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Report of the White House Science Council

May 1983

MASTER

OFFICE OF SCIENCE AND TECHNOLOGY POLICY
EXECUTIVE OFFICE OF THE PRESIDENT
WASHINGTON, D.C. 20500

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THE WHITE HOUSE

WASHINGTON

May 20, 1983

Dr. G. A. Keyworth, II
Science Advisor to the
President
Washington, D.C. 20500

Dear Jay:

The White House Science Council at its meeting today reviewed and approved the report of its Federal Laboratory Review Panel. I am pleased to transmit the report to you herewith.

As David Packard, the Panel's chairman points out, the Federal laboratories have several serious deficiencies, and a number of the laboratories do not meet the quality and productivity standards that can be expected of them.

Implementation of the Panel's recommendations would help overcome many of these deficiencies and better utilize the great potential of the laboratories. I urge you to help see that these recommendations are, in fact, acted upon expeditiously. The Council stands ready to help, as appropriate.

Sincerely,

Sol

Solomon J. Buchsbaum
Chairman
White House Science Council

Attachment
(1) Ltr. from David Packard, 5/12/83
(2) Federal Lab Report, May 1983

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PALO ALTO, CALIFORNIA 94304

DAVID PACKARD
CHAIRMAN OF THE BOARD

May 20, 1983

Dr. Solomon J. Buchsbaum
Chairman
White House Science Council
Executive Office of the President
Office of Science and Technology Policy
Washington, D. C. 20500

Dear Sol:

I am pleased to transmit to you, with this letter, the report of the White House Science Council's Federal Laboratory Review Panel.

In summary, the Panel found that the Federal laboratories have several serious deficiencies, and consequently, a number of the laboratories do not meet the quality and productivity standards that can be expected of them. We cannot overemphasize the need to correct these deficiencies.

The Panel's most important recommendations concern the missions and management of the laboratories. First, the parent agencies of the Federal laboratories must review and redefine the missions of these laboratories. At most multiprogram laboratories, the research activities could be reduced in breadth, and reconcentrated on those areas most relevant to the missions and of demonstrated excellence. The size of a laboratory must be determined by its mission requirements and by the quality of its work.

Second, the laboratories must be held more accountable for the quality and productivity of their research and development. There should be an oversight function that is responsible for the continuing excellence of the laboratories. This function could be performed by an external oversight committee. Micromanagement, or excessive detailed direction to the laboratories, focusing on procedures rather than content, should be stopped.

Dr. Solomon J. Buchsbaum May 20, 1983

The Panel has also made recommendations to relieve the constraints on Federal laboratories with regard to personnel administration; to provide funding in a way more conducive to rational planning; and to increase the collaboration of Federal laboratories with universities and industry. This last point is certainly not the least important. At a time when the nation's economic and defense leadership is increasingly challenged, greater synergism between all our R&D institutions is a must.

Sincerely,

David Packard

DP/lgk

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FINDINGS AND RECOMMENDATIONS

The Federal Laboratory Review Panel was established by the White House Science Council. Dr. George A. Keyworth asked the Panel to review the Federal laboratories and to recommend actions to improve their use and performance. The Panel has completed an extensive survey of both government-operated and contractor-operated laboratories. The Panel is convinced that the Federal laboratories have great potential and are an essential part of the American institutions where R&D is performed and scientists and engineers receive training. At the same time, the Panel has observed a number of serious deficiencies in the Federal laboratories. These deficiencies limit both the quality and the cost-effectiveness of research done by the Federal laboratories. The negative effects of these deficiencies have increased to serious levels during the past decade.

The Panel has focused on several major aspects of the Federal laboratories, including *mission*—important for defining the relationship of these laboratories to other scientific institutions and also for assuring the best performance of each laboratory; *personnel*—the key laboratory resource upon which excellence depends; *funding*—an important factor in the laboratory's stability and long range organizational integrity; *management*—crucial in creating and maintaining an environment conducive to first class research; *interaction of the Federal laboratories with universities, industry, and users of research results*—necessary for greater relevance and usefulness of the laboratories' research results.

In this summary, we present the Panel's major recommendations. We believe they demand the attention of both the Administration and Congress. At a time when the nation's economic and military competitiveness is increasingly challenged, it is imperative that the nation gets the optimum return from its investment in the Federal laboratories. The Panel believes that all the recommendations, if implemented, will improve the quality of the work done by the Federal laboratories.

1. Mission

The Panel believes that clearly defined missions consistent with the appropriate roles for Federal laboratories*, are important to the vitality of any laboratory. Of the laboratories visited, those with well defined missions clearly were better performers than those with poorly defined missions. Those laboratories with both well defined missions and close interaction with the users of their research appeared to be the most effective of all.

*The appropriate roles for Federal laboratories are discussed in the Introduction section of the report.

[illegible]

1-1. As a top management priority, Federal agencies should reexamine the missions of their laboratories. Together with the laboratory directors, the agencies should redefine the missions as necessary to ensure that they are consistent with the appropriate roles for Federal laboratories. The missions must be made sufficiently clear and specific to guide the agency and the laboratories in setting goals against which the laboratories' performance can be evaluated.

1-2. The size of each Federal laboratory should be determined by its missions and the quality of its work. That size should be allowed to increase or decrease (to zero if necessary) depending on mission requirements, but it should not fluctuate randomly. Preservation of the laboratory is not a mission.

2. Personnel

The Panel believes that almost all of the Federal laboratories, both government-operated and contractor-operated, suffer serious disadvantages in their inabilities to attract, retain, and motivate scientific and technical personnel required to fulfill their missions. The principal disadvantage is the inability of the Federal laboratories, particularly those under the Civil Service system, to provide scientists and engineers with competitive compensation at entry and top senior levels.

[illegible]

2-1. Administrative and legislative actions should be initiated now to create, at government-operated laboratories, a scientific/technical personnel system independent of current Civil Service personnel systems.

2-2. Contracts governing government-owned, contractor-operated laboratories should be rewritten to permit the contractor to establish and carry out an independent salary administration.

3. Funding

The Panel is concerned that the direction and performance of the Federal laboratories is less than optimal because of serious problems with the adequacy of research funding. Supporting high quality research requires stability and a long-range view.

[illegible]

of the Federal laboratories should be devoted to programs of independent research and development at the laboratory directors' discretion. Federal agencies should establish a mechanism to evaluate the results of such work, with the size and continuation of discretionary funds related to laboratory performance. In order to encourage cooperative research programs, the laboratory directors should have the authority, and be encouraged, to spend part of the discretionary funds at appropriate universities and industries.

4. *Management*

The Panel concludes that some agencies give excessively detailed management direction to the laboratories (i.e. micromanagement). At the same time, they do not hold the laboratories sufficiently accountable for output in terms of quality and productivity.

Recommendations

4-1. For each Federal laboratory, there should be an external oversight function responsible for assuring the continuing excellence of the laboratory. This function could be performed by a committee which should include strong industry and university representation. This committee would spend enough time at the laboratory to become familiar with the laboratory's strengths and weaknesses. It would focus on productivity and on the excellence, relevance, and appropriateness of research. The oversight committee would make recommendations to the agency and inform the laboratory director of these recommendations. Those recommendations would be taken into account by the agency and laboratory in their budget decisions. In addition, the committee would also give special attention to reducing micromanagement by the sponsoring agency.

4-2. Federal agencies should rely to a greater extent on the competitive peer review process for funding basic research at the laboratories.

4-3. The laboratory director must be held accountable for the quality, relevance, and productivity of the laboratory. Appointment of the director should be for a finite term, with the option of extending or abbreviating the term depending on the performance of the director and the laboratory.

5. *Interaction with Universities, Industry, and Users of Research Results*

The Panel feels that the degree of interaction of Federal laboratories with universities and industry varies among laboratories, but has not been strong traditionally. The national interest demands that this collaboration be stronger to ensure continued advances in scientific knowledge and its translation into useful technology.

Recommendations

5-1. Federal laboratories should encourage much more access to their facilities by universities and industry.

5-2. R&D interactions between Federal laboratories and industry should be greatly increased by more exchange of knowledge and personnel, collaborative projects, and industry funding of laboratory work, provided an oversight mechanism is established to prevent unfair competitive practices.

5-3. Contracting by agencies and laboratories for universities and industry to conduct R&D should be encouraged by simplifying the necessary Federal procurement procedures. The procurement process should give laboratory directors greater flexibility in contracting.

6. Conclusion

In addition to the major recommendations contained in this summary, there are several others in the body of the report. We believe that the Panel's recommendations, when implemented, will make constructive changes to revitalize the Federal laboratories so that their wealth of talent and facilities will contribute more effectively to our citizens' health, our nation's defense, and our economic growth.

INTRODUCTION

Background

The White House Science Council's Federal Laboratory Review Panel[1] was appointed by Dr. Solomon J. Buchsbaum, Chairman of the Council, in March 1982. Dr. George A. Keyworth, Science Advisor to the President, asked the Panel to review the Federal laboratories and to recommend actions to improve their use and performance. The Panel was specifically charged to look at laboratory missions, identify any systemic impediments to performance, and determine whether this nation is getting the optimum return on its substantial investment in talent and facilities at the Federal laboratories.

There are more than 700 Federal laboratories, set up at various times for specific purposes. Over time, their activities have tended to expand and diversify, partly because they succeeded in their original tasks and partly because mission requirements changed. In some cases, this expansion has resulted in a dilution and weakening of purpose, mission, and capability.

Panel Activities

Of the Federal agencies with research and development (R&D) laboratories, the Panel concentrated on six with the major share of laboratory funding: The Departments of Defense, Agriculture, Commerce, Energy, and Health and Human Services, and the National Aeronautics and Space Administration. Panel members visited several large multiprogram R&D laboratories[2] and met with top agency representatives responsible for laboratory management. The Panel also examined past studies of Federal laboratories[3], and was kept informed of ongoing reviews by the President's Private Sector Survey and the Energy Research Advisory Board. The Panel invited input from industry and universities and took those into account in its deliberations[4].

Overall Findings

The Panel did not review the Federal laboratories in sufficient detail to evaluate fully the quality of the work being done or to measure the Federal laboratories' contributions in relation to university and industrial research. The Panel did find highly competent people, important research programs, and unique large facilities that would be beyond the means of both universities and industry. The Panel also identified a number of serious deficiencies at the Federal laboratories that limit both the quality and cost effectiveness of the work done there. These deficiencies are not new, but their negative effects have increased to serious levels over the past decade. The nation's return on its investment in support of the laboratories is being undercut seriously by vagueness and inconsistencies in some of the laboratories' missions,

[1] See Appendix A for a list of Panel members.
[2] See Appendix B for list of laboratories visited
[3] See Appendix C for list of major past studies
[4] See Appendix D for individuals, corporations and organizations

and by the increasingly pervasive effects of impediments described later in this report.

R&D Roles

The Panel believes that Federal laboratories play important roles in the nation's scientific and engineering enterprise—roles that complement those played by industry and universities. Specifically, the Panel believes that these roles are appropriate for the Federal laboratories:

- Perform basic and applied research in areas where the Federal government has a legitimate responsibility, including nuclear energy, agriculture, health sciences, and development of military technology and equipment.
- Conduct other research projects of a long range nature that require unique, capital-intensive facilities and multidisciplinary approaches.
- Build and manage large multiuser technical facilities, and encourage universities and industry to use them.
- Contribute, through cooperative programs with universities, to the education of scientists and engineers in applied research where university capabilities may be limited.
- Perform research and provide services on important national standards, metrology, environmental protection, health and safety.
- Provide special services, such as producing radioactive material, maintaining banks or libraries of materials (such as agricultural plant material), and provide calibration services such as those relating to time, and other physical measurements.
- Develop commercial products only when that work has industry cooperation *and* is directly related to the laboratory's unique capabilities.

These roles are intermediate between those of universities and industry. Both Federal laboratories and universities are very important to support a high rate of technological advance in the U.S. Universities often excel in basic research, and they provide the additional important benefit of producing future scientific talent. On the other hand, Federal laboratories and commercial firms have many common capabilities and interests. Commercial firms are, by far, the most effective in applying research results to broader, practical uses, and to deliver products and services to the market. They also have the best capability to conduct activities to improve industrial competitiveness and productivity. The national investment in R&D must be justified by the contributions of the R&D institutions to the nation's goals of health, strong economic growth and national defense. These contributions can be optimum only if these institutions fulfill their proper roles and complement one another, so that their research contributes to U.S. leadership in technologies and products. The balance in Federal funding between Federal laboratories, universities, and commercial firms may not be optimum and needs further attention.

Nature of Recommendations

The recommendations in this report are made in the framework of the roles described above. They aim to bring the Federal laboratories to the necessary level of excellence and productivity to justify a continuing high level of investment in them. The Panel believes strongly that action on these recommendations, some of which have been made before, is well overdue. The Administration and the Congress can and should make major corrections in 1983 to improve the quality and productivity of the Federal laboratories.

The recommendations address the following factors, which are vital to the laboratories' ability to perform and to contribute to the nation's well-being and national security:

- Clear *missions* that allow firm goals to be set against which the performance of the laboratories can be measured.
- Appropriate *resources*, most importantly adequate scientific talent, for carrying out the missions.
- A *management* of the laboratories that fosters an environment conducive to first-class research.
- Strong *interaction with universities, industry, and users of research results*, to maximize the complementary use of talent and resources; to assure application of results to broader, practical uses; and to minimize undue overlap and unfair competition.

1. MISSION

The Panel believes that clearly defined missions are important to the vitality of any laboratory. Of the laboratories visited, those that had well defined missions clearly were better performers than those that did not. Those laboratories which had both well defined missions *and* close interaction with the users of their research seemed the most effective.

The Panel observed that some of the laboratories did have a clearly defined mission for a part—often a major part—of their work, but the balance of the work was often fragmented and unrelated to their main activity. This phenomenon frequently occurs when a national need that justified the original mission of a laboratory becomes of lower priority. The laboratory then tends to diversify into other work to occupy its staff and preserve institutional stability. The DOE laboratories offer an example of this tendency. During the mid-1970s, work related to their original missions under the Atomic Energy Commission decreased. Research on alternate energy resources was used to fill the gap and increase the activity level at several of the large DOE laboratories. The new missions were not very clearly defined or carefully considered at any level of management.

Given the great concern at that time about future energy sources, a lot of money was made available to the laboratories. But, very little came of this effort, and in the 1980s most of the research on alternate energy resources has been cut back, transferred to industry, or transformed into longer-term exploratory development. These changes have left several of the DOE laboratories without well defined missions. The absence of missions, in turn, contributes to less than optimum use and performance.

The Panel believes that the clearer a laboratory's missions are, the better its performance will be. It would be better to reduce the size of a laboratory to meet the real needs of its legitimate missions than to maintain its size by filling in with unrelated research projects.

A laboratory whose original missions no longer serve high-priority national needs may be able to acquire new missions. To be carried out competently, these missions must be consistent with the laboratory's existing strengths and expertise. If necessary, a laboratory without a mission should be shut down.

The Panel also concludes that some of the work done by the Federal laboratories could have been done as well, or possibly better, by private industry or by universities (e.g., engine designs, batteries and fuel cells, electric power transmission and distribution, design of specific airframe/engine installation concepts, and renewable energy sources). This would have been less likely to happen if the missions of the Federal laboratories had been defined to encourage cooperation rather than competition with industry and universities. Most research projects at Federal laboratories could benefit from related research in universities

and in industry and could be guided by prospective users, either in industry or in government agencies.

Finally, the Panel observed a certain amount of overlap and competition between some laboratories, but this should not be a problem if the main missions are clearly defined. Some competition is good. For example, the competition between Lawrence Livermore and Los Alamos in nuclear weapons development seemed to be an important factor in the high quality of weapons work in both laboratories.

The breadth of research activities at most Federal laboratories could be reduced and the depth increased in those areas of demonstrated excellence and mission relevance. The laboratories could also take better advantage of modern communications technology for information exchange among a large number of people over wide geographic areas.

Recommendations

1-1. As a top management priority, Federal agencies should reexamine the missions of their laboratories. Together with the laboratory directors, the agencies should redefine the missions as necessary to ensure that they are consistent with the appropriate roles for Federal laboratories. The missions must be made sufficiently clear and specific to guide the agency and the laboratories in setting goals against which the laboratories' performance can be evaluated.

1-2. The size of each Federal laboratory should be determined by its missions and the quality of its work. That size should be allowed to increase or decrease (to zero, if necessary) depending on mission requirements, but it should not fluctuate randomly. Preservation of the laboratory is *not* a mission.

2. RESOURCES: PERSONNEL

The key to a laboratory's success is a high quality and properly motivated scientific staff. The inability of many Federal laboratories—especially those under Civil Service constraints—to attract, retain, and motivate qualified scientists and engineers is alarming. The personnel problem is most serious at government-owned, government-operated laboratories (called GOGO's) but it also affects government-owned, contractor-operated laboratories (GOCO's). At present, this situation limits the productivity of the laboratories. If not corrected, it will seriously threaten their vitality.

While middle level salaries may be competitive, the GOGO's have difficulty attracting young scientists and engineers at the entry level (GS-5 and 7) on one hand, and very experienced and qualified top-level personnel on the other. There are many reasons for this difficulty, but the main one is noncompetitive pay and benefits compared with industry and universities[1]. Furthermore, cumbersome procedures for hiring new staff make it hard to bring in new talent even when other obstacles have been overcome.

The rigidity of the Civil Service promotion and salary system limits rewards for outstanding scientists and engineers. Many of them leave the GOGO laboratories when they reach the levels where they cannot advance unless they are willing to assume management and administrative responsibilities (usually GS-12 and 13 levels). Promotion is linked to management responsibilities, and current rules do not allow for adequate recognition of scientific performance alone. Recent personnel ceilings imposed strictly on a numerical basis without distinguishing among types of staff have adversely affected the laboratories' R&D activities.

The GOCO's are not legally under the Civil Service system, but some agencies have chosen to impose ceilings on allowable reimbursements for scientific personnel.

This personnel situation leaves the Federal laboratories vulnerable to weak scientific leadership if senior qualified personnel cannot be replaced, and to declining quality of research because of inadequate infusion of young talent.

It is important that Federal laws and regulations be modified to exempt scientific and engineering personnel at Federal laboratories from the unduly rigid hiring, salary, and promotion rules of the Civil Service system. In place of these rules there should be: 1) a more flexible system that facilitates hiring, and enhances career progress for

[1] The pay discrepancy varies among laboratories. The National Institutes of Health has the largest difference between the Federal pay ceiling and the private-sector earning power of specialized academic physicians.

technically qualified personnel, and 2) an effective performance-based reward system.

The recent experiment by the Department of Defense at the Naval Weapons Center (China Lake, California) and the Naval Ocean Systems Center (San Diego, California) is considered highly successful by the participants[2]. The experiment applies a revised personnel management system which simplifies classification and bases pay, appraisal, and retention on performance. It also reduces the paperwork required to hire and promote. The experiment shows that it is possible to introduce flexibility in personnel management at the government-operated Federal laboratories.

GOCO personnel problems can be corrected by a very simple and logical step. Every contract to manage a government laboratory—whether the contractor is an industrial firm, a university, or a nonprofit organization—should give the contractor complete authority to set and carry out personnel policies that will enable the laboratory to attract retain, and motivate its professional staff. The laboratory management must have authority to set and carry out personnel policies that are comparable with those of competitors. This can be done best by the laboratory management, not by the agency.

Recommendations

2-1. Administrative and legislative actions should be initiated now to create, at government-operated laboratories, a scientific/technical personnel system that is independent of current Civil Service personnel systems. The experimental system for managing scientific and technical personnel at the Naval Weapons Center and Naval Ocean Systems Center is an example of how this can be approached.

2-2. Contracts governing government-owned, contractor-operated laboratories should be rewritten to permit the contractor to establish and carry out an independent salary administration.

2-3. Personnel ceilings at government-operated laboratories should not be used in addition to budgetary control. Federal agencies should provide budget constraints and give the laboratory directors freedom to decide how to meet them. Laboratory directors should also be allowed to make the final decisions on contracting for support services at their laboratories.

[2] See Appendix E for description of experiment.

3. RESOURCES: FUNDING

The current processes by which laboratories are funded impede rational planning and effective conduct of R&D activities. The budget process consumes too much time at too many levels, both in the agency and the laboratories. Delayed appropriation actions by Congress, often compounded by agency indecision, have dragged uncertainties in laboratory funding well into the fiscal year in which funds are to be spent. It is also clear that most laboratory directors need more flexibility to allocate funds at their laboratories. However, added flexibility will be an improvement only if accompanied by increased accountability for performance and results.

If U.S. taxpayers are to get the most return from their support of R&D, government laboratories must have sufficient discretionary funding for independent research and development. Almost every laboratory has found that the most important innovation often comes from the scientists' independent ideas of actions. Thus, the productivity of the U.S. R&D establishment depends on a vigorous independent R&D program. Yet, funding for independent R&D has been decreasing over the years.

Recommendations

3-1. The Congress and Office of Management and Budget should authorize funding for R&D programs on a predictable multiyear basis so that staffing levels and research activities at Federal laboratories can be properly planned.

3-2. At least 5 percent, and up to 10 percent, of the annual funding of the Federal laboratories should be devoted to programs of independent research and development at the laboratory directors' discretion. Federal agencies should establish a mechanism to evaluate the results of such work, with the size and continuation of discretionary funds related to laboratory performance. In order to encourage cooperative research programs, the laboratory directors should have the authority, and be encouraged, to spend part of the discretionary funds at appropriate universities and industries.

3-3. Federal laboratories should be allowed to carry forward remaining funds into the next fiscal year. This would eliminate the wasteful practice of hurried spending at the end of each fiscal year.

4. MANAGEMENT

It is clear to the Panel that excessively detailed direction of laboratory R&D activities from agency headquarters, known as micromanagement, has seriously impaired R&D performance in some laboratories. Numerous detailed external directions are given as to how work should be done, while at the same time, the overall missions and goals of the laboratories are inadequately defined. This trend must be reversed.

The micromanagement problem is most serious at the Department of Energy (DOE) laboratories and has its roots in the lack of stability in the DOE itself. The Department has changed leadership many times, and its mission has changed and diversified too often, to the point where it is no longer clear. The Department also must respond to a much larger number of Congressional committees and subcommittees than other Federal agencies do.

Perhaps the most serious deficiency of the Federal laboratories is their lack of accountability. They are not subject to the competitive driving force of the peer review system as the universities are. Nor has their survival depended on satisfying the cost effectiveness and relevance constraints of industrial R&D laboratories. In the absence of economic and competitive forces, the Federal laboratories must be held accountable by their agencies. Unfortunately, in most cases, the agencies' oversight means an excessive amount of reporting and paperwork, but inadequate scrutiny of the quality and relevance of the laboratories' activities.

The current review mechanism often focuses on evaluation of proposed work rather than actual performance. Review processes also emphasize the more easily measurable criteria (e.g. time and cost) rather than the more difficult but important criteria of excellence, relevance to national needs, and appropriateness[1]. Review committees usually have only advisory authority and report to the laboratory directors.

As a result of this kind of oversight, there are many opportunities for low-quality research in pedestrian subjects or in areas inappropriate for government involvement. R&D in Federal laboratories, even within the same agency, is often poorly coordinated, leading to unproductive overlap among laboratories and missed opportunities for synergism.

A proper balance of basic research activities between the laboratories and the universities is important to maintain both the nation's scientific base and educational capability. A good way to assure a proper balance

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[1] Excellence: Is this research of high quality? Is this researcher competent?

Relevance: Does this research address an important scientific question to solve a national need? Is it related to the agency's mission?

Appropriateness: Is this laboratory the best place to perform this research? Should the Federal government be funding this research?

is to insist upon excellence as a criterion for support. The competitive peer review process, though imperfect, is a good mechanism for evaluating basic research. Yet, among the agencies with major laboratories, only the National Institutes of Health rely on this process systematically and, even then, only for extramural programs.

Different agencies have different forms of laboratory management. Even within the Department of Energy, operating procedures differ: some laboratories are operated by universities, others by private companies, still others by government employees. Each form of management presents advantages and disadvantages, but the quality of management is crucial to a laboratory's performance. Federal agencies must insist on highly competent laboratory directors. The agencies must then make sure that the laboratory directors understand their missions and the place of their laboratories in the overall work of the agency. Each agency should involve the laboratory directors in developing an overall R&D plan. This would encourage teamwork and increase synergism between the laboratories.

Recommendations

4-1. For each Federal laboratory, there should be an oversight function responsible for assuring the continuing excellence of the laboratory. This function could be performed by an external committee which should include strong industry and university representation. This committee would spend enough time at the laboratory to become familiar with the laboratory's strengths and weaknesses. It would focus on productivity *and* on the excellence, relevance, and appropriateness of research. The oversight committee would make recommendations to the agency and inform the laboratory director of these recommendations. Those recommendations would be taken into account by the agency and laboratory in their budget decisions. In addition, the committee would give special attention to reducing micromanagement by the sponsoring agency.

4-2. Federal agencies should rely to a greater extent on the competitive peer review process for funding basic research at their laboratories.

4-3. The laboratory director must be held accountable for the quality, relevance, and productivity of the laboratory. Appointment of the director should be for a finite term, with the option of extending or abbreviating the term depending on the performance of the director and the laboratory.

4-4. The above recommendations apply to all Federal agencies. The management of the Department of Energy presents an additional special problem, and the Panel recommends that the Administration and Congress work together to stabilize and strengthen DOE management and to define and affirm its mission. Congress should also refocus its oversight of DOE R&D into a significantly smaller number of committees.

5. INTERACTION WITH UNIVERSITIES, INDUSTRY, AND USERS OF RESEARCH RESULTS

The United States can no longer afford the luxury of isolating its government laboratories from university and industry laboratories. Although endowed with the best research institutions in the world, this country is increasingly challenged in its military and economic competitiveness. The national interest demands that the Federal laboratories collaborate with universities and industry to ensure continued advances in scientific knowledge and its translation into useful technology. The Federal laboratories must be more responsive to national needs.

The ultimate purpose of Federal support for R&D is to develop the science and technology base needed for a strong national defense, for the health and well-being of U.S. citizens, and for a healthy U.S. economy. Federal laboratories should recognize that they are an important part of the partnership with universities and industry in meeting this goal. A strong cooperative relationship must exist between Federal laboratories, universities, industry and other users of the laboratories' research results.

Federal laboratories have felt traditionally that they are part of the government, committed to its highest service and totally dependent on it for support. They perceived industry as an awkward partner with a different value system. Although the degree of interaction with universities and industry varied among the laboratories visited, the Panel feels that this interaction could be increased at all Federal laboratories.

One means of interaction is through R&D contracts. The current Federal procurement system discourages agencies and GOGO laboratories from contracting with universities and industry. Procedural requirements for doing so are far more cumbersome than for assigning work to the Federal laboratories. As a result, many parent agencies have assigned to the laboratories work that would be more appropriately performed elsewhere, and the GOGO laboratories have been reluctant to contract with universities and industry. The Panel believes that this situation has caused the balance of R&D funding in many agencies to shift in favor of the Federal laboratories at the expense of the universities and industry for over a decade. This problem is most severe with the DOE and DOD, and least with the NIH.

A final note on interaction between Federal laboratories and users of research results concerns the DOD. Since the major task of DOD laboratories is to enhance the capability of our military forces, greater communication between the DOD's operating forces and its laboratories would benefit both parties. This communication is currently hampered by the many layers of management between the laboratories and the operating forces.

Recommendations

5-1. Federal laboratories should encourage much more access to their facilities by universities and industry.

5-2. R&D interactions between Federal laboratories and industry should be greatly increased by more exchange of knowledge and personnel, collaborative projects, and industry funding of laboratory work, provided an oversight mechanism is established to prevent unfair competitive practices.

5-3. Contracting by agencies and laboratories for universities and industry to conduct R&D should be encouraged by simplifying the necessary Federal procurement procedures. The procurement process should give laboratory directors greater flexibility in contracting.

5-4. Support to the military operating forces should be an important criterion among others for measuring performance of the DOD laboratories.

ACKNOWLEDGEMENTS

The Panel wishes to thank the directors and staff of the laboratories that we visited for their cooperation and assistance in the conduct of this review. The Panel also expresses appreciation to all the representatives from industry, universities, and government who formally and informally provided valuable input to the Panel.

APPENDIX A

WHITE HOUSE SCIENCE COUNCIL FEDERAL LABORATORY REVIEW PANEL

Panel Members	Chairman:	PACKARD, Mr. David Chairman of the Board Hewlett-Packard Company
	Members:	BARDEEN, Dr. John Department of Physics University of Illinois
		BROMLEY, Dr. D. Allan Department of Physics Yale University
		FREDRICKSON, Dr. Donald S. Howard Hughes Medical Institute
		KERMAN, Dr. Arthur K. Department of Physics Massachusetts Institute of Technology
		TELLER, Dr. Edward Hoover Institution on War, Revolution and Peace, Stanford University
		WHEELON, Dr. Albert D Space Communications Group Hughes Aircraft Company
	Executive Secretary:	LING, Dr. James G. Office of Science and Technology Policy
	Policy Analyst:	LETHI, Mrs. Minh-Triet Office of Science and Technology Policy

APPENDIX B

LABORATORIES VISITED BY WHITE HOUSE SCIENCE COUNCIL FEDERAL LABORATORY REVIEW PANEL

Laboratory	Date of Visit
Department of Agriculture	
Beltsville Agricultural Research Center	October 8, 1982
Department of Commerce	
National Bureau of Standards	November 28, 1982
Department of Defense	
Air Force Weapons Laboratory	June 21, 1982
Harry Diamond Army Laboratories	November 27, 1982
Naval Research Laboratory	November 27, 1982
Naval Weapons Center	December 14, 1982
Department of Energy	
Argonne National Laboratory	July 15, 1982
Brookhaven National Laboratory	August 30, 1982
Lawrence Berkeley National Laboratory	July 26, 1982
Lawrence Livermore National Laboratory	July 27, 1982
Los Alamos National Laboratory	June 21, 1983
Oak Ridge National Laboratory	August 31, 1982
Pacific Northwest Laboratory	July 28, 1982
Sandia National Laboratory	June 21, 1982
Department of Health and Human Services	
National Institutes of Health	November 28, 1982
National Aeronautics and Space Administration	
Jet Propulsion Laboratory	November 2, 1982

APPENDIX C

PAST STUDIES REVIEWED BY FEDERAL LABORATORY REVIEW PANEL

Department of Agriculture	Science for Agriculture. The Rockefeller Foundation and Office of Science and Technology Policy, 1982.
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APPENDIX D

SOURCES OF INDUSTRY INPUT TO FEDERAL LABORATORY REVIEW PANEL

Aerospace Corporation
Eberhardt Rechtin, President

Bell Laboratories
C.K.N. Patel, Executive Director
Research, Physics Division

Boeing Company
K. F. Holtby, Senior Vice President

Burlington Northern Railroad
Steven Ditmeyer, Director
Research and Development

Exxon
Peter Eisenberger, Director
Physical Sciences Laboratory

Duane Levine, Director
Science Laboratories

Ford Motor Company
Dale Compton, Vice President for Research

General Atomic
Harold Agnew, President

General Dynamics Corporation
L. F. Buchanan, Vice President
Engineering and Program Development

General Electric
Roland W. Schmitt, Senior Vice President
Corporate Research and Development

Robert C. Hawkins, General Manager
Advanced Technology Operations

Arthur Flathers
Aerospace Group

Craig S. Tedmon, Jr., Staff Executive
Power Systems Technology Operations

General Motors Research Laboratories
Robert A. Frosch, Vice President
General Motors Corporation

Grumman Corporation
Joseph G. Gavin, Jr., President

IBM
Bill Howard, Office of Vice President and Chief Scientist

Lockheed Corporation
Roy A. Anderson, Chairman of the Board

McDonnell Douglas
Sanford N. McDonnell, Chairman of the Board and Chief Executive Officer

Northrop Corporation
Donald A. Hickes, Senior Vice President Marketing and Technology

Thomas V. Jones, Chairman of the Board and Chief Executive Officer

Rockwell International Corporation
Robert Anderson, Chairman of the Board and Chief Executive Officer

TRW, Inc.
John S. Foster, Jr., Vice President Science and Technology

Institute of Electrical and Electronics Engineers, Inc.

APPENDIX E

NOSC/NWC PERSONNEL DEMONSTRATION PROJECT

Area of Interest: Demonstration Project
(An Experiment in Federal Personnel Management)

Background Statement

Under Title VI of the Civil Service Reform Act (CSRA) of 1978, there were provisions for federal agencies to obtain approval from the Office of Personnel Management to conduct a demonstration project to determine if the removal of personnel management constraints and changes to personnel regulations could increase effectiveness and efficiency in the work force. By law, such experiments were limited to a total of 10 active projects, could last for a maximum of five years, and were limited to a maximum of 5,000 employees.

To date only one project has been approved, and that is the Navy's joint Naval Ocean Systems Center/Naval Weapons Center Demonstration Project, initiated in July 1980. The Project allows waiver of certain personnel-related laws and regulations; however, it does not waive leave, insurance, annuity, Hatch Act, or EEO rules or regulations. Basically, it is a revised personnel management system providing simplified position classification, performance linked pay and appraisal, and performance based retention.

The following Executive Summary provides basic information on this Center's personnel Demonstration Project. Its purpose, description, and operating policies are covered. If you would like more detailed background on the Project, a suggested contact is:

Contact: Bob Glen
Demonstration Project Manager (Code 0902)
Extension 3196

Executive Summary

Personnel management under the Civil Service system has experienced a number of problems; key examples are:

(1) Classification—complex and outdated position standards which delay recruitment and promotions, limit organizational flexibility to administer personnel resources, and place personnel staffs in an adversarial role with line management mission, product, and service obligations.

(2) Performance appraisal—unsatisfactory pay incentives to reward good and penalize poor performance, and the inability, through performance planning and mutual employee-supervisor goal setting, to objectively establish and measure employee effectiveness in relation to organizational goals.

(3) Merit pay—lack of sufficient incentives and flexibility in dealing with all levels of the work force and in offering recent college graduates and other potential employees pay which will keep pace with professional growth, performance and responsibilities demonstrated.

(4) Reduction-in-force—inability to recognize performance as a major criterion in RIF situations and to avoid adverse effects upon good performers who happen to have low retention standing or who may be recently-hired female or minority employees.

The NOSC/NWC Demonstration Project was established to address the above problem areas within the existing personnel system and to show that the effectiveness of federal organizations can be enhanced by allowing greater line management control over personnel functions.

Purpose

The intent of this Project is to permit increased line management involvement in major personnel-related decisions, such as recruitment, compensation, training, appraisal, and rewards. The line manager is the primary decision maker on personnel issues of pay, classification, merit, and job assignments which have important effects upon motivation, performance, and organizational effectiveness. To accomplish these changes, the Demo Project includes (1) a more flexible, manageable, and understandable classification system which aggregates several GS grade levels into broad pay bands; (2) a performance appraisal system that links performance goals, compensation, and organizational effectiveness; (3) an expanded application of the CSRA merit pay concept for both supervisory and non-supervisory employees; and (4) an emphasis on performance as a primary criterion in the retention process while retaining tenure, veterans preference, and length-of-service factors.

Types and Number of Participating Employees

In keeping with the 5,000 employee limit in the Project, the two Centers have included the following full-time personnel in the Demo Project:

	NOSC	NWC
Scientists and Engineers, and Senior Professional Staff	1,284	1,444
Technicians	332	588
Administrative Specialists	223	395
Technical Specialists	171	183
Clerical	360	–
	2,370	2,610
	4,980	

Scientists and engineers and all GS-13-15 personnel entered the Project when it began in July 1980. The GS-12 Administrative and Technical Specialists entered the Project in January 1981 with the Technicians following in August 1981 and the GS-11 and below Administrative and Technical Specialists being included in August 1982.

Since both Centers' clerical population could not be added to the Project without exceeding the 5,000 person limitation, it was decided to include only NOSC's clerical personnel in August 1982, in order to ensure an opportunity for full evaluation of the Project's concepts for all of the above career paths.

Basic Features

Implementation procedures for the Project vary somewhat between the two Centers in relation to unique management needs and styles. However, both Centers have a similar basic approach to pay, performance appraisal, and position classification. Under the experimental effort, both Centers have grouped 16 pay and classification grades (GS-1 through GS-16) into broad levels as noted below for the applicable career path:

Career Path Identification by Classification Level as Related to Current Grade Levels

Scientists, Engineers, and Senior Prof. Staff	1-4	5-8	9-11	12-13	14-15	16-18	DP
	A	I	II	III	IV	V	
Technicians	1-4	5-7	8-10	11-12			DT
	A	I	II	III			
Technical Specialists	1-4	5-8	9-10	11-12			DS
	A	I	II	III			
Administrative Specialists	1-4	5-8	9-10	11-12			DA
	A	I	II	III			

The separate career paths incorporate at least two grades within each path. Performance appraisal serves as the basis for determining incentive pay adjustments in terms of classification standards and performance objectives established. Each career path is a competitive area for reduction-in-force purposes, and retention is determined primarily on the basis of performance appraisal.

Classification and Pay System

Each class of positions covered by the Demo Project (scientist and engineer, technician, technical specialist, and administrative specialist) reflects career progression of those having similar qualification requirements and lines of work. Pay bands in each career path reflect

entry, trainee, and journeyman levels of work for that occupational group. Series levels are included in the DP career path.

The classification system recognizes both the rank-in-person concept reflecting unique aspects of matrix and line management plus sponsor relationships as well as the rank-in-position distinctions through classification in broad classification levels. The first line supervisor is involved with classifying positions by using simplified standards for each pay level. Typical duties, responsibilities and levels of difficulty of work at each classification level are listed in a "menu" format. Supervisors then select from the appropriate classification standard for a given level. To acknowledge personal contributions and capabilities of individual employees as well as duties and responsibilities of positions, the traditional position description or PD has been retitled "Personal Activities and Capabilities" or PAC. The classification standards are computerized to allow for automatic listing of menu items, and the resulting PAC is identified by special code and stored for record purposes. PACs are quickly prepared and approached with maximum line supervision involvement and provide clear distinctions between functions, specialties and classification levels.

Scientific and engineering salaries are established consistent with labor market conditions and the applicant's experience and education. However, since the basis for the Project pay system is the General Schedule, scientists' and engineers' pay rates for the various levels of responsibility are directly keyed to the special salary rates for scientists and engineers.

Performance Linked Pay

Employees can be paid no less than the minimum pay rate established for the pay band to which assigned. The broad band has been divided into increments between the highest and lowest salary of the level (i.e., GS-12/1—13/10 for DP level III and 24 increments, each equaling approximately 1.5% of the highest salary level). Increases in pay are based on performance within available resources, and the Center's annual merit payout has been approximately 2.4% of Demo Project payroll. This figure has been derived from monies that formerly would have been paid to deserving employees in the form of QSIs, SSPs, and within-level promotions.

Employee performance is evaluated on the basis of five incentive pay groupings from performance that is demonstrably exceptional to that which is substantially below fully successful. The following identifies performance rating definitions and payout choices in terms of whether or not comparability pay (federally determined) and increments are awarded for the various levels of performance indicated.

Performance Ratings/Payout

Rating	*Definition*	*Pay*
1	Performance that is demonstrably exceptional—clearly deserving of recognition equivalent to a within-level promotion.	c + 4i or c + 3i
2	Quality performance that exceeds the fully successful standards.	c + 2i
3	Fully successful performance—meets the expected results of the performance plan. Growth and progression normal for NWC.	c + i or c
4	Below fully successful. Corrective action needed.	c/2
5	Substantially below fully successful. Serious performance deficiencies. Needs significant improvement for work to meet established standards.	0

Employees who exceed performance expectations receive incentive pay increases substantially exceeding government-wide comparability increases. Employees who fully meet performance expectations receive at least comparability, while those who do not fully meet performance expectations receive either one-half or none of the comparability increase.

Employees' salaries advance to the upper limit of a pay bank only through performance, not time-in-level. A lump sum bonus payout, corresponding to the payout shown above, is given to those employees whose salaries are at the top of the level or the pay cap. If, on the other hand, an employee receives no or limited pay increases due to marginal performance, and the minimum salary of the current pay band exceeds the present salary, the employee "migrates downward" to the next lower level. This occurs without specific adverse or performance-based action. In this manner, higher performing employees are rewarded in consonance with their contributions and poorer but minimally adequate performers have their salaries held constant. Employees whose performance is unacceptable may be removed or changed to a lower level as a performance-based or adverse action.

Reduction-In-Force

The Demonstration Project's major change in RIF procedures is the ranking of employees within each competitive level, based primarily on performance rating groupings and secondarily on the elements of tenure, veteran's preference, and length of service. The intent is to increase the probability of retaining the highest performing employees in their positions and displacing the lowest performers. "Bumping" is limited to the career path to which the employee is currently assigned. Thus, if engineering positions are abolished, clerical, technician, specialist and administrative personnel would not be bumped.

Employees can retreat to the career paths through which they progressed. Retention standing within a competitive level is determined by performance rating groups, and the high retention group(s) is placed at the top of the register in standard tenure, veteran's preference, and length of service order. Employees in lower retention groups are

placed at the bottom of the retention register, using the same standard order and are the first to be released from the competitive level. Individuals in higher retention groups always displace those in the lower group(s).

Implementation

A task team approach has been used to develop implementation ideas and create "ownership" of these important changes to the federal personnel system. This has involved representatives of career paths and various skills at the Center who are affected by the Project. Task teams involving pay, classification, performance evaluation, and communication are examples of representative groups from both managers and employees affected by the Project. They have made significant contributions to Center policies affecting all implementation aspects of the Demo-Project. Special employee groups to review provisions affecting career paths, such as technicians, have been used, also. These groups have influenced changes which have been made to pay bands, performance appraisal, and the new position classification approach. Task team policies have been developed in conjunction with NOSC task team counterparts.

As career paths have entered the Project, training has occurred in some depth on the basic features of the new system, how it works, and the responsibilities and expectations of supervisors and employees. Training sessions on performance planning and assessment, compensation, classification, and general system operation have been conducted by employees who have been trained by Personnel Department representatives. Specific topics other than those above included goal setting, motivation, communication, handling conflict, and performance monitoring. Essential to the understanding and acceptance of the Project have been efforts on communication and descriptions of the departmental Performance Review Boards (PRBs) where final performance evaluation decisions for employees are made.

Evaluation

To assess the Project results and evaluate the feasibility of applications to other federal organizations, evaluation efforts by OPM contract and internal evaluation groups at both Centers are underway. Coopers and Lybrand were awarded the OPM contract ($100 K with each Center paying one-fourth of the cost) and will provide their first report in September 1982. This Center's internal evaluation effort is headed by Dr. Ed Alden (Code 08203). The external evaluation effort will monitor the implementation of the Project and assess anticipated and unanticipated effects. The firm fixed price contract is for one year with four renewable options of one year for the five year evaluation period. To help isolate effects of the Project, changes at the two participating Centers will be compared with data from two other Navy labs, NADC and NSWC.

Factors as recruitment success, turnover, and Personnel Department performance will be evaluated, along with management issues of equity, motivation, satisfaction, mobility, line management flexibility/

accountability, and changes in the number of adverse actions. Attitude surveys are being conducted by both the internal and external evaluators, plus management audits, exit interviews, and other analyses involving recruitment, mobility, and sponsor satisfaction. OPM's major objectives for measuring the success of the Project include recruitment success, increased high performer retention, improved personnel function performance, and expanded performance-based pay systemization.

Benefits of Project

The Project is expected to demonstrate that a genuinely management-centered personnel administration process will lead to more efficient and effective use of the resources of the participating laboratories. In addition, by providing a means of real-world testing for models of improved and simplified classification and performance evaluation systems, the project will have results that can be applied throughout the federal service. Some examples of anticipated effects caused by the proposed changes and corresponding measures for evaluating these effects are depicted in Table 1.

Table 1.

Some Examples of Anticipated Effects Caused by the Proposed Changes, With Measures for Evaluating These Effects.

Change	*Anticipated effects*	*Evaluation measures*
Classification and pay	Increased recruitment success EEO commitment Flexibility of workload assignment Increased personnel effectiveness	Cost per recruit, recruit quality and quantity Cost, quantity and quality of recruits Time, cost of reassignments and transfers Cost, management and employee satisfaction
Performance appraisal	Correlation of pay and performance Improved EEO relations Increased employee commitment Decreased turnover of "desirable" employees Increased turnover of low performers Increased organizational effectiveness and efficiency	Perceived equity Increased retention of high performance minorities and women Satisfaction and commitment instruments Turnover rate of critical employees Turnover rate Peer, sponsor, and user evaluations; cost to conduct business
Retention	Retention of high performers Increased EEO effectiveness	Retention rates Retention rates of minorities and women
Adverse action	Increased adverse action effectiveness	Cost, rate of successful actions