such as the proposed new Arthritis Institute. In cases of significant resource additions, most program expansion will, of necessity, occur in the extramural area, owing to space or full-time-equivalent position constraints.

The NIH agrees that the size of its laboratory operation should be appropriate to its missions and the quality of its research. As new health demands and new scientific opportunities develop, the NIH will do its best to mobilize the resources for expanded intramural and extramural programs. Growth, if and when it takes place, should be gradual enough to be sustained.

FUNDING

Recommendation 3-1: Multiyear Funding

NIH funds are appropriated on an annual basis. With regard to pay raises, the Congress may appropriate supplemental funds for all or part of the pay raise, may approve a transfer from another appropriation, or may provide no dollars and require NIH to absorb the cost.

NIH supports a 2-year appropriation for both in-house and extramural research, and is in favor of a pay raise appropriation.

Two-year appropriation would require modification to the appropriation language for each NIH account and approval by Congress. The Office of Management and Budget (OMB) and Congress must approve pay raise appropriation.

Recommendation 3-2: Discretionary Funds

The NIH intramural research program is executed under the discretion of the director and scientific director of each of its institutes in accordance with the broad program goals and objectives of the Administration and Congress, and thus is considered to be 100% discretionary.

No change in funding is necessary to meet the recommendation.

Recommendation 3-3: Carry-over Funding

NIH has 1-year obligation authority; no carry-over authority.

NIH recommends that 1% of total appropriations be permitted to be carried over for 90 days.

Appropriation language for each NIH account would require modification and approval by Congress.

MANAGEMENT

Recommendation 4-1: Oversight Function

Excellence of a laboratory is determined largely by the quality of an individual scientist's research. The determination of quality includes the evaluation of original publications in the scientific literature (their impact on an area of science can be assessed in a quantitative way by citation analysis) and the recognition accorded a scientist by peer groups (evidenced by election to prestigious societies, receipt of prizes or awards, or other measures of "standing" in a scientific field). An intramural scientist's research is reviewed (1) by external Boards of Scientific Counselors at least every 4 years, (2) by the NIH Board of Scientific Directors at a time when the scientist is considered for tenure or promotion, and (3) by the laboratory and branch chiefs on an annual basis. The first two of these processes, as described below, represent external reviews with respect to each component Federal laboratory.

Recommendation 4-2: Greater Reliance on Peer Review

The NIH intramural research programs are, in a very real sense, critically reviewed by peers from outside the Federal Government, on a fixed schedule, with important implications for the size and direction of the programs and for the funding and other support for individual laboratories and scientists. (See comments on previous recommendations.) Each institute has its Board of Scientific Counselors for this review purpose.

NIH does not view the "competitive peer review process" as the proper mechanism for dealing with in-house staff. An ongoing process of review and evaluation is more appropriate to an operation in which one's own employees are engaged in research, as contrasted with extramurally supported grantee or contractor projects.

Recommendation 4-3: Finite Term for Laboratory Director

Within the framework of the NIH Intramural Programs, this management consideration related to the scientific directors, and to the laboratory and branch chiefs. The specific projects within each laboratory and branch are reviewed at least every 4 years by the outside Boards of Scientific Counselors and annually by the scientific director.

A scientific director of an NIH institute or division is jointly accountable to the institute director and to the NIH Deputy Director for Intramural Research regarding quality, productivity and program relevance. On several

occasions in the past, a scientific director has been replaced because of inadequacies in performance. Similarly, laboratory or branch chiefs are accountable to scientific directors and may be replaced as necessary.

A proposed new pay and personnel system for NIH scientists (pertinent to Recommendation 2-1 of the Packard Report) has been developed, first, by the Committee on Pay and Personnel Systems in Intramural Research and, second, by the NIH Committee on Pay of Scientists. These two committees recommended consideration of renewable (e.g., 5-year) terms for laboratory/branch chiefs (after age 70, renewable annually).

INTERACTION WITH UNIVERSITIES, INDUSTRY, AND USERS OF RESEARCH RESULTS

Recommendation 5-1: Access to Federal Laboratories

By far the largest part of the NIH budget is devoted to support for extramural research performed principally at universities. In 1985, research project grants initiated by investigators amounted to $2.7 billion.

The academic community is provided access to NIH intramural laboratories and clinics through Guest Researcher appointments and via a number of temporary-type personnel mechanisms, such as Experts, Intergovernmental Personnel Act appointees, summer employment, etc. The NIH will continue to provide the opportunity for academic researchers to take advantage of the unique facilities, equipment, or expertise of the NIH intramural laboratories and clinics.

NIH has no policy that would preclude an industry employee from participating at NIH under a Guest Researcher appointment, provided that a determination was made that no conflict of interest existed and that planned research was consonant with the goals of the host laboratory. However, the relatively small number of industry scientists who have been Guest Researchers may be due to concerns that their proprietary interests would be jeopardized by signing the Guest Researcher Agreement. This document requires adherence to Executive Order 10096 with regard to any inventions conceived or actually reduced to practice in performance of the scientists' work at NIH. In fact, however, recent changes in Federal patent policy make cooperative ventures between the public and private sectors more attractive. A Committee on Joint NIH-Private Sector Endeavors, chaired by the Deputy Director of NIH, has formulated a set of general principles for participation in joint projects. An "inventory" of such projects will be maintained for reporting and monitoring purposes.

The Foundation for Advanced Education in the Sciences (FAES) at NIH is a private institution chartered in the State of Maryland. In collaboration with the Johns Hopkins University, a formal Ph.D. curriculum has been established wherein the students take their course work at Johns Hopkins and do their thesis research at NIH, under an NIH intramural scientist preceptor.

Through its extramural research and training programs, the NIH supported over 5,000 post-doctoral trainees in fiscal year 1983. Some of these individuals will select the intramural NIH laboratories and clinics as the location for their training. In addition, the staff fellow program brings many junior-level scientists to NIH for temporary appointments ranging from 2 to 7 years. A small fraction will ultimately be offered a permanent

position at NIH; the majority will assume positions in the private sector, typically in academia, but now increasingly also in the biotechnology industry.

The NIH Scientific Faculty, suggested as the new personnel system for scientists at NIH, proposes to use the TIAA-CREF retirement system which is in use at most universities. Availability of this option would create more opportunities for mobility between NIH and the academic sector (perhaps several times during a career).

Recommendation 5-2: R&D Interaction Between Federal Laboratories and Industry

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Technology transfer at NIH was given formal recognition in 1977 with establishment of the Consensus Development Program. The Office for Medical Applications of Research was created in the Office of the Director to serve as its administrative focal point.

The Consensus Development Program has three primary objectives: (1) to provide a setting for the evaluation and review of the scientific soundness of a health or health-related technology, with emphasis on safety and efficacy; (2) to aid in the diffusion of knowledge of advances in biomedical technology through dissemination of the findings from the consensus development process to physicians and the consumers; and (3) to facilitate the diffusion, adoption, and appropriate use of those technologies found to be sound.

To date, nearly 50 statements on topics ranging from the treatment of breast cancer to the removal of third molars have been distributed. Consensus statements are produced by persons outside the Federal Government and are designed to serve as guidelines for the physician and the patient. The emphasis is placed on scientific evaluation, but social and economic considerations can have an impact in the assessment of a given technology. As a result of consensus development evaluations, it is hoped that the use of those technologies found to be scientifically sound will increase, and that the use of those that receive no such endorsement will diminish, thus improving the quality of health care.

The Committee on Joint NIH-Private Sector Endeavors has articulated general principles to guide the establishment and conduct of joint activities with commercial organizations. Issues to be considered include (1) the programmatic importance of the project to NIH, (2) the reasons for pursuing partial or total outside support, (3) the scientific integrity of a jointly sponsored research project (e.g., data management, quality control, decisions to modify protocol, release of study results), (4) the integrity of NIH (e.g., implied endorsements, advertisements), (5) the accuracy of scientific information to be disseminated, and (6) legal and policy issues (e.g., patents, gifts, solicitation of contributions, conflicts of interest, peer review).

A number of patented inventions made in NIH laboratories have been licensed to industry. Most licenses (some 54, through July 1983) awarded were non-exclusive, although 10 exclusive licenses were also granted during this period. Inventions include newer biotechnology advances (e.g ,

monoclonal antibodies against various viruses), analytical techniques (e.g., fiber-optic pH, oxygen and carbon-dioxide sensors, countercurrent extraction and chromatography instruments), and therapeutic modalities (e.g., anti-cancer agents). A recent formal agreement between Damon Biotech, Inc. and the National Cancer Institute (NCI) illustrates the kind of mutually advantageous arrangement that can be worked out between government and industry. In the latter case, Damon possessed proprietary knowledge of certain encapsulation technology, including biological materials and living cells within semi-permeable membranes. The NCI wished to explore the possible advantage of such technology in cancer research.

DEPARTMENT OF THE INTERIOR: U.S. GEOLOGICAL SURVEY BUREAU OF MINES

MISSION

Recommendation 1-1: Mission Review

USGS:

The Director of the U.S. Geological Survey (USGS) has indicated that laboratory research will support USGS missions. Program reviews and evaluations have been the major method of determining laboratory objectives.

The present planning and budget formulation process will continue to be the method by which laboratory mission and program mission are linked. During the planning process, new programs and new initiatives to expand are proposed. These are reviewed at the division and directorate levels in terms of their authority in supporting the missions of the USGS as defined by the Organic Act and subsequent legislation. These initiatives when proposed in the budget process are reviewed by the Department of the Interior, the Office of Management and Budget (OMB), and Congress in terms of their contribution to USGS mission objectives.

BOM:

Each of the four mining research centers in the Bureau of Mines (BOM) has been designated as the lead center for certain mining research areas. Mission statements defining the role of the mining research centers have been prepared. The mission of each of the six minerals and materials research centers has regularly been examined to assess the need for redefinition in keeping with the overall mission and goals of the Bureau.

The Bureau of Mines makes the special capabilities and expertise of the laboratories available to others, consistent with current policy and regulations.

Recommendation 1-2: Size of Laboratory

USGS:

USGS has relied specifically on the planning/budget formulation process to determine the size of its laboratories.

USGS has found that the current planning/budget formulation process is a very effective means of determining optimal laboratory size. USGS will continue to use this process. Although the total budget will have a significant impact on the size of laboratories, other factors relating to mission and other agency requirements will be influential.

BOM:

The scope of Bureau research depends upon national priorities. Thus, the size of Bureau research centers has changed with changing scope.

For example, as the role of Federal research evolved from developmental to more basic research, the pilot plant facility at Boulder City, Nevada, was closed in fiscal year 1983. In an earlier example, when the goals of a cooperative experimental ironmaking blast furnace were reached, the steel industry and the Bureau concurred in closing the facility.

FUNDING

Recommendation 3-1: Multiyear Funding

USGS:

Funds are appropriated on an annual basis, with no separate appropriation for research.

USGS supports R&D funding on a 2-year basis if that funding is predictable. The appropriation would have to allow for increases for pay raises, cost-of-living allowances, and supplementals for unforeseen circumstances of a significant nature.

No agency action is required until the Executive Branch (represented by the President's Science Advisor and the Office of Management and Budget) and the Congress jointly agree to the funding recommendation.

BOM:

As an agency of the Administration, the Bureau must conform to Administration policies and is unable to anticipate Congressional actions. Therefore, plans for the affected programs have been made only after Congressional intent is clear. This has resulted in delays in program implementation and in obligating the added funding.

Recommendation 3-2: Discretionary Funds

USGS:

USGS basic earth science research is conducted within the broad program goals and objectives of the Administration and Congress and is considered to be completely discretionary. Research projects and publication of results are reviewed through a process of peer review and executive approval which maintains the highest scientific standards.

No change in funding is necessary to meet the recommendation.

BOM:

Pioneering research has been an established practice. For the last 30 years the BOM has authorized the use of up to 10% of its R&D funds for this research in-house. The efforts are periodically reviewed by research center management and the more promising efforts become formal research projects after review and approval by Headquarters management. Funding of cooperative research programs with universities and industries is constrained by Federal procurement regulations.

Recommendation 3-3: Carry-over Funding

USGS:

USGS has 1-year obligation authority; no carry-over authority.

The USGS recommends that 1% of total appropriations be permitted to be carried over for 90 days.

Appropriation language for the USGS account, including research funded by reimbursement, requires modification and approval by OMB and Congress. As part of the 1986 budget process, the USGS will seek carry-over authority from Congress through appropriate Department of the Interior channels to OMB.

The 1986 USGS preliminary budget to the Department of the Interior will contain a request for carry-over authority.

BOM:

The Bureau of Mines follows OMB guidance.

MANAGEMENT

Recommendation 4-1: Oversight Function

USGS:

Ongoing internal program evaluations include laboratories. USGS scientists frequently coordinate research efforts with universities and other governmental units. Periodic meetings with state geologists provide considerable input to the USGS regarding relevance of research efforts to public needs. Other formally established advisory groups make recommendations to USGS, which, in turn, affect research at the laboratory level. These are the advisory groups established to implement USGS delegated coordination responsibilities under OMB Circular A-16, (coordination of National and state mapping requirements), and A-67 (coordination of Federal and non-Federal water data and analysis activities). Specifically for geological programs, there is a committee advisory to the USGS under the aegis of the Board on Earth Sciences of the *National Academy of Sciences/National Research Council* (NAS/NRC).

USGS is continuously examining ways to increase the effectiveness of its laboratories. There will be a continued effort to make use of advisory and peer groups that represent educational, industrial, and other government sectors.

BOM:

The performance of the research centers is evaluated by the two assistant directors responsible for research. Technical personnel from the Mine Safety and Health Administration periodically review and evaluate the Bureau's Mine Health and Safety Research Program. There have also been several reviews of important parts of the Bureau's research program by committees of the National Academy of Sciences with strong industry and university representation. Any tendency toward micromanagement has been decreased by cutting in half the size of the Headquarters research management staff during the past 2 years. Changes have

been made in the procedures for review of on-going mining research projects which also should help prevent micromanagement of the research centers by Headquarters staff.

Recommendation 4-2: Greater Reliance on Peer Review

USGS:

As part of the annual program/budget development process, the USGS laboratories outputs and accomplishments are peer reviewed. Each research project is reviewed at the first level of supervision several times per year to assure that the project is accomplishing its objectives. Ad-hoc committees are appointed at higher levels as necessary to review specific programs. The many publications that are published in external journals receive extensive peer review by scientists from other research sectors.

The USGS plans to continue its present review practices. They have been found to be effective in ensuring products of a high quality and a high level of productivity that reflect the missions of the survey.

BOM:

There is competitive review of all proposals for contract research. Proposals for new in-house research projects are evaluated and prioritized by committees of technical peers from the research centers and Headquarters staff. Technical personnel from the Mine Safety and Health Administration provide half the members of the committees that evaluate proposals or in-house research on mine health and safety.

Recommendation 4-3: Finite Term for Laboratory Director

USGS:

The Director of the U.S. Geological Survey is a political appointee and serves at the pleasure of the President. Appointment of directors since the establishment of the USGS in 1879 has been done in consultation with the National Academy of Sciences. The procedure of recent years has been for NAS, at the request of the Secretary of the Interior, to organize a nominating committee of leading earth scientists. The committee prepares a list of nominees in priority order from which the Secretary makes his selection.

BOM:

BOM research centers directors are at GM-15 and Senior Executive Service (SES) levels. They are responsible to an assistant director at Headquarters and are subject to individual performance plan standards. During the past decade, several research center directors have been placed in less critical positions when their performance was judged less than fully satisfactory by higher Bureau management.

INTERACTION WITH UNIVERSITIES, INDUSTRY, AND USERS OF RESEARCH RESULTS

Recommendation 5-1: Access to Federal Laboratories

USGS:

Throughout its more than 100-year history, the USGS has encouraged close interactions with universities and industry through mutual research and sharing of laboratory facilities. A NAS/NRC committee consisting of people from industry and academia exists partly to facilitate such interactions. The USGS will continue to implement new recommendations from this committee. Cooperative projects will continue to be looked at on a case-by-case basis.

The USGS will continue to make the special capabilities and expertise of the laboratories available to others, consistent with current policy and regulations in this area. Examples of USGS facilities used by university personnel include the TRIGA reactor, electron microprobes, transmission electron microscopy, and mass spectrometers. Research in mineral and energy resources with industry is rather inhibited because of proprietary problems. An exception is the USGS Core Library in Denver which stores samples of cores from wells drilled principally in the western and central United States. Approximately 400 visitors from industry use the facility each year.

In addition to more formal arrangements with the academic community listed below, the USGS and academic scientists carry on a continuous dialogue through the usual channels. Many joint publications are written, involving no transfer of funds. The USGS employs about 150 university professors on a when-actually-employed basis and is thus able to utilize the talents of some of the more gifted academic researchers for its mission.

The USGS has traditionally played a strong role in education in the geological sciences. Examples are:

About 10 National Research Council postdoctoral fellows are in residence at any given time.

The USGS employs from 50 to 75 undergraduates as field assistants each summer, through a formal arrangement with the National Association of Geology Teachers. Four hundred students compete for the positions each year; graduates of the programs are especially desirable to oil companies, who allocate extra points to them in their rating system.

Two hundred other summer jobs are given to students each year under regular summer-employment programs. Many of these positions also are field assistantships.

Graduate internships are given to some 30 M.S. and Ph.D. students. They are funded for actual time worked, and many derive a thesis from their work. Full use of laboratory facilities is available to them. About two permanent positions per year are allocated to graduates of this group. In addition, the USGS participates in the Federal Junior Fellow Program by placing 70 talented, college bound, high school graduates who are interested in careers in governments.

A plan is being drawn up for a USGS lecture program at historically Black colleges and universities. In addition, research projects were funded at two of these institutions in fiscal year 1984.

A number of students use USGS facilities for thesis work on an ad-hoc, non-employment basis.

Over 50 USGS employees serve as Adjunct Professors around the country and teach evening courses; many more lecture at universities on invitations.

BOM:

The Bureau of Mines has always encouraged close interactions with universities and industry through mutual research and sharing of laboratory facilities. Most BOM laboratories are located close to university campuses and maintain an active association with those institutions, with joint use of laboratories. Industry personnel have historically had the use of BOM laboratories in cooperative studies.

The BOM will continue to make special capabilities and expertise of the laboratories available to others, consistent with current policy and regulations in this area. Cooperative projects will continue to be looked at on a case-by-case basis.

Recommendation 5-2: R&D Interaction Between Federal Laboratories and Industry

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USGS:

From its inception over a century ago, USGS has made communication and dissemination of the results of its research an integral part of its mission. The USGS spends nearly $30 million per year on what can be called technology transfer in its broadest sense.

The fiscal year 1983 Congressional budget for the first time specifically allowed the USGS "to enter into collaborative projects and to accept contributions" from outside sources. This development has greatly increased USGS capability for cooperation with industry. The USGS and the minerals, fossil-fuel, and geothermal industries have had considerable information exchange for many years. Strict guidelines have been prepared on acceptance of contributions by the USGS and on cooperative research, the most important one being that results of projects must be open to the public. The USGS continues to encourage inquiries on cooperative research without actively soliciting joint projects. Owing to the sensitive nature of its mineral and energy properties, the oil and mineral industry is more sensitive than most to the public nature of joint cooperation. The NAS/NRC committee is addressing this problem to suggest future areas of cooperation between the USGS and industry. Examples include research on fossil-fuel and mineral-forming processes that should be of interest to many countries. A meeting to solicit industry's views is being considered.

BOM:

A long and varied association with industry has evolved at BOM. Currently, there are cooperative arrangements with industry for 144 specific activities

ranging in content from simple exchange, to technical information exchange, to joint planning, to research, to in-mine testing of proposed technology. In addition, cooperative arrangements with 12 industry associations are now in force. The BOM continues to encourage inquiries on cooperative research without actively soliciting joint projects.

The Committee on Mineral Technology Development Options of the NAS/NRC stated that the BOM should: (1) develop and implement cost sharing and cooperative efforts between government and industry and make them more effective; and (2) work closely with industrial research consortia developed by the various mineral industries. These recommendations are being implemented.

Recommendation 5-3: Simplification of Federal Procurement Procedures

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BOM:

A concerted effort during the past few years has been made to reduce the number and dollar value of noncompetitive contract awards by BOM while still maintaining a strong working relationship with universities and colleges. Both recent legislation and policy directives have emphasized the need for competition. The result is that the normal procurement process has been lengthened, especially for R&D projects. Also, for most projects, universities must now compete against each other as well as against private organizations. Although P.L. 98-72 provides that "unique or innovative" unsolicited proposals need not be announced in the *Commerce Business Daily,* BOM has found that most of the unsolicited proposals received from educational institutions do not meet that exception to the extent that the offerer would be harmed by such an announcement. However, in order to reduce procurement leadtime and to avoid public announcement of proposed actions, BOM will use grants, rather than contracts, for deserving projects. This will also enable the BOM to meet its responsibility under the President's program to strengthen the capacity of historically Black colleges and universities to provide quality education.

BOM action to date has been minimal, since no simplification can be made until the General Services Adminstration (GSA) imposed procedures can be simplified. If anything, procedures have become more complicated with time.

MISSION

Recommendation 1-1: Mission Review

Department of Transportation (DOT) laboratories are primarily test and evaluation facilities with each laboratory's mission tailored to meet specific needs of an operating administration that deals with a single mode of transportation. The Transportation Systems Center (TSC), however, has as its mission the performance of study and analysis functions for the entire Department through annual program agreements (providing the funding to support the activities) with all of the major DOT organizations. Most of DOT's laboratories have recently been reevaluated and restructured, where necessary, to ensure consistency with evolving program goals. For example, as part of its evaluation of the Transportation Test Center (TTC), the Federal Railroad Administration (FRA) redefined the TTC mission to include broader transportation and other research and test issues, especially by non-government sponsors. At the same time, the "care, custody and control" of the entire laboratory facility was contracted to the private sector. Only safety-related railroad research continues to be sponsored by FRA at TTC.

On March 28, 1984, the Secretary appointed a Science and Technology Advisor for the Department. This action is in keeping with one of the recommendations of the President's Private Sector Survey on Cost Control which recommended that DOT should create, through the Office of the Secretary, an entity responsible for R&D policy and goal-setting, and monitoring. The newly appointed Science and Technology Advisor will be conducting a review to assure that recent evaluations/study recommendations are formalized and reflected in new laboratory mission statements and performance goals as part of a comprehensive assessment of departmental R&D programs. With respect to TTC, the FRA will continue periodic formal reviews with the private sector operator to assess the need for any required changes in the TTC mission.

It is anticipated that recommendations will be provided to the Secretary in the near future by the Science and Technology Advisor concerning departmental oversight of all DOT research and development activities. Depending on secretarial decision, an impact on all "mission" and "management" recommendations can be anticipated.

Recommendation 1-2: Size of Laboratory

The operating administrations of DOT have established systems through the budget process for the allocation of resources for all of their components, including the laboratories. Changes in the size of laboratory staff are dependent on assigned workload and overall personnel allocations. Requests for additional allocations are evaluated and if fully justified, temporary adjustments are made. Several laboratories are currently reviewing the size and composition of their staffs and taking actions to cut back

in certain areas and/or hire in others. For example, the Federal Aviation Administration's (FAA's) Technical Center has reduced functions not considered essential to the National Airspace System Plan and enhanced its role in the testing and evaluation of new computers and automated systems.

The Transportation Systems Center's staffing and skill mix are a function of its mission and workload because all funding is provided by various DOT organizations from their approved programs and in support of their specific needs. TSC is also subject to personnel ceiling limitations set by the Department, the Office of Management and Budget (OMB), and the Congressional budget process. There have been substantial reductions in force (approximately 20% of the work force) at TSC during the past 2 years, in response to Administration priorities, needed skill mix changes, and funding reductions.

A formal review of the first year of operation of TTC by the private sector indicated a misalignment of the labor skill mix based on the expected testing and revenues for the second year of operation. The private sector operator was free to implement the necessary adjustments based on anticipated mission requirements.

The Department will evaluate its use of established systems to control and monitor the size of the laboratories, increasing or reducing staff as appropriate, seeking all suitable opportunities for defederalization, and considering laboratory closing consistent with diminishing mission requirements.

FUNDING

Recommendation 3-1: Multiyear Funding

DOT receives no-year funding on an annual basis. Congress appropriates approximately 50% of the DOT pay raise requirements. The remaining pay raise cost is absorbed within DOT by reducing other object classification areas, such as overtime, travel, supplies, materials, and equipment.

Instability due to annual appropriation is not a problem. No recommendation is made for 2-year funding. DOT supports full pay raise supplemental.

No agency actions are required. OMB and Congress must approve pay raise supplemental.

Recommendation 3-2: Discretionary Funds

The DOT generally receives no discretionary funds. The concept is being reviewed along with other Grace Commission recommendations on R&D management.

The concept of discretionary funding is supported, but without establishing a specific percentage, since the mission and modus operandi of the laboratories vary with each Administration.

Each of various Grace Commission and Packard Report recommendations for DOT is currently under study. A decision as to the implementation of discretionary funding will be made in the context of these recommendations and in the context of other related management issues.

Plans are to resolve these issues in time for the next budget cycle.

Recommendation 3-3: Carry-over Funding

Appropriations for research and development are no-year funds. No change in funding is necessary to meet the recommendation. No action is required.

MANAGEMENT

Recommendation 4-1: Oversight Function

Several DOT laboratories have already established internal and/or external review committees. For example, TTC has set up several industry committees, including university advisory groups, to review proposed work and evaluate the quality of the reports, sponsor technical conferences, and support industry implementation of the results. In 1983, the Federal Highway Administration's (FHWA's) Fairbank Highway Research Center expanded arrangements for obtaining more extensive input from state highway agencies. Micromanagement does not appear to be a problem in DOT, and the committees have not been involved in this issue.

Recommendations will be presented to the Secretary in the near future for strengthening agency oversight of all DOT research and development activities. With respect to the laboratories, specific attention will be addressed toward assuring conformance with the thrust of this panel recommendation.

Recommendation 4-2: Greater Reliance on Peer Review

Basic research is not performed or funded at DOT laboratories.

Recommendation 4-3: Finite Term for Laboratory Director

DOT laboratory directors are held accountable, and their position descriptions and performance standards stress accountability and productivity. No finite term of appointment is formally addressed. The private sector operator of TTC has sole responsibility for the quality and productivity of the Center. Performance will be judged on the business he attracts from the private sector and on the ability to carry out specific research tests under the terms of task order contracts issued by FRA. Conditions for contract termination are specified in the 5-year facility contract which also has an option for 2 additional years.

DOT plans to continue the established system of performance evaluation to assure accountability, quality, and productivity. Implementation of this recommendation with respect to finite terms is currently being studied.

INTERACTION WITH UNIVERSITIES, INDUSTRY, AND USERS OF RESEARCH RESULTS

Recommendation 5-1: Access to Federal Laboratories

The Department of Transportation, through its modal administrations, strives to keep the academic community involved in various transportation programs. The U.S. Coast Guard's R&D Center has had cooperative

efforts in the fire research area. The Coast Guard Academy facilities and faculty are shared with the academic community. The Federal Highway Administration has considerable involvement with existing programs of contract research by which states (with Federal aid) have close ties between state highway agencies and local universities. The Federal Aviation Administration, at its Civil Aeromedical Institute in Oklahoma City, allows regular use of its facilities for testing and evaluation of equipment and is encouraging further use of its facility by the university community and industry. The Research and Special Programs Administration, through its Transportation Systems Center in Cambridge, Massachusetts, has an excellent technical and contractual relationship with universities covering a variety of research subjects dealing with the entire transportation community. TSC has been the lead monitor for many DOT research contracts with such institutions as Worcester Polytechnical Institute, University of California at Berkeley, and the Massachusetts Institute of Technology.

Recommendation 5-2: R&D Interaction Between Federal Laboratories and Industry

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Technology sharing is basic to the responsibilities of the Department. The Department of Transportation Act of 1966 specifically directs the Secretary to "promote and undertake development, collection, and dissemination of technological, statistical, economic and other information..." and to "...consult and cooperate with state and local governments." All elements of the DOT respond to this mandate and have set up a variety of mechanisms for the sharing of Federal technology, including: the dissemination of special "information packages" and newsletters, conducting technical conferences and planning meetings, the use of technical advisory and review committees, and the establishment of technology-transfer centers.

Each DOT operating administration typically has its own set of research programs and consultation mechanisms, often managed by an Associate Administrator for Research and Development or a similarly titled official. The various technology and knowledge sharing programs within DOT are structured to support the specific functions of each of the operating administrations. To assure support of broader departmental objectives, the Office of Intergovernmental Affairs' Technology Sharing Division in the Office of the Secretary of Transportation (OST) provides cross-program coordination. The focus of the OST work is on integrating the various operating administration efforts, providing needed policy support to them, and reaching constituent groups not contacted by the other elements.

The Department of Transportation manages nine laboratories engaged in R&D activities. The responsibility for technology transfer involving the laboratories rests within each of the operating DOT administrations. In support of the Stevenson-Wydler Act, the Office of Research and Technology Application (ORTA) contacts have been identified for each laboratory. Departmental oversight and coordination is provided by the Technology Sharing Program under the Assistant Secretary for Governmental Affairs

within the Office of the Secretary. Collaborative efforts between the laboratories and universities are encouraged.

Industry support of U.S. Coast Guard fire research is being carried on through equipment donations and services. The Federal Aviation Administration has many collaborative efforts in terms of equipment testing and direct funding support at both its Technical Center in Atlantic City, New Jersey, and Civil Aeromedical Institute in Oklahoma City, Oklahoma. The aviation industry regularly uses these facilities for test and evaluation of aircraft safety equipment as well as of communications, navigation, and other electronic devices. The Federal Highway Administration's Fairbank Laboratory in Langley, Virginia, has made it standard practice to establish cooperative agreements with industry and universities. The FHWA recently signed a contract with the American Iron and Steel Institute to conduct on a cost-sharing basis major experiments in its structures laboratory for the improvement of design concepts for steel bridges.

The Federal Railroad Administration's Transportation Test Center in Pueblo, Colorado, was turned over to the private sector in 1982 through a facilities contract for the "care, custody and control" of the test center. The R&D interactions of the TTC are facilitated through the use of industry oversight committees and consultants, as well as through the use of collaborative research programs. In these programs, both in-kind services and funding resources are obtained from industry. A "user fee" mechanism is applied to all non-Federal work done by the contractor in order to prevent unfair competitive practices in seeking outside work.

The Transportation Systems Center in Cambridge, Massachusetts, is a recognized leader in the study and analysis of transportation issues and problems. In the course of these studies, TSC creates, collects, and disseminates transportation-related data and information. TSC continually communicates the results of its activities, especially to colleges, universities, and the transportation community. This is accomplished through the Center's Office of University Research and Technology Sharing.

The DOT will continue to explore further cooperative arrangements with universities to utilize its laboratory facilities. The DOT will also explore new possibilities for cost-sharing research programs with private industry using its laboratory facilities.

Recommendation 5-3: Simplifying Federal Procurement Procedures

The DOT would welcome a simplified and liberalized mechanism for collaboration between R&D laboratories and universities or various industries to streamline cooperative R&D efforts. The strict provisions of the Federal Procurement Regulations (FPR), coupled with strictly structured funding procedures, inhibit this procedure.

At present, interactions between DOT laboratories and industry/universities are generally limited to specific contractual relationships presented in accordance with competitive FPR guidelines. Little opportunity exists for negotiated agreements, for joint R&D efforts partially funded by government and partially by industry, or for other innovative arrangements.

All service support contracts at the Transportation Test Center, formerly administered by the Federal Railroad Administration (FRA), are now executed solely through a private sector contractor. The contractor is not encumbered by Federal procurement procedures except where Federally funded research is concerned. The provision for obtaining the research needed by the FRA is incorporated into the basic facilities contract. This procedure greatly facilitates FRA contracting for research with the TTC operator, who represents the railroad industry.

MISSION

Recommendation 1-1: Mission Review

The Environmental Protection Agency (EPA) places a high priority on maintaining current functional statements for its laboratories which clearly define their missions. From July 1981- July 1982, the Office of Research and Development conducted an in-depth study of the organization of EPA laboratories and decided that the current organizational structure was appropriate; however, EPA continues to incrementally review and revise the mission and organization of its laboratories to reflect changes in program priorities. In addition to continually reviewing and revising the mission of its laboratories, the EPA Office of Research and Development (ORD) plans to establish a Strategic Planning Staff whose function will be to study emerging environmental problems and determine: (1) whether research is warranted, (2) where research efforts should be focused, and (3) perhaps even how the research results would relate to current or proposed policy direction. The laboratories' missions will be redefined as necessary to accommodate the research efforts identified by the Strategic Planning Staff.

Recommendation 1-2: Size of Laboratory

EPA constantly reviews the size of its laboratories in relation to their missions. The Agency uses the flexibility available through the personnel system to relocate the work force as appropriate. Every attempt is made to vary the size of laboratories on the basis of long-term, major program shifts, rather than as a reaction to changes in one budget year. Experience has shown that there can be a resurgence in a program following a short-term reduction in resources. Because of the problems in staffing up or down, every effort is made to look at the long term. However, occasionally the budget process does produce major fluctuations in the resources available to support laboratories, and the size of the laboratory staff must be adjusted accordingly.

FUNDING

Recommendation 3-1: Multiyear Funding

EPA has never received a true multiyear appropriation. The Office of Research and Development currently receives two separate appropriations on an annual basis. One is for salaries and expenses (S&E), which is a 1-year appropriation and covers all the costs associated with conducting the in-house program. The second appropriation supports the extramural research and development program (R&D) and is a 2-year appropriation. However, this 2-year appropriation only contains sufficient funds to cover 1 year's expenses. A new 2-year appropriation is enacted each year. Pay raises must be covered by the S&E appropriation.

EPA wholeheartedly supports the recommendation that funding be authorized on a predictable basis. Resource instability and unpredictability are problems that have hampered EPA in its efforts to plan and implement a well-integrated research program. If fluctuations in the level of R&D resources could be eliminated, or at least substantially reduced, the R&D program would be greatly enhanced. However, requesting and receiving an R&D appropriation only every 2 years may not really help solve this problem. Stability over a longer period than 2 years is necessary, yet having the flexibility to ask for budget increases to support new program requirements is also desirable.

Funds also should be appropriated to cover pay raises. Agencies should not be required to fund pay raises from resources earmarked for other purposes.

Congress must approve these changes.

Recommendation 3-2: Discretionary Funds

The primary mission of EPA's laboratories is to support the Agency's regulatory program. Scarce resources leave very little flexibility to engage in research other than that required to support the Agency's client offices. EPA has an exploratory research program of $15 million to examine emerging environmental problems. These funds support research at colleges and universities in the form of grants and cooperative agreements. Also, 1% of the R&D appropriation is set aside to fund the Small Business Innovation Research Program. These programs provide a meaningful long-term research effort.

EPA generally supports the recommendation; however, support of the Agency's regulatory program must continue to be top priority.

The Agency should provide the laboratory directors greater flexibility in planning the projects to be conducted in their laboratories.

In fiscal year 1985 laboratory directors will have increased flexibility in conducting projects. Headquarters has reduced resource reporting requirements to allow laboratory directors greater discretion in managing the resources of their laboratories. To the extent that resources permit, in future years laboratory directors will be provided even greater discretion in planning and executing the research programs of their laboratories.

Recommendation 3-3: Carry-over Funding

EPA has a 2-year appropriation to support its extramural research and development program. To the extent that funds are available, the Comptroller allocates carry-over to Agency programs based on justifications of need and Agency priorities. Because of the time required to analyze needs and determine priorities, carry-over funds are frequently not made available to the laboratories for obligation until late in the fiscal year.

EPA supports this recommendation. Currently the Agency has the mechanism in place to enable the timely obligation and disbursement of carryover funds. However, because of the limitation of resources, the Agency must carefully consider competing priorities and allocate available carryover funds as required to best support the Agency's mission.

MANAGEMENT

Recommendation 4-1: Oversight Function

This recommendation is already being implemented at EPA. The Office of Research and Development reviews each research program at least once every 2 years and reviews proposed research on an as-needed basis. Review panels include research leaders from EPA and scientists from other government agencies, the academic community, and industry. This review process serves to evaluate how ongoing research is progressing and how proposed research is to be performed, that is, how scientifically sound the technical approach or experimental design is. This system assures that research funds are providing high-quality products reflecting good science and engineering; it also monitors performance and productivity. Although EPA has an ongoing external peer review process, the Agency has recently taken additional actions to make it even more effective. The peer review process has been decentralized to make it the responsibility of the laboratory director rather than a centralized management responsibility. Within the past 6 months, the Office of Research and Development has examined the delineation of the roles and responsibilities of Headquarters and laboratory management. Changes in management information requirements are being made to implement the appropriate division of responsibilities. These changes will further diminish the potential for micromanagement because the laboratory directors will be held responsible for accomplishments and outputs and overall utilization of their resources rather than being required to account for expenditures at the task or project level.

Recommendation 4-2: Greater Reliance on Peer Review

EPA sponsors research in the scientific and academic community primarily through two mechanisms which are both peer reviewed. One mechanism is the competitive grants program which was established in 1979 and is administered by the Office of Exploratory Research. Under this program, proposals are solicited each year and grants are awarded competitively based primarily on the recommendations of the scientific peer review panels. Another mechanism is for the individual laboratories to enter into cooperative agreements with the academic or scientific community. Prior to award, all proposals for cooperative agreements are peer reviewed by extramural reviewers who are experts in their field. The Office of Research and Development's policy is to broadly solicit applications and to award grants and cooperative agreements competitively,to the maximum extent practicable. All grants are awarded competitively, and any decision to award a cooperative agreement on a noncompetitive basis must be justified in a memorandum that is included in the project file.

Recommendation 4-3: Finite Term for Laboratory Director

EPA agrees that the laboratory directors must be held accountable for the activites in their laboratories. EPA laboratory directors are all members of the Senior Executive Service (SES) who have performance contracts that hold them completely accountable for the productivity of the laboratory. SES procedures allow a great deal of flexibility to reassign members as necessary and appropriate; however, this recommendation will be given further consideration.

INTERACTION WITH UNIVERSITIES, INDUSTRY, AND USERS OF RESEARCH RESULTS

Recommendation 5-1: Access to Federal Laboratories

The 14 EPA/ORD laboratories are located on nine sites, all of which are within a short commuting distance of university campuses. Cooperative agreements with the institutions are in force.

The unique Clinical Studies Facility of the ORD/Office of Health Research is located adjacent to the University of North Carolina School of Medicine. The cooperative agreement stimulates collaborative programs and permits use of the facility by university staff.

Negotiations with the Coordinating Research Council of the Air Pollution Research Advisory Committee to utilize the ORD mobile source facilities at Research Triangle Park for a series of studies are currently in process.

An air pollution control research facility (Limestone Wet Scrubber) at Research Triangle Park has been utilized extensively by an industrial organization during the past several years.

The Unique Oil and Hazardous Material Spill Simulator Facility in Edison, New Jersey, has been made available to both university and industrial research teams.

The EPA Fluid Modeling Facility is made available to students at North Carolina State.

The University of Cincinnati operates ORD's Test and Evaluation Facility under contract. Additionally, graduate students from the University are provided the opportunity to conduct research at the facility.

In addition to ongoing activities aimed at encouraging university and industry access to Agency facilities, EPA recently implemented a new "Senior Visiting Scientists" program. This program is designed to bring some of the leading names in environmental science from universities and other institutions into EPA laboratories to conduct research. These scientists will help promote those areas of environmental science that are most significant to the Agency, and the program will help build closer working relationships between EPA laboratories and leading environmental scientists.

Recommendation 5-2: R&D Interaction Between Federal Laboratories and Industry

The automotive industry and EPA co-fund the Health Effects Institute to address studies pertaining to health effects presumed to be induced by automotive emissions.

The EPA Environmental Research Laboratory at Ada, Oklahoma, has been involved in collaborative studies with the American Petroleum Institute concerning land treatment of petroleum processing wastes.

Collaborative programs with industry in the development of pollution control systems (fabric filters, limestone injection technology, sequencing batch reactors, mobile treatment facilities, hazardous waste disposal technologies) have been a major component of the EPA research program.

Recommendation 5-3: Simplifying Federal Procurement Procedures

EPA is required to comply with the Federal Acquisition Regulation (FAR) and other government policies on procurement but, to the extent that there is any flexibility, the Agency is making every effort to simplify and streamline the procurement process. In 1982, EPA established a Procurement Review Task Force in response to Executive Order 12352 directing reforms in government procurement. The Task Force spent 10 months studying the problems surrounding the EPA procurement process, making recommendations for improvement, and effecting their implementation. Some of the results of that project are increased flexibility, elimination of redundancies and inconsistencies, reduced leadtimes, increased accountability, reduced paperwork, cost savings for the government and the private sector, and overall simplification of the procurement process within the Agency. The Office of Research and Development is in the process of revising Agency policy on management approval levels for procurement to provide the laboratory directors greater flexibility and authority than they currently have.

MISSION

Recommendation 1-1: Mission Review

The National Aeronautics and Space Administration (NASA) annually prepares a long-range plan that defines and describes the objectives and programs for the agency and each of the centers (laboratories). In the past 3 years, increasing attention has been given to the contributions, roles, and well-being of the various elements of the NASA institution.

In 1981, a top-level review led to the consolidation of two smaller centers with two larger ones based on a determination of the best way to carry out related missions with available resources. The same year, three Associate Administrators, the principal program executives of NASA, were given responsibility for the institutional management of the centers. Included in their responsibilities is the advocacy and fostering of roles and missions for their centers.

The budget submission each year displays the missions and programs of the centers and provides the regular opportunity to review them. Major program initiatives, such as the Space Station, also require top management to look at the distribution of missions.

In 1983, NASA instituted a formal goals and objectives process. The agency goals and objectives were adopted with the participation and input of the center directors who were then instructed to formulate objectives supporting and elaborating on those of the agency. This year, NASA managers are reviewing the 1983 objectives for updating and modification. The underlying purpose of the process is to keep agency efforts focused on priority missions.

Recommendation 1-2: Size of Laboratory

NASA planning and budget processes include analysis of center manpower needs. There is an effort to avoid small fluctuations in response to normal program expansion or reduction so that a critical mass of relevant R&D competence can be maintained. This is often accomplished by adjusting the size of contractor support work forces.

However, the size of centers is responsive to major changes in program emphasis. NASA's overall civil service permanent complement has fallen from the Apollo program peak of over 35,000 in the late 1960s to under 22,000 today. Within that level, individual centers show marked differences based on major program changes. Marshall Space Flight Center, with a large launch vehicle and engine development mission, dropped from a high of over 7,000 to just below 3,500 now. Lewis Research Center dropped from 5,000 to 2,750 as some of its specialized programs declined in scope.

Reductions like these and the closing or consolidation of centers demonstrates conclusively that preservation of each laboratory has not been a mission.

FUNDING

Recommendation 3-1: Multiyear Funding

NASA has annual appropriations available for 2 years for its basic and applied research. The research program is a relatively small part of the agency's total program and is not specifically identified.

The basic and applied research activities are conducted in a manner that is synergistic with many of the developmental activities of the agency. To break out these research and development activities in a separate appropriation probably would subject them to more scrutiny in an environment not related to the overall mission of the agency and might result in more rather than less instability in the funding process. The 2-year availability of appropriated funds insulates against short-term instability, and continuing appropriations have not been a major problem to basic and applied research activities.

Recommendation 3-2: Discretionary Funds

Discretionary funding allocated to center directors constitutes approximately 4% of total in-house basic and applied research funds. The funding supports independent research, generally of a highly innovative nature, for which small expenditures are sufficient to establish whether there should be sustained effort or not. Accordingly, some activities "graduate" to regular R&D funding.

As recently as 1983, one center had discretionary research results cited for IR-100 Awards as "two of the 100 most significant new technical products of the year." The center directors make annual reports of discretionary fund activities to the Deputy Administrator, who subsequently relates funding levels to the performance of the centers. The reports are shared by all centers. The directors are authorized to fund both in-house and out-of-house work.

MANAGEMENT

Recommendation 4-1: Oversight Function

NASA has an Advisory Council and a network of advisory committees reporting to it. The members are eminent people outside NASA in aerospace industry, academia, and other areas in which they are in a position to give NASA advice. One of the concerns of the Advisory Council and its committees is the status of the center programs.

NASA will look to the Advisory Council for more activity in overviewing the continuing excellence of the centers. During the past year, the Space Systems and Technology Advisory Committee, headed by Robert L. Walquist of TRW, has been conducting a study of the "center of excellence" in roughly a dozen areas of technology at the research centers. They have

focused on the availability and quality of the center people, facilities, and programs in these specialized areas. The committee will report to the Advisory Council in the near future.

Recommendation 4-2: Greater Reliance on Peer Review

The NASA Advisory Council system, including its committees, provides an overall review of the agency's research and technology programs by outside authorities who are peers of NASA's researchers and research managers. Findings and recommendations are fed into the planning and budgeting processes. In addition, there is formal peer review of scientific activities.

INTERACTION WITH UNIVERSITIES, INDUSTRY, AND USERS OF RESEARCH RESULTS

Recommendation 5-1: Access to Federal Laboratories

Since its establishment in 1958, NASA has sought both advice and assistance from the university and industrial communities in determining and conducting research into problems of flight within and outside the Earth's atmosphere. This mutual effort to add to national strength has resulted in extensive and diversified relationships between university and industrial personnel and NASA research laboratories.

NASA has major interfaces with two closely related communities: aeronautics and space. In the area of aeronautics, universities and industry make extensive use of NASA ground-based facilities through a number of existing mechanisms. This program is working well and major changes are not planned. However, exploratory, four-way discussions are in progress among the following parties: (1) NASA aeronautics laboratories, (2) universities seeking to strengthen their graduate aeronautical engineering programs, (3) aircraft manufacturers interested in upgrading their engineering and design capabilities which will include not only traditional model test facilities, but also enable industry access to NASA's newly established supercomputer-based computational facilities, and (4) state government economic development agencies taking an interest in local aeronautics firms as part of their efforts to utilize science and technology for industrial development. These discussions are focusing on a model program that would combine graduate study with practical experience in both NASA field centers and industry design and production groups. If successful, such a program could be expanded to include other disciplines, industries, universities, and laboratories.

In the area of space, NASA facilities are physically located both in space and on the ground. The use of these facilities for *space technology* development has recently been addressed by a special study group, and the resulting actions are described under the NASA response to Packard Report Recommendation 5-2. The use of the NASA space facilities for *scientific research* is determined by open competition, and no changes in this area are appropriate or planned. However, the use of NASA ground facilities by the university and industrial scientific research communities

is an area that can be enhanced. It is planned that each NASA center will publish a document describing its applicable ground facilities in order to enhance their use by the total research and technology communities. The use of the facilities by such outside groups will be made a basis for the evaluation of the performance of each of the NASA laboratories.

NASA's university program is conceptual in nature and is a collection of diverse activities, which individually and collectively contribute to the agency's mission. The principal and most visible direct interaction between NASA and the university community is the support of university research and development projects. In fiscal year 1984, NASA funded approximately $230 million to educational institutions to conduct research in aeronautics and space science. Of this total, approximately 10% was used to update university instrumentation.

While sponsored research is the single largest activity fostering interaction and access to facilities and research programs, NASA is committed to discovering, developing, and facilitating new relationships with the academic community at all levels. To meet this objective, NASA has initiated a number of programs targeted at specific populations within the educational community. For clarification purposes, they are categorized as (1) university programs, (2) personnel programs, and (3) external education programs.

NASA sponsors a number of specific university programs that facilitate NASA/university interaction. Each year the agency provides opportunities for individuals to do post-doctoral research at NASA centers. This program is part of the National Research Council's Resident Associateship Program. In cooperation with the American Society of Engineering Education, NASA centers invite faculty members from across the nation to be guest investigators at NASA facilities during each summer. Beginning in 1980, the agency initiated a program to provide research opportunities for graduate students to conduct their thesis research at NASA facilities. Many additional programs, such as the Joint Institute for Advancement of Flight Sciences, Get Away Special, University Consortium, and Space Shuttle Student Involvement Project, aim to discover and develop talent and to increase involvement between NASA and the university community.

NASA continues to take advantage of the numerous personnel programs within the Federal government to foster interaction between students and faculty at all levels in the educational community and NASA laboratories. These programs, while affected by full-time equivalency limitations, still provide an excellent mode of fostering interaction. The cooperative education program continues to be a source of discovering new talent. NASA centers utilize co-op programs at the community college, baccalaureate, and post-baccalaureate levels in areas of secretarial science, engineering technology, engineering, and science disciplines. Additional programs, such as the Intergovernmental Personnel Act, Summer Employment Upward Bound, Presidential Management Intern, and the Pre-College Trainee programs, to name a few, all contribute toward multilevel interactions between NASA and the educational community.

Another important component in fostering relationships with the educa-

tional enterprise is the NASA External Educational Services Program. Targeted primarily at the primary and secondary education level, information on NASA's missions and results is provided to students and teachers in their academic setting to foster an interest in mathematics, science, and engineering. In addition, many NASA centers have developed teacher resource rooms that provide public-school teachers an inexpensive avenue to obtain films, video tapes, pictures, and information to supplement school curricula.

In addition to these activities, a joint NASA/National Academy of Sciences study group has been formed to recommend ways by which NASA-university relations can be enhanced. The report of this group is scheduled for the Fall of 1984. The recommendations will be evaluated and implemented if appropriate.

Recommendation 5-2: R&D Interaction Between Federal Laboratories and Industry

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NASA has historically had close and extensive interactions between its laboratories and the aeronautics industry. This program is working well, and major changes are not planned. A special agency study, however, has recently been completed to determine how NASA can apply its experience in aeronautics to enhance R&D interactions with the aerospace industry. The study recommended 14 specific actions that, on April 3, 1984, were endorsed by the Administrator as agency policy. Particular attention will be given to establishing increased uses of NASA facilities in space, such as the Space Shuttle and the Space Station, by industry for technological development.

In addition, NASA is seeking new opportunities for cooperation with state government initiatives linking science and technology with industrial development. Several such opportunities for joint NASA-university-industry research and development programs, drawing partial support from state industrial-development sources, have been identified. "Centers of excellence" established at or in conjunction with universities under state auspices provide the focuses for most of these programs. The programs themselves would have the potential to facilitate intersectoral communication and technology transfer in aeronautics, space industrialization, and the non-aerospace use of NASA-developed technology.

The NASA Technology Utilization Program, an agency-wide effort involving and drawing on all of NASA's laboratories and R&D programs, continues to provide a variety of means for U.S. industry access to NASA technology. The program's management has, over its 20-year history, learned that it must rely on private sector industrial involvement to facilitate non-aerospace use of such technology. While much of this activity involves what might be called the "retailing" of specific items for individual products or processes, the program is now concentrating more heavily on "wholesaling," involving in some cases the transfer of generic capability, so that the acquiring industry can undertake a wide range of applications. The current directions and achievements of the NASA Technology Utilization Program are set forth in NASA's annual *Spinoff* publication.

Acronym Glossary

AD	Area Directors (USDA)
ANL	Argonne National Laboratory (DOE)
ARS	Agricultural Research Service
ASB	Army Science Board
BAO	Boulder Atmospheric Observatory (NOAA)
BNL	Brookhaven National Laboratory (DOE)
BOM	Bureau of Mines
CIMAS	Cooperative Institute for Marine and Atmospheric Studies (NOAA)
CIMMS	Cooperative Institute for Mesoscale Meteorological Services (NOAA)
CIRA	Cooperative Institute for Research in the Atmosphere (NOAA)
CIRES	Cooperative Institute for Research in Environmental Sciences (NOAA)
CODAR	Coastal Ocean Dynamics Applications Radar (NOAA)
DARCOM	Army Materiel Development and Readiness Command
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FAES	Foundation for Advanced Education in the Sciences (NIH)
FAR	Federal Acquisition Regulation
FPL	Forest Products Laboratory
FPR	Federal Procurement Regulations
FRA	Federal Railroad Administration
FS	Forest Service
GMCC	Geophysical Monitoring for Climatic Change (NOAA)
GOCO	Government-Owned Contractor-Operated
GSA	General Services Administration
IPA	Intergovernmental Personnel Act
IR&D	Independent Research and Development Program (DOD)
IRI	Industrial Research Institute
JILA	Joint Institute for Laboratory Astrophysics (NBS)
JIMAR	Joint Institute for Marine and Atmospheric Research (NOAA)
JISAO	Joint Institute for Study of the Atmosphere and Ocean (NOAA)
LINAC	Linear Accelerator
LMC	Laboratory Management Council (DOE)
LMTF	Laboratory Management Task Force (DOD)
MFAC	Marine Fisheries Advisory Committee (NOAA)

NACOA	National Committee on Oceans and Atmosphere (NOAA)
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NBS	National Bureau of Standards
NCI	National Cancer Institute
NIH	National Institutes of Health
NMFS	National Marine Fisheries Service (NOAA)
NOAA	National Oceanic and Atmospheric Administration
NPS	National Program Staff (USDA)
NRAC	Naval Research Advisory Committee
NRC	National Research Council (NAS)
NTP	National Toxicology Program (NIH)
NURP	NOAA Undersea Research Program
OMAR	Office for Medical Applications of Research (NIH)
OMB	Office of Management and Budget
ORD	Office of Research and Development (EPA)
ORNL	Oak Ridge National Laboratory (DOE)
ORTA	Office of Research and Technology Application (DOC,DOD,DOT)
OSD	Office of the Secretary of Defense
OST	Office of the Secretary of Transportation
OTTO	Ohio Technology Transfer Organization (NOAA)
PTI	Productivity, Technology, and Innovation (DOC)
RDT&E	Research, Development, Test, and Evaluation (DOD)
S&E	Salaries and Expenses (EPA)
SAB	Scientific Advisory Board (Air Force)
SES	Senior Executive Service
SPO	Strategic Planning Objectives (DOC)
SURP	Synchrotron Ultraviolet Radiation Facility (NBS)
TSC	Transportation Systems Center
TTC	Transportation Test Center
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey