

When $\bar{B} = \bar{B}_2 < B_{op}$, and given $Q = Q_0$, the highest productivity is at point (A_2, B_2) . Yet the costs of the two mixes are the same—both fall on the line $P_A \cdot A + P_B \cdot B = Q_0$.

but

$$C(A_2, B_2) = C(A_{op}, B_{op}) = Q.$$

$$E(A_2, B_2) < E(A_{op}, B_{op}).$$

Thus, when this grade control is not irrelevant, it always reduces cost-effectiveness in terms of productivity per dollar of cost.

3.2 Effect of Control over Average Salary

Let S = maximum average salary. Thus

$$\frac{P_A \cdot A + P_B \cdot B}{(A + B)} \leq S.$$

For the interesting case, assume that $P_A < S < P_B$. Then $(S - P_A) > 0$, and $(S - P_B) < 0$. Also

$$P_A \cdot A + P_B \cdot B \leq (A + B)S$$

$$B(P_B - S) \leq A(S - P_A)$$

$$B \leq \frac{(S - P_A)}{(P_B - S)} A$$

Figure 5

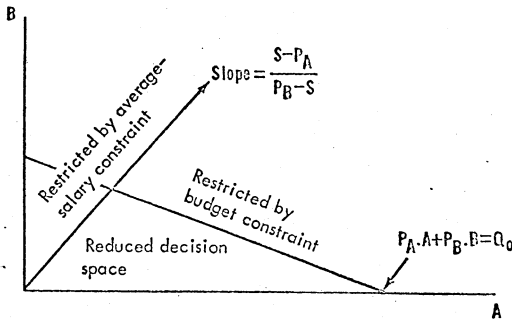
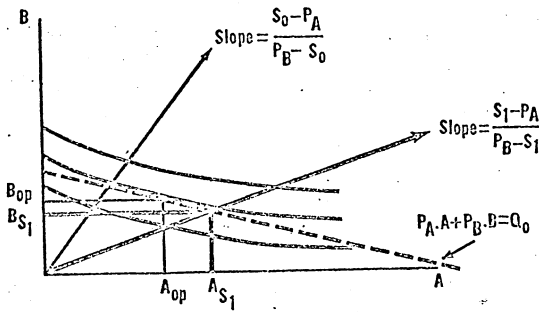


Figure 5 illustrates how control of average salary reduces the decision "space" available to the local line manager. Figure 6 shows the influence of this constraint on the effectiveness of his decisions.

Figure 6



When $S = S_0$, the constraint is irrelevant.

When $S = S_1$, $S_1 < S_0$ so that $\frac{S_1 - P_A}{P_B - S_1} < \frac{B_{op}}{A_{op}}$

$$C(A_{S_1}, B_{S_1}) = C(A_{op}, B_{op})$$

but

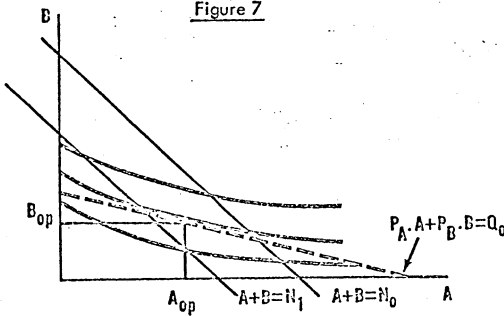
$$E(A_{op}, B_{op}) > E(A_{S_1}, B_{S_1}).$$

Thus when the average-salary constraint is not irrelevant, it always reduces effectiveness in terms of productivity per dollar of cost.

Effect of Control over Total Spaces

The statement of this constraint is $A + B = N$.

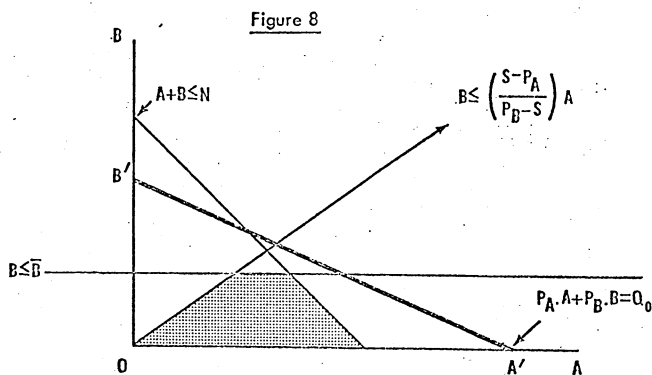
Figure 7



Once again, when $N = N_0$ the constraint is irrelevant, and when $N = N_1$ it reduces effectiveness.

General Result

From the preceding examples it becomes apparent that the general effect of these types of control is to diminish the decision space available to the local line manager and thus to make it less probable that he will be able to achieve an optimum level of operation in regard to cost-effectiveness. (See Figure 8.)



$OB'A'$, the original decision space, is defined by the single budget constraint. The shaded area represents the reduced decision space after the three constraints have been drawn. As shown here, the budget constraint has become irrelevant—which may not always be the case.

The addition of one or more constraints may or may not reduce the cost-effectiveness of the operation by a large amount. The important point to remember, however, is that such constraints or controls cannot increase effectiveness but can only reduce it. Moreover, it is most unlikely that, by some mystical process, the simultaneous imposition of these controls would force the local manager to make a decision that would have been optimum without them.

The major point is that these three controls, which represent indirect attempts to control dollars rather than other resources such as manpower, can only reduce operating effectiveness; they can in no way increase it.

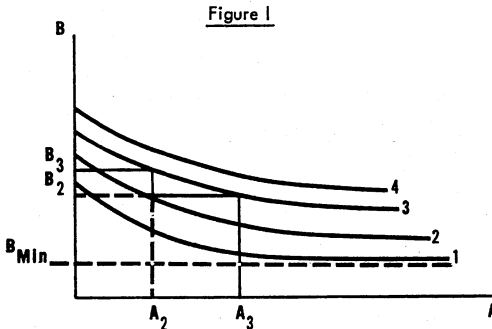
1. Methodology and Outline

The indifference curves and maximizing principles of economic analysis are used here to demonstrate how management controls over high grades, average salary and manpower spaces prevent the line manager who is limited to a certain dollar budget from optimizing his organization's effectiveness. For the sake of simplicity and clarity, the analysis is restricted to a two-dimensional framework, although it can easily be extended to as many dimensions as desired, depending on the number of inputs.

First, the general method of optimizing the allocation of resources is discussed, and then the impact of each control is separately analyzed.

2. General Method

Suppose that the professional personnel of an organization (e.g., a laboratory) can be divided into two subsets, the GS-13s and below (GS-13-) and the GS-14s and above (GS-14+). Let A represent the number of GS-13s- and B, the number of GS-14s+. Further, let us assume that the productivity of a typical employee within each grade range can be measured and that overall productivity varies according to the mix of A and B. On this basis, the following diagram (Figure 1) may be constructed:



The curves labeled 1, 2, 3 and 4 correspond to isoproductivity curves. Thus, line 1 represents the combinations of A and B that yield an equal level of productivity; line 2 represents a higher level of productivity than line 1, and so on. With an input mix of A_2 , B_2 , for instance, productivity is $E(A_2, B_2)$. If A_2 is held constant and the number of GS-14s+ is raised to B_3 , then productivity increases; that is, $E(A_2, B_3) > E(A_2, B_2)$. Similarly, $E(A_3, B_2) > E(A_2, B_2)$.

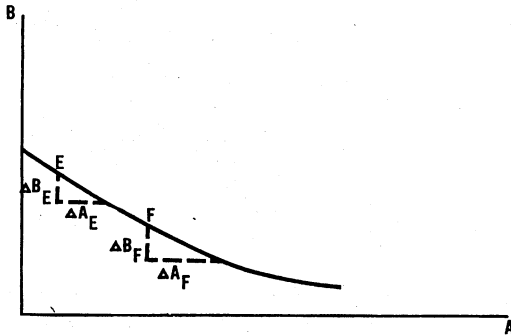
Several other important points about the diagram should be noted: The lowest level of productivity, represented by curve 1, is asymptotic to $B_{\min}$, which represents the minimum of GS-14s+ that must be hired to reach any positive level of productivity. Moreover, all the curves have a flat, negative slope throughout. The negative slope indicates that both A and B have positive productivity, i.e., there is no negative productivity. The curve's flatness indicates that, in any possible input mix, the GS-14s+ are always more productive than the GS-13s-; that is, assuming that we seek to maintain the same level of productivity, if B is decreased by 1, we must increase A by more than 1.

Also, the isoproductivity curves are convex to the origin:

$$\left(\frac{dB}{dA} < 0, \frac{d^2B}{dA^2} > 0 \text{ for } A > 0, B > 0 \right).$$

This property depends upon the assumption of diminishing marginal productivity. For example, refer to Figure 2: At point E on curve 1, a decrease ΔB_E in the number of GS-14s+ requires an increase ΔA_E in the number of GS-13s- in order that total productivity remain constant.

Figure 2

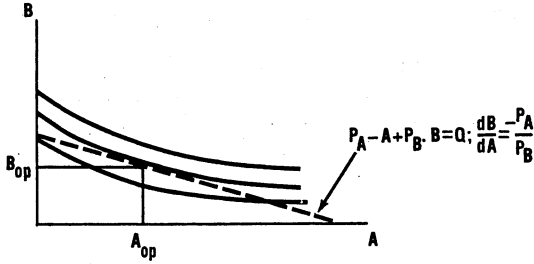


However, at point F, where the relative number of GS-14s+ is smaller, the same decrease in the number of GS-14s+ ($\Delta B_F = \Delta B_E$) requires a larger increase in the number of GS-13s- ($\Delta A_F > \Delta A_E$) to keep the total productivity constant. This condition does not appear unreasonable, for the GS-14s+ may perform some tasks more efficiently than the GS-13s-. If the curves were concave to the origin, this would be equivalent to making an assumption of increasing marginal productivity; i.e., as the GS-14s+ become relatively fewer, it will take fewer and fewer GS-13s- to replace the same number of GS-14s+.

3. Maximizing Productivity, Given a Budget Constraint

Suppose the isoproductivity curves are represented as in Figures 1 and 2. Let P_A = salary (cost) paid a GS-13-; let P_B = salary (cost) paid a GS-14+; and let Q = the total budget available for salaries. Then, $P_A \cdot A + P_B \cdot B \leq Q$. Now, superimpose this linear budget constraint on the productivity contour surface, as in Figure 3.

Figure 3



Given Q , we now maximize our productivity by hiring $A = A_{op}$, $B = B_{op}$, since at this point the budget line reaches—and is tangent to—the highest isoproductivity curve. This method vitally depends on the convex nature of the isoproductivity curves.

3.1 Effect of Limitation on Number of GS-14s+ (B)

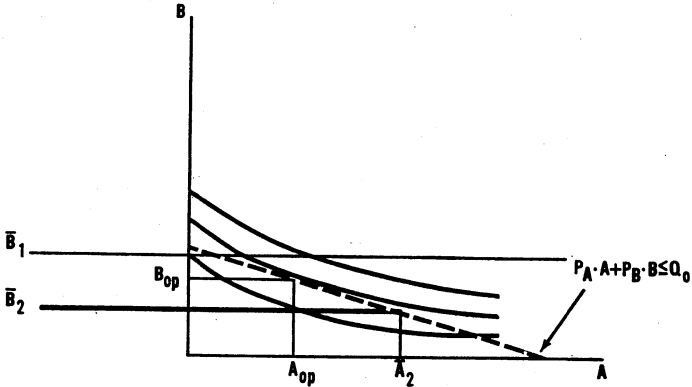
Let us state the constraint imposed by a limitation on the number of GS-14s+ in the following manner:

$$\bar{B} = \text{maximum allowable number of GS-14s+;}$$

thus,

$$B \leq \bar{B}.$$

Figure 4



When $\bar{B} = \bar{B}_1 > B_{op}$, the constraint is irrelevant, because, given $Q = Q_0$, the optimum mix is A_{op} , B_{op} , with effectiveness (productivity) equal to $E(A_{op}, B_{op})$.

When $\bar{B} = \bar{B}_2 < B_{op}$, and given $Q = Q_0$, the highest productivity is at point (A_2, B_2) . Yet the costs of the two mixes are the same—both fall on the line $P_A \cdot A + P_B \cdot B = Q_0$.

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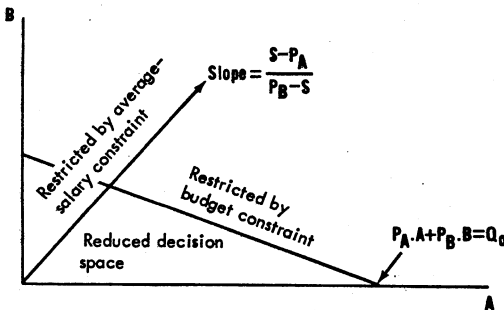
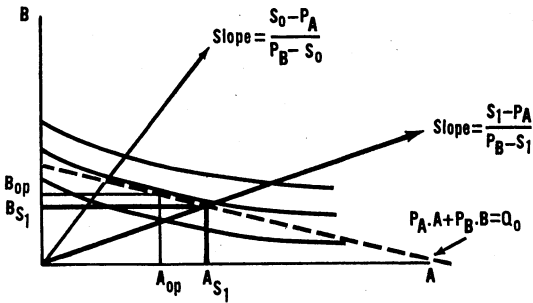


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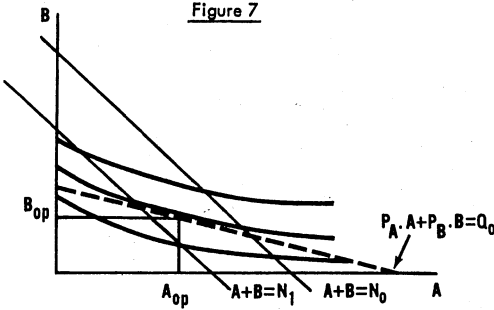
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3.3 Effect of Control over Total Spaces

The statement of this constraint is $A + B = N$.

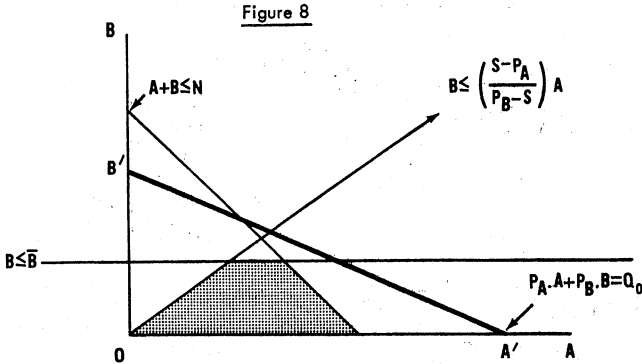
Figure 7



Once again, when $N = N_0$ the constraint is irrelevant, and when $N = N_1$ it reduces effectiveness.

4. General Result

From the preceding examples it becomes apparent that the general effect of these types of control is to diminish the decision space available to the local line manager and thus to make it less probable that he will be able to achieve an optimum level of operation in regard to cost-effectiveness. (See Figure 8.)



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Question No. 12. It has been argued that there is a lot of unused flexibility and extensive authority existing within the present manpower control system and therefore it is unnecessary to remove current manpower controls. Do you concur in this view? Please explain.

Answer. In our studies of manpower problems, we ascertained that there were many individual cases of unused flexibility and authority. These generally evolved from misinterpretation of policies or regulations. We have taken steps to correct cases of this nature largely through a general educational process and clarifying regulations and instructions. However, with even the most liberal interpretation of all manpower constraints, the laboratory director has very little real management flexibility. His problems are compounded by the fact that manpower controls are additional controls superimposed on several other types of controls such as dollars, time and facilities. See Question 11. We recognize the necessity for some form of over-all control but believe that current procedures do not provide sufficient manpower flexibility to maintain a viable responsive organization. For example, manpower ceilings:

- a. Restrict early college recruitment.
- b. Inhibit the labs' ability to do work on request from another agency.
- c. Prevent the rapid expansion required in undertaking new crash programs.
- d. Inhibit rapid staff readjustments required by changing technological programs.
- e. Result in undue emphasis on the number of people rather than the quality.
- f. Motivate managers to always operate at the prescribed level rather than a lesser and possibly more efficient level.

There needs to be a relaxation of manpower controls if we are to become more efficient. It is also recognized that we must approach this cautiously. As you know, I have suggested elimination of manpower ceilings for cross-agency work. I believe this might be a good first step toward improved flexibilities.

Mr. DADDARIO. Would you proceed Dr. Jacobs.

(The biographies of Dr. Jacobs and Dr. Mider follow:)

DR. LEON JACOBS

Date and Place of Birth: March 26, 1915, Brooklyn, N.Y.

Educational background:

Brooklyn College, Brooklyn, N.Y., 1931-35, B.A.

George Washington University, Washington, D.C., 1936-33, M.A.

George Washington University, Washington, D.C., 1939-43, 1946-47, Ph.D.

Tissue Culture Course, Mary Imogene Bassett Hospital, Cooperstown, N.Y. 7/49-9/49.

Course in Virology, U.S. Department of Agriculture Graduate School, 1949.

Course in Ophthalmic Pathology, Armed Forces Institute of Pathology, 2/9-13/53.

Course in Pathology, U.S. Department of Agriculture Graduate School, 1953.

Course in Veterinary Pathology, Armed Forces Institute of Pathology, 1959.

Professional experiences:

Junior Nematologist to Protozoologist, Division of Zoology, NIH, 1937-43.

U.S. Army, 1943-46.

Protozoologist to Scientific Director, NIAID, NIH, 1946-56.

Head, Section of Protozoal Diseases, Laboratory of Tropical Diseases, NIAID, NIH, 1956-59.

Chief, Laboratory of Parasitic Diseases, NIAID, NIH, 1959-64.

Acting Scientific Director, NIAID, NIH, 1964-65.

Scientific Director, DBS, NIH, 1966-67.

Deputy Assistant Secretary for Science, DHEW, 1967-

Membership in scientific societies:

American Society of Tropical Medicine and Hygiene:

Fellow and Editor of *Tropical Medicine News*, 1952-55.

Representative of National Research Council, 1957-61.

Council, 1964-

American Society of Parasitologists:

Editor, *Journal of Parasitology*, 1955-58.

Chairman, Committee on Business Operations, 1959-60.

Council, 1963-

American Association of Immunologists.

Helminthological Society of Washington.

Tropical Medicine Society of Washington.

Society of Protozoologists.

American Association for the Advancement of Science.

Sigma Xi.

Research interests: Cultivation, epidemiology, and pathogenicity of parasitic protozoa: immunology and serology of protozoan and helminthic infections. Particularly interested in toxoplasmosis (life cycle and epidemiology, immunity, diagnostic procedures, ocular and other clinical manifestations and serology).

STATEMENT OF DR. LEON JACOBS, DEPUTY ASSISTANT SECRETARY FOR SCIENCE, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, ACCOMPANIED BY DR. G. BURROUGHS MIDER, DIRECTOR OF LABORATORIES AND CLINICS, NATIONAL INSTITUTES OF HEALTH

Dr. JACOBS. Mr. Chairman, I am happy to have the opportunity to appear before you today to discuss the work which is being carried on in the various laboratories of the Department of Health, Education, and Welfare and the way in which these laboratories are managed. Because of the varied mission of DHEW laboratories, my prepared remarks are general. I am not now a laboratory director, although I have been one at NIH. Therefore, I am accompanied by Mr. Reo E. Duggan, Deputy Associate Commissioner for Compliance, Food and Drug Administration; Dr. John C. Eberhart, Director of Intramural Research, National Institute of Mental Health; Dr. G. Burroughs Mider, Director of Laboratories and Clinics, National Institutes of Health; and Dr. Winston M. Decker, Director, Office of Research and Development, Bureau of Disease Prevention and Environmental Control.

The Department conducts laboratory research in the Public Health Service which now includes the Food and Drug Administration, the National Institutes of Health, and the Health Services and Mental Health Administration. Very few generalizations can be made about these laboratories, since the type of research carried on by each bureau and even the type of research carried on within a bureau is so diverse.

Our major research efforts are in the biomedical sciences. Our storehouse of biomedical information is much less complete than the data base available to the physical scientist. Biological science has nothing comparable to the critical tables so essential to the physicist, chemist, or engineer. We are not so frequently organized for the accomplishment of a specific, defined, developmental mission as are some of the laboratories devoted to these more exact sciences, although we do indeed have various developmental programs.

Biomedical scientists are convinced that a better understanding of the ways of the body functions, from the total organism to its minutest subunits, will point the way toward better management of sick people and enhanced development of human capabilities. Our field has always been a mixture of the fundamental and applied—a free-ranging scientific inquiry as well as a vigorous capability to cope with the practical problems of health and disease.

An important policy all DHEW laboratories follow is to communicate continually with their counterparts in the academic world and in the broad scientific community. There is an effective interchange of

staff at all levels of research and management between our laboratories and other Federal and nongovernmental laboratories.

A close coordination of research efforts also exists between DHEW and non-Federal laboratories. The research grants awarded to academic and other nonprofit research institutes by the National Institutes of Health make the talents and resources of these organizations available to a concerted attack on health problems. Joint research programs are carried out by the National Institute of Mental Health and nongovernmental research laboratories. The same is true of laboratories in the Bureau of Disease Prevention and Environmental Control (now a part of the Health Services and Mental Health Administration).

There are, as well, studies made in DHEW laboratories for other Government agencies.

Examples of the effectiveness of these policies are apparent in the description of the functions and activities of our laboratories that follows:

NATIONAL INSTITUTES OF HEALTH

The National Institutes of Health, the principal research arm in the Public Health Service, is concerned with the extension of basic knowledge regarding the health problems of man and how to cope with them. Each of the eight institutes supports research in highly specific categories of disease such as cancer, heart, stroke, neurological diseases, and infectious diseases. Two of the institutes focus on such general problems as behavioral sciences, aging, human growth and development, surgery, anesthesiology, and mental retardation. Seven of the eight conduct programs in our own Federal laboratories by Federal physicians and scientists, but this represents an expenditure, including funds supporting contract research, of about 15 percent of the total \$1.2 billion budget.

The intramural programs, research conducted by Federal scientists in Federal laboratories located chiefly at Bethesda makes a significant contribution to the overall research effort, but can respond in only a limited way to the broad scope of the needs of our total programs.

A wealth of talent resides in academic and other nonprofit research institutes which can effectively engage in health research, and grants-in-aid have become increasingly the most significant part of the budget. This encourages close interaction between different sectors of biomedicine.

With the rapid growth of NIH after the war, attention was increasingly directed toward extramural activities. The growing extramural budgets also captured most of the time of each institute director. Two things happened: The concept of a scientific director was created, and each institute acquired a group of outstanding scientists to advise on the planning required because of the continually moving frontiers of science and medicine. Each of the scientific directors is in effect a laboratory director.

It is the duty of each research scientist at the NIH to report the results of his findings for the judgment of the scientific community as soon as the research is mature. The number of contributions to medical and scientific literature in 1967 was 2,302. In addition, we expect our scientists to participate in the activities of professional societies so that they engage in debate on general or more specific issues.

A number of programs have been established to encourage the interaction of ideas between our staff members and those who form the worldwide community of biomedical research:

1. A program for appointing young doctorates to 2-year fellowships (internships in science), with authority for 1-year renewals and an opportunity for conversion to continuing civil service appointments in outstanding cases.

2. A program for appointing visiting scientists from foreign countries. During the past 5 years, about 1,000 appointments have been made from 50 countries.

3. A program for training associates in the medical and biological sciences. Medical students usually apply for positions as associates in their senior years. During the past 8 years we have rotated about 900 associates through this program.

4. A program for bringing in guest workers to lecture or work with regular members of our staff.

5. Policies which encourage lectures, conferences, and so forth. These formal and informal meetings are part of the continuing education of the younger scientists.

6. Policies encouraging teaching. Almost 100 of the staff have faculty appointments.

Only one component of NIH has a regulatory function. This is the Division of Biologics Standards, which has the responsibility for the safety, purity, and efficacy of vaccines, blood and blood products, serums, et cetera, used for the diagnosis, prevention or treatment of human disease. Its operations are so technical that it must devote 50 percent of its resources to basic and applied research on these problems.

Mr. DADDARIO. Is No. 1 established just for the purpose of raising the quality of your laboratory by exchanging ideas, having these young people come, or is it also a way to hire them?

Dr. JACOBS. It is both a recruitment device and a means of effecting an interchange between the NIH scientist and the university.

If a man has, in the long run, the desire to be both a teacher as well as an investigator, he may not desire to come to NIH for any extended period. It doesn't appeal to him then to have part of his salary deducted for retirement. He is not interested in it at this stage of the game. He is appointed as a staff fellow with the understanding that he will stay for 1 or 2 years and engage in scientific work and relationships with the other scientists at the NIH, and then go on to a university career.

In other words, this is to a great extent like the post doctoral fellowship which exists within the universities. We offer the same opportunity at NIH.

Then he can go out.

On the other hand, if he does find that the environment at NIH is what he really likes, if he finds that teaching does not appeal to him as much as full time devotion to research, then he may ask to be put in a civil service category and brought on board that way.

Mr. DADDARIO. It serves adequately two purposes.

How many, in fact, do stay on?

Dr. MIDER. It is between 50 and 60. It is a comparatively small program. Most of those people hold doctorates in philosophy rather than medicine.

Mr. DADDARIO. You are talking about how many people?

Dr. MIDER. This is running right now about 25 to 30 a year. They may not stay more than 3 years, and they may not be 5 years beyond their degree.

Mr. DADDARIO. You are talking about young people recently trained who can offer something to you, and you can offer something to them, and from whom you do get an opportunity to build up your own staff.

Dr. MIDER. Yes, sir.

Mr. DADDARIO. Without it being a serious number.

Your policy of encouraging teaching strikes me as being a particularly good objective. Do you find this is something that these men want to do and which gives them the opportunity to do the teaching they desire? Is this your reason for doing it rather than anything else?

Dr. JACOBS. Yes; and there are various devices for doing this. Some of them as mentioned in the text have faculty appointments at local universities. This is true of many of the scientists at NIH. They also travel to other cities to give lectures or seminars. We have people who hold appointments at the local medical schools and who may conduct rounds in them as a part of their general clinical research effort. They may have a research program associated with the medical school and conduct rounds there and teach at the same time.

This other program mentioned here under No. 3, program for training associates in the medical and biological sciences, this consists mostly of what we call research or clinical associates who are brought in from the medical schools and spend 2 or 3 years with us after internship. This is a kind of graduate teaching on the part of the investigators at NIH. To have a preceptorship with one of these young men is a stimulating experience for the scientist and it takes the place of the graduate student he might have were he in a university situation.

Frequently, also, we have young people who do not have a doctorate, but are interested in getting a doctorate degree and they do work under people at NIH who have faculty appointments in local universities who then serve as their research professors.

As a matter of fact, that is the way I got my degree and a number of years later somebody else got her degree under a similar arrangement with me serving as her professor. So this is a continuing kind of thing, and we do have at NIH a program on which I have brought you a little booklet called the Foundation for Advanced Education in the Sciences. This is a scientist-supported endeavor started by scientists at NIH who were interested in teaching, and it conducts courses on the grounds at NIH and these are now linked up with a local university for credit, so there are a number of mechanisms by which this is accomplished.

Mr. DADDARIO. Good.

Dr. JACOBS. National Institute of Mental Health (now part of the Health Services and Mental Health Administration).

The basic character of the NIMH research program as well as the broad nature of its mission is to prevent and treat mental illness and to foster the mental health of the people. The intramural research is limited and makes no attempt to cover either all psychiatric research or all the behavioral and biological sciences relevant to mental illness. The field as a whole is supported by the extramural research grant and training programs, as well as by foundations, universities, the

States, and industry. The intramural program provides NIMH with a critical mass of excellent investigators who carry out substantive research not so readily accomplished in the overburdened university and medical school departments.

A limited but meaningful and effective exchange exists between NIMH and university scientists.

Through fellowships and clinical and research associate appointments (comparable to those at NIH), promising young men are brought to our laboratories for a 2- or 3-year period of research training, after which they return to universities. A number of senior investigators spend a year or more as visiting scientists working with our staff. The work-assignment procedure makes it possible for experiences which will ultimately strengthen our program. New laboratories sometimes are established so that they can make use of other governmental facilities. For example, the Addiction Research Center at the NIMH Clinical Research Center in Lexington, Ky., and the Division of Special Mental Health Research Programs at St. Elizabeths Hospital make use of the unique resources of the institutions with which they are associated.

The intramural program may contract with other laboratories in studies supplementing our own research. For example, scientists at Wayne State University studied blood samples from NIMH patients in the clinical center; and psychiatrists in Lebanon, Japan, and Taiwan carried out observations on families with a schizophrenic member which paralleled those made on similar families in Bethesda. Conversely, our psychologists evaluated certain tests given to patients treated at Yale University and at the Langley Porter Clinic of the University of California. Examples of similar relationships can be cited throughout the Public Health Service.

BUREAU OF DISEASE PREVENTION AND ENVIRONMENTAL CONTROL

(Now part of Health Services and Mental Health Administration)

The Bureau of Disease Prevention and Environmental Control operates laboratories for detecting toxic, infectious, or other harmful agents in man's environment; assessing their biological effects; and developing control measures. The work is oriented to continuing missions.

Some of the laboratories support field investigations. They are multi-purpose, with functions including surveillance and research combined with the management of nationwide or regional control programs and the conduct of training for government and industry personnel. The National Communicable Disease Center in Atlanta, Ga., for example, combines in one major facility the operation of international and national disease control programs with laboratory services essential to the support of such programs. In addition, it has research and training functions. The Cincinnati facilities of the National Center for Urban and Industrial Health have a similar blend of functions.

In marked contrast, many of the Bureau's laboratories work on specific disease or environmental control problems and their location is based on the mission and availability of related scientific resources. For example, three laboratories working on controlling shellfish diseases are in coastal areas. And the Arctic Health Research Center, of

course, is in Alaska. These small problem-oriented laboratories, with staffs ranging from 10 to 100 persons are two-thirds Federal facilities and one-third leased from universities or other organizations.

Most BDPEC laboratories are devoted to routine surveillance and research missions involving basic microbiological and chemical methodologies. Their work, in conjunction with State and local agencies, constitutes a network for surveillance of health hazards and for control activities.

A few laboratories are specialized and are unique resources. The injury control program's Human Factors Laboratory in Providence, R.I., determines the human characteristics affecting a person's ability to anticipate danger and prevent injury. The National Center for Air Pollution Control operates a laboratory in Ypsilanti, Mich., where devices for the control of emissions from automobiles are tested to determine compliance with performance standards. These facilities are made available to others when additional activities can be accommodated.

There are many examples where the laboratories serve the health-related work of other Federal agencies. The Las Vegas laboratory of the National Center for Radiological Health provides surveillance of atomic testing. Food protection laboratories of the National Center for Urban and Industrial Health have conducted studies during the past 5 years on such matters as bacterial contamination of space vehicles for NASA and a study of marine toxins for the Army, and for other agencies.

The occupational health laboratory of the National Center for Urban and Industrial Health provides a significant pharmacological and toxicological resource to other parts of PHS, other agencies, and to industry. The Arctic Health Services Laboratory has helped the Defense Department in problems of water supply, sewage disposal, and disease vector control.

There are severe limitations on the capabilities of BDPEC laboratories serving the missions of other Federal agencies. The laboratories have limited resources for meeting their primary health missions. Numerous public health problems cannot be undertaken because of these limitations. Time can only be diverted from the major mission when the problem of another agency has major public health implications.

For much of its research and surveillance activities, the Bureau depends on contractual arrangements with academic institutions, industrial organizations, and agreements with other Federal agencies. There is a constant search for organizations with competence to conduct specific research, surveillance, and developmental activities.

The Bureau's laboratories have strong relationships with academic institutions. Many of the laboratories share central maintenance services with a university or buy services from the university. For example, the National Communicable Disease Center located on the edge of the campus of Emory University in Atlanta has developed extensive relationships with the university which have been enriching experiences for both. These relationships with universities have helped in attracting high quality professional personnel to Federal laboratories.

THE FOOD AND DRUG ADMINISTRATION

The Food and Drug Administration operates chemical and bacteriological laboratories in 18 field locations, and chemical, bacteriological, and biological laboratories in headquarters installations. The research and regulatory programs conducted in these laboratories are designed to develop information needed in enforcing the Food, Drug, and Cosmetic Act and related legislation.

The resources of the chemical laboratories are devoted to: (1) research on the composition of foods and food additives, drugs, cosmetics, pesticides, colorants, and hazardous household substances; (2) development of reliable methods for determining the concentrations of significant ingredients (including contaminants) in these commodities; and (3) application of analytical methods to the examination of articles encountered in the marketplace for compliance with legal requirements.

The bacteriological laboratories are engaged chiefly in two activities:

- (1) They develop methods for detecting, recovering, and identifying undesirable micro-organisms and their deleterious metabolic residues in foods, drugs, and cosmetics; and they examine commercial products to insure that these commodities are free of such contamination.

- (2) They devise and apply microbiological assay procedures to determine the potency of antibiotic drugs and vitamin preparations.

The pharmacologists and biochemists in the biological laboratories and associated animal facilities conduct research and regulatory investigations to measure the toxicological properties of substances occurring in foods, drugs, cosmetics, and hazardous household articles; they devise bioassay procedures for determining the potency of drugs (e.g., insulin, digitalis, adre nocon tiotrophic hormones), and they employ these bioassay methods in examining commercial products.

The Food and Drug Administration has maintained liaison with the Department of Defense, other laboratories in the Public Health Service, and Veterans' Administration, and performs laboratory services for them upon their request. The responsibilities of the Food and Drug Administration laboratories, both in executing its own programs and in performing services for other agencies, are continuous in nature. Upon completion of any project, resources are directed to cope with other problems confronting the agency. Priorities for action are assigned upon approval by the Office of the Commissioner of proposals recommended by the laboratory directors. Decisions as to whether a new laboratory facility is needed or the job can be handled within existing laboratories are likewise made in the Office of the Commissioner after discussions with all interested elements in the agency.

To relate the activities of Public Health Service laboratories to the questions asked in your invitation to the Department to testify, your first question concerned the redirection of a laboratory's capabilities when it has completed its assigned mission. Since the basic mission of Public Health Service laboratories is the broad question of health problems, their activities are actually never completed. Specific projects within this broad mission are completed, and at such times new projects are undertaken after thorough planning and review by

the Bureau. The direction of a laboratory's activities is subject to continual review and, within its mission, there is enough flexibility to take on new projects as they become necessary.

To answer your question on the utilization of capabilities existing in our laboratories by other government agencies, the description of current activities indicates that there is a considerable sharing of information and occasional exploitation of facilities across agency lines. Public Health Service laboratories occasionally undertake specific research projects for other government agencies.

As to a laboratory's ability to respond to national problems in which they have a capability, the capability of Public Health Service laboratories lies in the area of health research, which in itself is a national problem. The board capability necessary to meet other national problems such as transportation, housing and crime, do not exist in our Public Health Service laboratories except where there may be a health problem connected. I believe our record indicates a high degree of responsiveness in this area.

While the suggestion that laboratory directors have funds available to respond to new areas of opportunity has merit, within the general mission of Public Health Service laboratories, there is some latitude for the director to venture into new areas. This is accomplished administratively and there appears to be no need for special funds for this purpose.

You asked about guidelines regarding the establishment of new laboratories when new missions are established. The choice is between utilizing existing laboratories or establishing new ones.

The existing laboratory missions within the PHS range from disease investigations to air pollution controls. The skills needed in these laboratories vary accordingly, the specialized personnel employed in these programs is rarely adaptable to new, entirely different missions. The same is true for the facilities.

For these reasons, when we choose between using an existing laboratory or establishing a new one, our choice is usually determined by the suitability of personnel and facilities.

Mr. Chairman, as I stated earlier, this presentation is very general. A more exact description of the diverse laboratories within the Department of Health, Education, and Welfare would be tedious. We can provide you with descriptions of individual laboratories and with reports from them, and we have some of these documents with us, should you wish to have them. We will be pleased to discuss any questions.

Mr. DADDARIO. Thank you, Dr. Jacobs.

You have been here during this morning's discussion concerning what authority laboratory directors ought to have as far as discretionary funds are concerned, and you have heard the discussion concerning the competition for funds.

Recognizing that your situation is somewhat different than that of the Department of Defense, what is your judgment about this?

Dr. JACOBS. I think Dr. Mider can supplement me on this argument, but I would like to say that from my own experience as a laboratory director—I was acting scientific director of the National Institute of Allergy and Infectious Diseases for a year and of the Division of Biologics Standards for a while—I know that because of personnel

lapses we generally have enough flexibility at the scientific director level to initiate something new or to sponsor a good appealing idea which is broached by a laboratory chief or one of his scientists.

In addition to that, we maintain a small reserve just for this purpose and this seems to be adequate for us. We don't require generally this kind of hardware and massive expenditures which are necessary in order to test something in the physical sciences. It is very frequently possible to initiate a new program on a small amount of money with a modicum of encouragement.

Would you supplement that?

Dr. MIDER. All I can do is agree with you.

For example, when virology became important in cancer, viruses appeared as causative factors in neoplastic diseases. In 1952 the Cancer Institute had a commitment of \$50,000 out of \$3 million for such work. In seeking counsel from our advisory group and the senior members of the staff, the judgment was made that until we knew more about the chemical nature of viruses we should let it smoulder, but we had a very rugged individualist who refused to accept this and she proceeded to show she could isolate a variety of viruses.

Within 1 year the commitment to virology increased from \$75,000 to \$350,000 as a result of recognition by scientific staff that this was an attractive area in which to work. It took only \$75,000 of new money.

This was used to get a couple of people, but more importantly to give the scientists the types of apparatus they needed.

I recall that our program in human genetics was born in the National Institute of Dental Research when they recruited a good human geneticist. Before he had been at NIH very long, it was recognized that his capability was substantially greater than we had anticipated and Dr. Shannon proposed to the scientific directors that if each institute would immediately contribute \$25,000 to a better genetics program he would build the program into the budget for the next fiscal year and, indeed, that is what happened. In operating the cancer program I had to have about \$250,000 free and clear to take care of items of equipment and contingencies costing \$5,000 or more and against that I had a 7-percent personnel services lapse that I could anticipate during the year. Use of this money to make it easier to do that and harder to do something else is a powerful force.

Mr. DADDARIO. You then have over the course of time developed the kind of flexibility which in a sense gives you the authority which in another laboratory is called discretionary funds. You are able to support a good idea when it comes, and it is up to the laboratory director to decide what is good and what is not.

Dr. JACOBS. That is right.

Dr. MIDER. We have one thing going for us. All of our laboratories are in Bethesda and that is where our management capability is. It is very different in some other bureaus which are geographically dispersed.

Mr. DADDARIO. During the course of these discussions the desire was shown on the part of one of the witnesses that we build laboratories side by side. You bring it up again, and I would like to talk about it a little bit. What does it allow you to do?

Dr. MIDER. I like to think I represent the friendly front office, and we hope it is friendly. We have an open door and any laboratory director or any of his people can come in and question us and find out why we made a particular decision and perhaps get it reversed.

The laboratory directors who take responsibility for about 500 or 600 people, as opposed to 2,000 in some of the physical science labs, have a very close meshing with the people at the NIH who are going to make decisions.

Dr. Jacobs and Dr. Eberhart have been scientific directors. We meet twice a month and discuss the problems of the NIH, try to improve the environment, and try to understand each other so that decisions that are made are responsive to the needs of the individual scientists.

Mr. DADDARIO. You are able to do it because you are working closely with each other. You can do it face to face or by phone, and as you begin taking this down strata by strata in your activities, your people have this same opportunity. They are able to get together and talk, and this in turn generates new ideas.

Dr. MIDER. That is right.

Dr. JACOBS. Every week we put out at NIH a calendar of events giving all of the seminars that will be conducted, the meetings, throughout the Institutes. This intermixing of disciplines which occurs because people see interesting items for discussion in a particular field, has led to an enormous interinstitute collaboration, too sponsored and generated by the scientists themselves, which helps in creating and maintaining a very stimulating environment for the scientists working there.

Mr. DADDARIO. You showed some enthusiasm about the fact that you are there in that area. Are you indicating that we ought to look at that and perhaps bring some of these laboratories closer together in order to create more efficiency and the better use of the people?

Dr. MIDER. I think there might be some opportunities to do that.

I think it more important, Mr. Chairman, that science should contribute to education and to social goals, and I would hope that we would form closer links with the academic world and for that matter with industry, if it is in the public interest to do so.

In addition to our situation there is an excellent group in Flagstaff, Ariz., part of the Department of Commerce, that works extremely well.

There is another one in Boulder, Colo., part of the Bureau of Standards that works with the University of Colorado.

We have several offsite groups. We have a laboratory at Hamilton, Mont. It was formed in the early twenties. The Public Health Service took over an establishment and program that had been mounted by the State of Montana to make the Bitter Root Valley safe to live in. This is pretty good land and they had a disease known as Rocky Mountain spotted fever. The offending organism turned out to be a rickettsia which was found to be carried by ticks and within 10 years after the Public Health Service took over this Laboratory a vaccine to immunize people against the disease was made which with refinement is still in use today among the people who work in areas where they are particularly likely to be bitten by ticks.

Rickettsial disease is not an important problem in our area today. It is important, however, to your global commitment whether economic or social and we have what is probably the most complete collection of ticks in the world and we are still adding ticks to that. But that is no longer the focus of the laboratory. The laboratory is studying disease transmissible from animals to man. We have a scientist at Hamilton who is probably doing some of the best work in tuberculosis. Fortunately, we have a facility in which we can handle new problems. We are studying diseases which take years to manifest themselves, and instead of having conventional laboratory rodents we need larger domestic animals such as goats. The laboratory at Rocky Mountain is still concerned with diseases transmissible from animals to man, but it is taking on a new complexion to meet new needs.

On the other hand, it causes us some problems. One problem now is how to engage the group at Hamilton with some of the more complex modern techniques which they need to incorporate into their studies, but we will do it.

Mr. DADDARIO. You touch again on the fact that science cannot solve all of the problems and that there needs to be the involvement of social scientists and political scientists.

You represent your Department on the Federal Council's Laboratory Committee?

Dr. MIDER. Yes, sir.

Mr. DADDARIO. One of your major concerns is that Federal laboratories have a university nearby. How does this work out? What are we doing, or what ought we do to improve this relationship so that we can formulate better mechanisms to solve our problems?

Dr. MIDER. There is no easy answer to that. I think that the best way is to improve the quality of the science conducted in the Federal laboratories to the extent that Federal scientists earn the respect of their colleagues in academic and other environments.

There are other ways. There are certain complicated devices or pieces of equipment that exist in Federal laboratories that are not necessarily found elsewhere. This is not true in our field. I think the National Institutes of Health has been instrumental in increasing the capability of the medical schools and graduate schools and the university system. I wouldn't have it any other way, but our job is to continue to earn the respect of the scientific community and the support of the Congress which has been so generous through the years. The hallmark of our success is how well our people are accepted in professional societies, how they participate, how many of them become officers, how many of them and which ones are eagerly sought out to give seminars or lectures away from our own organization.

In short, what their impact is on the moving frontiers of science, how we cope with this, that, or the other disease, hopefully preventing it rather than treating it.

Mr. DADDARIO. Do any of you other gentlemen have any comment on this point?

Dr. JACOBS. I think that is pretty well covered.

Mr. DADDARIO. Dr. Mider, getting back again to your work on the Federal council, what recommendations would you make to this subcommittee as a result of your activity? We are looking at the national

laboratories and their ability to focus to other national goals and objectives. Should we consider rating these laboratories as to quality and as to the capability to meet new demands? Should we give them greater authority in certain areas, and if we do that, what would happen to the other laboratories which would not be allowed these opportunities? Would it stimulate them or affect their morale to the point where they would not be as effective?

Dr. MIDER. I think I know something about NIH and some other laboratories in the Public Health Service. Through my work on the standing committee, I have learned that there are different problems in different laboratories just as there are different problems in different areas of science.

I really think that any laboratory director or any agency director who cannot justify the studies and direction of research that is going on in his R. & D. establishment is in trouble. I think that a good flow of bright young minds which will only be attracted if you have mature scientists who are respected by their peers is essential in every scientific R. & D. establishment whether it be Federal or industrial. I don't have any easy answers. I think that there are some things that we can do that will be forthcoming in a report to be presented shortly. One thing that is important is that the career people become better acquainted with the people representing the office of the Secretary. I think that Dr. Jacobs' presence in that office is very helpful not only to the Secretary and his staff, but to us.

Mr. DADDARIO. When you say that, you are referring, I expect, to some of the problems a laboratory director has. If we can somehow make that job easier and if he can create a better understanding of the work he wants to do, we can improve the quality of the Laboratory.

Dr. MIDER. That will come about by the people who run the Department.

Mr. DADDARIO. Yes.

We have gone beyond our hour, but we appreciate your staying with us.

We will have other questions which we will submit to you, and we hope that you will cooperate in answering them for us.

Dr. JACOBS. We would be happy to.

Mr. DADDARIO. We appreciate your being here. It has been a good morning for the subcommittee and we have learned a great deal.

QUESTIONS SUBMITTED TO DR. LEON JACOBS BY THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND DEVELOPMENT

Question 1. In your prepared statement you mentioned examples of DHEW laboratories performing health-related work for other Federal agencies and gave some examples. Could you provide additional information about the following:

- (a) *Who funded the work?*
- (b) *What was the role of the laboratory director in making the arrangements?*
- (c) *What kind of arrangement was used?*
- (d) *Did personnel ceilings cause any problem?*

Answer. The following applies for each of the examples cited in the testimony:

(a) The work conducted for other agencies was funded in each case by the other agency.

(b) The laboratory director was, in most cases, the one who observed the opportunity and made the work plan arrangements with the other agency. However, in other situations, such as the long-term working arrangements with the Atomic Energy Commission for radiation surveillance and assessment functions, needs were determined at higher management levels based upon the best utilization of agency capabilities to provide adequate public protection.

(c) The mechanism of providing support was an interagency transfer of funds.

(d) Personnel ceilings severely limit the capability to enter into any such arrangements other than those requiring very few positions.

Question 2. In your prepared statement you said there is a constant search for organizations with competence to conduct specific research. Who is responsible for this search? How is it carried on? How does it involve Federal laboratories?

Answer. The responsibility for locating organizations with competence to carry on specific research, whether other Government agencies, or private organizations, rests in part with DHEW laboratory directors and in part with contracting and management personnel. The process consists both of using informal relationships and lines of communication and of following established, formal methods. Responsible program officials are expected to make themselves familiar with all potential resources available for the conduct of program activities. In many cases, formal advertisement procedures are used in soliciting proposals for research contracts from non-Federal organizations.

At the National Institutes of Health, for instance, responsibility for the search for organizations with competence to conduct specific research is shared between the sponsoring program and the NIH Contracting Officer, who is located in the Office of Administrative Management. Under the NIH system, the program areas maintain their own bidders mailing lists and they are responsible for soliciting contract proposals. Augmenting that, the Supply Management Branch (SMB) advertises the requirement in the U.S. Commerce Business Daily. Proposals are received by program, evaluated, and considered by a program review group and by a policy review group within the individual Institute or Division. The proposal to be accepted is then submitted to SMB with a contract request and justification for the selected source. This judgment and the adequacy of the solicitation is subject to the Contracting Officer's review and approval. When the most acceptable proposal is determined by program and when it is the first time a contract is contemplated with the source, program managers quite often will send their Project Officer on a site visit in order to determine adequacy of facilities, competency, etc.

At the Cancer Institute, for example, a roster of organizations with capabilities in biomedical research was initiated during the latter part of 1963. Questionnaires designed to gather information with respect to a company's personnel, facilities, experience and general areas of interest were sent to organizations. Names of organizations to which the questionnaires were sent were obtained in a variety of ways. Some of the organizations were known to the scientists at the National Institutes of Health; the names of others were obtained from other agencies where they had contracts in biomedical research. Still others were obtained by publicizing the establishment of the roster in the Commerce Business Daily and inviting interested organizations to request questionnaires. Since establishment, the roster has been kept up-dated.

As to the involvement of Federal laboratories in the search for competent organizations, DHEW laboratory directors, with the help of their senior scientists, can generally keep abreast of the scientific activities or competences available within other Federal programs. In the search for other agencies to conduct activities for programs in air pollution control, for instance, it was natural for the Air Pollution Control Administration to establish relations with the Bureau of Mines of the Department of the Interior. We rely on the usual methods of scientific communication to identify areas of mutual interest between laboratories. Similarly, we have no formal method of advertising research and development activities to universities, although we did, when I was Scientific Director of the Division of Biologics Standards, initiate an attempt to establish a liaison with representatives of the National Association of College and University Business Officers to apprise academic institutions of our contract needs. The usual method of contracting with universities is to identify competent individuals in them and to invite them to submit proposals.

Question 3. In the House floor debate on H.R. 10790, the electronic products radiation control bill, Mr. Price emphasized his desire that the Department of Health, Education, and Welfare in using the research authority provided in that bill make full use of AEC laboratories working in biological effects of radiation. What specific internal DHEW policies would apply to this situation? When were these established? Please furnish copies of any documents which may be applicable.

(a) Assuming this legislation is enacted, what criteria will DHEW use to decide whether to use existing AEC capabilities as an alternative to establishing new and duplicate capabilities at public expense?

Answer. To carry out research responsibilities specified in H.R. 10790, DHEW would search out potential resources within the Department, in other Federal agencies and also in private organizations and industry. The guiding criteria regarding the utilization of AEC's facilities, or any other facilities, would be capability and availability to carry out the specific research activities to be undertaken. The Department of Health, Education, and Welfare would prefer not to develop new facilities and new research teams if appropriate facilities and personnel are available to do the work in other Federal agencies, or private enterprise.

Question 4. The Atomic Energy Commission has mentioned its efforts to bring the capabilities of its laboratories in pollution research to potential user agencies and the drafting of specific proposals for related research. What proposals has DHEW received from AEC for pollution-related research in AEC laboratories? When were these received? What is the present status of these proposals? What are their prospects? What difficulties, if any, have you encountered in dealing with these proposals and with the AEC?

Answer. Exchange of information on needs and capabilities and discussion of proposals has taken place on a number of occasions between representatives of AEC and its contractors and officials of various organizations of DHEW.

The Deputy Director and other officials of the former Bureau of Disease Prevention and Environmental Control (BDPEC) have participated in a series of meetings with the Atomic Energy Commission to explore capabilities and joint interests. Representatives of AEC have made information available on facilities and capabilities and such information has been disseminated to appropriate persons for their consideration. DHEW and AEC have recently initiated a jointly funded study with the Argonne National Laboratories. This study will provide information essential to air pollution control activities.

Proposals involving pollution research have been received and prosecuted within the context of the National Cancer Institute's collaborative research program with the Atomic Energy Commission at the Oak Ridge National Laboratory in Oak Ridge, Tennessee. This program was initiated in January 1963 to investigate the roles of radiation, viruses, and chemicals as causes of cancer. The initial funding provided for the establishment of facilities that would permit inhalation studies using experimental animals. Subsequent to the availability of facilities, the Fiscal Year 1965 proposal for the collaborative program included inhalation studies on co-carcinogenesis to "Investigate the Role of Air Pollutants, Radiation, and Viruses in Various Combinations in the Induction of Lung Tumors in Mice."

This study has been continued and expanded each fiscal year since its inception. The NCI has not received any other proposals from AEC for "Pollution-Related Research in AEC Laboratories."

The recent status of this activity was as follows:

"In the past year two additional inhalation chambers have been installed, calibrated and are now in use. A more toxic chromium compound that is 60 times more soluble than Cr_2O_3 -calcium chromate dust is being dispensed in these chambers to mice that have been pretreated with various combinations of radiation and virus infection. With these additions the total number of C57B1/6 mice in the experiments has risen to 7,547. At this time 645 have been sacrificed for initial or terminal examination and 2,329 have been found dead. The gasoline smog and chromic oxide dusted animals have had from 2,200 to 3,000 exposure hours while the calcium chromate dusted animals have had 900 to 1,000 exposure hours. Periodic routine examination has revealed that all animals have remained free from the nine murine viruses that can be determined as well as endo and ecto parasites and specific mouse pathogens such as *Pseudomonas* and *Salmonella*. These factors have contributed to lengthening the life span of the mice considerably beyond that reported for previous smog experiments. Thus the median death time for these SPF mice in the chambers will be over 20 months regardless of treatment with the controls perhaps as high as 26-28 months. This longer lifespan should materially enhance the chance for tumor induction and some evidence is developing along these lines. When all groups are compared at an equal age of 16 months, the mortality for mice living on wire is greater than for those living in pans. This is definitely reflected in the increased incidence of urogenital disease in the males and hair loss in the

females. Radiation and virus pretreatment clearly results in an accelerated mortality in the males when compared at 16 or 19 months of age. Some lung tumors have been observed, all of them being typical pulmonary adenomas and adenocarcinomas, the highest incidence so far being in the gasoline smog groups. The other most frequently observed pathologic lesions are leukemias, polyarteritis, glomerulosclerosis, ovarian tumors and hepatomas."

Because of the increased longevity of the SPF mice, the coming fiscal year will be the critical year in the inhalation experiment, as the animals will have been exposed 2-3 years to the atmospheric pollutants. A few of the inhalation chambers will become empty in this period and additional experiments will be programmed for them based on an analysis of the experimental data obtained. The NCI considers this portion of the collaborative program to be a long-term activity, and continued use of the facilities is planned.

Relationships between the NCI and AEC have been most satisfactory from every point of view, and there have been no significant problems in the total program or the aspect of it dealing with inhalation carcinogenesis.

Question 5. Some years ago the AEC transferred to the Public Health Service its former Minerals Beneficiation Laboratory in Winchester, Mass. The transfer occurred after AEC had shut down the laboratory, dismissed its staff and disposed of movable equipment. Since then PHS has restaffed and reequipped this laboratory to form its Northwestern Radiological Health Laboratory.

To what extent would it have been desirable to transfer the laboratory as a going concern with staff and equipment? If timing did not permit transfer of personnel, did PHS have an opportunity to review the equipment and reserve those items needed for its new function? What discussions were there between AEC and PHS about the fate of this laboratory before it was closed down?

Answer. Radiological health personnel of DHEW were made aware of the intention of the AEC to close down its laboratory in Winchester, Massachusetts, a short time before the laboratory was actually closed. This occurred fortuitously in connection with reporting of activities of the two agencies in an OST meeting. Upon hearing of the potential availability of this laboratory, negotiations were started with GSA for the transfer of the facility to DHEW. A significant part of the AEC staff was alerted to the probability of transferring the facility and many were offered positions with DHEW. Somewhat more than 20 people responded to these offers and were transferred. Most of them were technicians; a few were professionals. DHEW did not have an opportunity to determine what equipment would be useful in its program since AEC had apparently made a determination to distribute all movable equipment to other AEC facilities. However, hoods, benches and other fixed equipment were transferred to DHEW along with the facilities. Since the mission of the Winchester Laboratory under the Atomic Energy Commission's operations was considerably different from the mission of the DHEW operation, we doubt that it would have been particularly desirable to transfer the laboratory with the major part of its personnel and equipment. The professional personnel under AEC operation were involved primarily in a research mission, while the DHEW mission was essentially surveillance. These missions require significantly different staffing, especially the professional personnel.

Question 6. Dr. Weinberg has testified before this Subcommittee about arrangements between NIH and Oak Ridge for ultra-centrifuge development at Oak Ridge. How has this arrangement worked out from your standpoint? In particular, in what ways do the arrangements resemble and differ from those for contracting for industrial research?

Answer. The National Institute for Allergy and Infectious Diseases and the National Cancer Institute have participated in joint centrifuge development studies with the Oak Ridge National Laboratory for a number of years.

NIAD. For several years, the NIAD, jointly with the NCI and the National Institute of General Medical Sciences, has participated in a development program with the Oak Ridge National Laboratory (ORNL) of the AEC for the development and testing of a number of experimental centrifuge systems. This development was an outgrowth of the AEC "Plowshare Program" which is designed to apply nuclear technology for peaceful purposes. This Institute's interest in this program came as an extension of its Vaccine Development Program as continuous-flow ultracentrifuge systems were needed to speed the development of new virus vaccines and to aid in the improvement of the existing virus vaccines. We continue to have a strong interest in the development of these systems, not only for improvement of virus vaccines but also for the isolation and purification of

transplantation antigens. The Oak Ridge National Laboratory is also actively engaged in utilizing various separation systems for the production of macroglobulins and also in the development of improved viral diagnostic methods for the National Communicable Disease Center.

One of the centrifuge systems developed by the Oak Ridge National Laboratory's Molecular Anatomy Program is the K-II series rotor which is useful in the purification of vaccines since it can handle large quantities of material (up to 50 liters). Eli Lilly and Company, which is one of several companies participating in the testing and evaluation of these new centrifuge systems, aided in the testing of the K-II series rotor using egg-grown influenza vaccine as a model. By using the K-II series rotor system, ORNL and Lilly scientists were able to remove much of the extraneous protein material from the vaccine which resulted in an improved product that is highly purified and concentrated. Although there was no collaboration on the part of NIAID scientists on this particular vaccine development program, NIAID support to ORNL for centrifuge development studies for the past five years certainly materially aided in this advance.

This arrangement with ORNL has worked out very satisfactorily from the standpoint of NIAID. At the time this work was initiated, ORNL had the best capability for work on the zonal ultracentrifuge and NIAID was able to aid in supporting the development and to accomplish its own objectives sooner than by using any industrial group. At the present time, the Institute obtains, for its own use, experimental centrifuge systems which are not yet commercially available in order to solve special problems. NIAID scientists aid in the evaluation of these various systems and in so doing shorten the time period needed to make these special systems available to the general scientific community.

NCI. The interagency agreement with the AEC to support research under the direction of Dr. Norman Anderson at Oak Ridge has been highly satisfactory from the point of view of the NCI. Initially this activity was concerned principally with the development of advanced zonal ultracentrifuge equipment, and more recently has been expanded to include the applications of this equipment to the isolation and differential characterization of components between normal and cancer cells particularly in mammalian cells affected by oncogenic (cancer-producing) viruses. Progress during the last year has included the production of three new and four modified centrifuge rotors, all designed for specific cellular or virus separation problems, and the development of specialized preparative electrophoresis equipment for separating cancer virus induced antigens from hamster cells. The progress has been substantial because of the unusual combination of engineering and scientific skills available at Oak Ridge.

The relationship with Oak Ridge is both similar to and different from the relationship between NCI and other industrial and educational contractors. It is similar in the sense that each year the work is reviewed through periodic progress reports, and once each year a proposal is submitted for work planned the following year. This proposal is reviewed formally in the context of progress made during the previous year. The review procedures are essentially the same as those applicable to any other NCI contractor. There is also a close working relationship between the NCI Project Officer, Dr. Charles Boone, and the Principal Investigator at Oak Ridge, Dr. Norman Anderson. The agreement is basically a cost-reimbursement agreement.

The arrangement is different in the mechanical funding and billing process and its initiation. Instead of a contract negotiated by NIH contracting officer and a representative of an industrial concern, there is an interagency agreement between the AEC and NCI; AEC then authorizes its contractor, Union Carbide Nuclear Corporation to proceed with the work within its contract with AEC concerned with the operation of the Oak Ridge facility. Detailed invoices and billings are provided to AEC which has audit responsibilities. NCI is billed on a quarterly lump-sum basis through a "1080" transfer of funds between appropriations.

The NCI maintains a close working relationship with Oak Ridge on progress of the work. The NCI Project Officer and the Principal Investigator at Oak Ridge are in frequent contact. Progress reports are reviewed in much the same manner as work of direct contractors.

The business arrangements are quite satisfactory, and NCI benefits from existing mechanisms used by AEC in providing supervision of its total contract. These include on-site management, voucher audit payment, continuous internal audit, etc. The NCI determines the level of funding and work to be performed. If AEC agrees, it amends its task requirements and budget under its overall

contract covering Oak Ridge operations with Union Carbide Nuclear Corporation.

Question 7. How does the office of the NIH's Director of Laboratories and Clinics compare in purpose with the Assistant Director for Laboratory Management in DOD's Office of Defense Development, Research and Engineering?

Answer. The purposes of the office of NIH's Director of Laboratories and Clinics and the Assistant Director of Defense Research and Engineering for Laboratory Management in DOD are virtually identical. Each is concerned with policy issues relating to personnel, organization and finance. Each is trying to make the environment attractive so that it may recruit and retain the best people to subserve the research and development interests of the agency.

The DOD operation, as understood by us, is not concerned with day to day problems but rather with the overall Departmental laboratory program and where the emphasis should be in the next 5 years or so. It concerns itself with the problems and interests of the laboratory directors at some 90 different installations spread throughout the United States which employ a work force including some 25,000 professionals. The Army, Navy, and Air Force are concerned with day to day activities; DOD deals with problems of general or common concern.

Within NIH, similar interests and responsibilities are located in the Office of the Director of Laboratories and Clinics, but there is one important difference. The laboratory directors of the several Institutes, Scientific Directors in NIH parlance, and the Director of Laboratories and Clinics are all located on the same 300 acres in Bethesda, Maryland. Contacts between the Director of Laboratories and Clinics and the Scientific Directors are almost continuous—face to face meetings for informal advice; formal meetings twice a month at which problems of general importance to the several Institutes are discussed; and annual formal program reviews and budget formulations. In addition, the Director of Laboratories and Clinics serves as principal adviser on scientific issues to the Director, NIH. The NIH arrangement is thus fortunate in being able to provide for intimate, continuous scrutiny of this research and development establishment.

Question 8. Do all of the directors of HEW's in-house laboratories have discretionary funds or its equivalent?

(a) *What is the average amount as a percentage of the laboratory's budget?*

(b) *If all of the directors do not have such funds, what criteria are there to determine who gets it and who does not?*

(c) *What criteria are used to evaluate the work performed with such funds?*

Answer. Separate "discretionary funds" are not available as such to DHEW laboratory directors. There are, however, procedures of varying formality to permit managers of research programs some flexibility to meet unanticipated needs and take advantage of opportunities of special value. Within the separate appropriations and budget items, of course, a reasonable amount of flexibility rests with the program manager in selecting and shaping projects. If a new project represents a sufficiently significant departure, formal reprogramming of funds may be called for and may require authorization at several administrative levels above the program manager, and eventually from Congressional Committees.

In this context it would not be very useful for us to try to quantify this element of flexibility as a percentage of budget, though some description and examples from the experience of the NIH will provide insight into its magnitude and usefulness.

It is important to recognize that the various Institutes have their own annual appropriations which they defend before the subcommittees of the appropriations committees in both houses of Congress. The Director of each Institute and Division is responsible for the entire program, and the laboratory director, who in NIH terminology is referred to as the Scientific Director, or some other Associate Director acts on delegated authority from the Institute Director. He is, however, responsible to the Institute Director and to the Director of Laboratories and Clinics, NIH, for the conduct of research carried out by Federal scientists in Federal installations.

The Director, NIH, reserves a fraction of the Institute's budget as a Director's Reserve. This has been as high as 2 percent and as little as one-quarter of one percent of the total direct operations money. In fiscal year 1963 this was an aggregate of \$384,000—in essence a contingency fund. It is the intent of the Director, NIH, that the money be spent for the budget category from which it was reserved, and indeed this is usually the case. It gives an opportunity for an Institute Director to request release of reserves for a number of purposes, among

which is the acquisition of new or highly specialized equipment and the development of a new area of scientific inquiry.

At the Institute level the expenditure of funds is handled in various ways. Direct research is a line item in most Institute budgets, as is collaborative research (epidemiology, biometry, and research done by contract); expenditures are limited to the particular items, and funds may not be diverted without the consent of DHEW, BoB, and the appropriations subcommittees of the Congress. In some Institutes the Executive Officer, who is responsible for the business operations of the organization, exercises budgetary control for the Scientific Director or his equivalent, but in each case an expenditure plan is developed for each fiscal year. In general, it is not wise to commit the total budget to on-going activities, so the reserve is deliberately created. This varies from Institute to Institute.

One Scientific Director, for example, with a budget of approximately \$5 million, reimburses the NIH for various services such as heat, light, ventilation, procurement of expendable and non-expendable supplies including animals and for various administrative services provided through the NIH management fund. The balance of the budget, expended under Institute control, is divided into personal services and other accounts, and various allocations are made. The Scientific Director also requires an unencumbered account of \$250,000 at the beginning of the fiscal year. This is in part a contingency fund, but in part a control device, because the scientific staff is not expected to buy equipment for their projects that costs more than \$5,000 or to pay for the renovation of existing space. In addition, this particular Institute can expect an annual lapse of 7 percent from its accounts, due primarily to unanticipatable movement of personnel in and out of the organization. This in effect produces an adequate reserve responsive to the changing scene in the laboratories. In addition, the laboratory chiefs, as distinguished from the Scientific Director, build into their budgets such small amounts as \$500 to \$1,000 to allow them to capitalize on unanticipated opportunities as they emerge, without reference to the Scientific Director.

Since this method of budgeting can result in the accumulation of small balances in a number of organizational segments which in the aggregate can be substantial, not only are the laboratory chiefs required to keep an up-to-date record of their obligations, but a quarterly review of each account is made by the office of the Scientific Director and such adjustments are made among allocations to the laboratories as seem desirable.

It should be emphasized that biomedical research today still comes under the heading of "little science," is characterized by a high degree of individual initiative and enterprise, and requires relatively small amounts of money for individual projects. The birth of a new idea that is recognizable to the local scientific community as a new departure in research usually stimulates people with appropriate capabilities to re-think their own objectives. The new departure may require different types of instruments or different starting materials but usually does not demand a sudden increase in the work force. Thus, the availability of small reserves of funds may be highly important.

Criteria used to evaluate the work performed with reserved or contingency funds are the same as those used to evaluate the scientist's other work. Probably these funds yield a greater return in a shorter time because their commitment evidences a priority call upon resources to respond to a need or an opportunity.

Question 9. Several agencies have set up procedures to appraise the performance of contractors that do research and development for them, or that manage agency laboratories. What procedures does HEW use, and what consideration has been given to applying the standards and procedures of these appraisal processes to HEW operated laboratories? To what extent would this be desirable?

Answer. The appraisal of a contractor's capability and performance begins at the time a research project is initiated. After the idea for the project is approved by the scientific directors of the program, the work scope is publicized in the Commerce Business Daily to obtain competition. When a determination is made that an educational institution is best qualified to carry out the project, publicizing in the Commerce Business Daily is not required. When the complexity of the project warrants, contractor briefings are held to assure understanding of the character and objectives of the research involved. Proposals from contractors are reviewed by an ad hoc committee composed of a group of scientists expert in the field of research involved and selection is made of the best qualified contractor. The committee's review may include site visits to inspect the contractors' facilities. The ad hoc committee's actions are reviewed by regularly established contract review committees to evaluate not only the choice of contractor but also the scientific merit of the project. Before the contract is nego-

tiated, auditors from the Financial Management Branch will visit the contractor to determine the adequacy of his accounting system and his financial stability. The importance of a careful and judicious selection of a contractor to the successful completion of a contract cannot be overemphasized.

Once a contract is awarded a Project Officer is designated. He has prime responsibility for the professional and technical aspects of the contract and for a continuing evaluation of the ongoing research in terms of scientific achievement. The manner in which he discharges his responsibility will be dictated by the nature and size of the project. In general, the contract will specify at what time and in what format progress reports will be made. In addition, the Project Officer will have access to the people and facilities involved in the research activity. Reports may range from informal letter reports to formal reports featuring either quantitative or qualitative presentations or both. A Project Officer's contacts with contractor personnel may include telephone conversations, face to face discussions and both informal and formally planned site visits. A formal site visit may be made by a team of scientists with expertise in the field including outside consultants. The scientific monitoring techniques are augmented by the designation of an Assistant Project Officer who is responsible for the fiscal and administrative aspects of the contract. For example, under his direction contract specialists examine reimbursement vouchers, compare them with the approved budget and report to the Project Officer any significant deviations from the projected rate of expenditures. In line with the above, the Project Officer evaluates reports, makes observations through personal contact and thus is in a position to make a valid appraisal of performance under a contract. The appraisals of performance in bio-medical research are of necessity based to a large extent on subjective judgment. Nevertheless, there are instances where objective quality control techniques can be used. For example, compounds with known activity or lack of activity are interjected into a screening contract to test the validity of the contractor's reported results. The Project Officer's findings are completely documented in a Summary Sheet which is reviewed in depth by the regularly established program review committees. His judgment and recommendations carry great weight in a program's determination whether to continue or terminate a specific contract or line of research.

The selection process which we consider to be an integral part of the process involved in appraising a contractor's performance is not, in our opinion, analogous to the process involved in a decision to conduct an intramural project in our own laboratory. The monitoring of an ongoing intramural project and the appraisal of its effectiveness involve relationships that are very different. Evaluation of in-house research and development activities is primarily the responsibility of the program manager and his superiors in his organization. The individual investigator or group of investigators working on a program or project make periodic reports to their supervisors, and summary annual reports. The work can be judged by appraisal of its scientific quality and the productivity of investigators must be judged on the basis of the difficulty of the problem as well as on the production of papers. Contact between the intramural personnel, laboratory chiefs, and the Scientific Director is more intimate, regular, and of longer duration than with extramural contractors. Any attempt to use, in the intramural situation, the procedures employed in appraising a contractor's performance would entail serious hazards. Perhaps the most important of these would be the possibility of disrupting the environment of personal and working relationships which permits good scientific work and attracts good scientists.

Question 10.—The DOD witness proposed the elimination of manpower controls on cross-agency work in order to achieve flexibility similar to that available to the AEC contract laboratories. What is your opinion of this proposal?

Answer.—Relief from manpower controls would improve the ability of D/HEW laboratories to take on tasks for other agencies on a reimbursable basis or through a transfer of funds. Presumably, such a relaxation of manpower controls would also permit other agencies to respond more easily to requests of this Department. The benefit would depend, in the case of each project, on the extent to which the laboratory's resources other than personnel were already employed in supporting the primary mission of the laboratory's program.

Question 11.—What authority do your laboratory directors have to deal directly with other agencies that may wish to engage their research and development services?

Answer.—Laboratory directors have considerable freedom to deal directly with other agencies which may request them to undertake research and development

projects. In many cases, as a practical matter, the laboratory director himself makes the decision as to whether to perform the work. For major projects involving a substantial portion of a laboratory's resources, however, he would secure at least the formal approval of the Institute Director, Bureau Director, or other higher level administrative officer. Any major commitment, of course, entails a judgment regarding overall plans for a laboratory and program priorities affecting the laboratory. Such a judgment deserves the personal attention of the laboratory director's superiors, perhaps even the head of the agency or the Department.

Thus, the administrative level to which a decision to commit the resources of the laboratory might be referred would depend upon all the circumstances of the particular request, the size of the project to be undertaken, other demands on the resources of the laboratory, the overall requirements of the program of which the laboratory is a part, the length of time the commitment would last and a host of other factors. In any event, the recommendation of the laboratory director would carry great weight.

Mr. DADDARIO. This subcommittee will stand adjourned until tomorrow morning at 10 o'clock in this same place.

(Whereupon, at 12:30 p.m., the subcommittee was adjourned to reconvene at 10 a.m., Wednesday, April 3, 1968.)

UTILIZATION OF FEDERAL LABORATORIES

WEDNESDAY, APRIL 3, 1968

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
SUBCOMMITTEE ON SCIENCE, RESEARCH, AND DEVELOPMENT,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10 a.m., in room 2325, Rayburn House Office Building, Hon. Edward J. Roush presiding.

Mr. ROUSH. This meeting will be in order.

Today we continue our hearings on the utilization of Government laboratories.

Mr. Daddario is out of town this morning, and he has asked me to convey to you his apologies that he is unable to be here.

Our first witness is Commissioner Gerald F. Tape, of the Atomic Energy Commission.

The Atomic Energy Commission has been a pioneer of research in the physical and life sciences, and in the management of large multi-disciplinary laboratories such as Oak Ridge, Brookhaven, and Argonne. In its 1960 report, the Commission anticipated some of our interest in the use of Federal laboratories by saying:

... the Commission recognizes that the strong capabilities of the laboratories are not the exclusive resources of the atomic energy field; they are held in trust for the Nation as a whole. Urgent work for other Federal agencies on matters of national concern will be accommodated in the laboratories when their skills are needed. There is no intention of making the laboratories into "job shops", but the laboratories and the Commission will continue to recognize national needs that call for out-of-the-ordinary arrangements, effort and ability.

One such out-of-the-ordinary effort is illustrated by new authority given to the Commission last year in Public Law 90-190. In this law, Congress authorized the AEC to use its laboratories for health and safety matters not related to atomic energy, and it would appear that the policies and plans the AEC has prepared to carry out this new authority are directly pertinent to our interest in these hearings.

Our second witness today is Frank W. Lehan, Assistant Secretary for Research and Development, Department of Transportation. Earlier this year I had the opportunity to hear Mr. Lehan when he appeared before the Subcommittee on Advanced Research and Technology during the NASA authorization hearings, and we are pleased to have him back again.

Our final witness today is Dr. Thomas F. Rogers, Director of the Office of Urban Technology and Research, Department of Housing and Urban Development. In his testimony yesterday, Dr. MacArthur, of the Department of Defense, complimented Dr. Rogers' work while with the Department and said that he has brought to his new position

a great deal of technology and methodology which will be directly applicable to the technical solution of urban development problems.

We welcome you before the subcommittee, Dr. Rogers, and hope you will share with us how you expect HUD's program to develop.

We are prepared to receive your testimony, Commissioner.

(The biographies of Drs. Tape and English follow:)

DR. GERALD FREDERICK TAPE

Dr. Gerald F. Tape was born in Ann Arbor, Michigan on May 29, 1915. After receiving his A.B. degree at Eastern Michigan University in 1935, he entered the University of Michigan, where he received his M.S. degree in physics in 1936 and his Ph.D. in 1940.

In 1939, Dr. Tape was appointed instructor in physics at Cornell University, where he was associated with the cyclotron research group. From 1942 to 1946 he was on the staff of the World War II Radiation Laboratory, Massachusetts Institute of Technology, where he worked on the development of airborne radar, radar relay, and training equipment for radar operators. During 1944 and 1945, he directed the airborne radar work of the MIT Radiation Laboratory in Europe, operating primarily with the U.S. Eighth Air Force from laboratory headquarters in Malvern, England. In 1946, he became a member of the University of Illinois staff, serving first as assistant professor and later as associate professor of physics. He was in charge of the administration and teaching of engineering physics courses and also continued his work in nuclear physics and cyclotron development.

Dr. Tape became associated with Brookhaven National Laboratory, Upton, Long Island, N.Y., in 1950. He served as Deputy Director from October 1951 to May 1962, during which time he was involved in all scientific, technical and administrative aspects of the laboratory's program. In January 1962, he was appointed Vice President and in October 1962 President of Associated Universities, Inc., the corporation which operates the Brookhaven National Laboratory for the Atomic Energy Commission and the National Radio Astronomy Observatory for the National Science Foundation.

Dr. Tape, appointed to the Atomic Energy Commission by President Kennedy, took office on July 15, 1963; his term of office expired on June 30, 1966. Dr. Tape was reappointed by President Johnson for a term expiring on June 30, 1971.

DR. SPOFFORD G. ENGLISH

United States Atomic Energy Commission, Washington, D.C. Chemistry. Mt. Pleasant, Tenn., Nov. 16, 1915; m; c.3. B.S., Oklahoma, 38, M.S., 40; Ph. D. (Chem.) California, 43. Chemist, Okla. Geol. Surv., 36-40; Asst. Chem., Univ. of California, 40-42, Res. Assoc., Metal. Lab., Univ. Chicago, 42-43; Sect. Chief, Chem. Div., Clinton Labs, Oak Ridge, 43-46; Asst. Prof. Chem., Univ. of California, 46-47; Chief, Chem. Br., Div. Res., U.S. Atomic Energy Comm., 47-60; *Dep. Dir., Div. Res., USAEC, 60-61; *Spec. Asst. to Gen. Mgr. for Disarmament, USAEC, 59-61; (*Dual Capacity); *Asst. Gen. Mgr. for Res. & Dev., USAEC, 61-*; Member, U.S. Delegation to UN Disarmament Conference—London—1955; Member, U.S. Delegation to UN for drafting of Statute of International Atomic Energy Agency, N.Y.—1956; Member, U.S. Delegation to International Conference on Cessation of Weapons Tests, Geneva—1959; Outstanding Service Award, USAEC, 1956; Sigma Xi; Phi Beta Kappa; physical Chemistry; nuclear chemistry; chemical kinetics; research and development of radiation detection instruments; administration of research.

STATEMENT OF DR. GERALD F. TAPE, COMMISSIONER, U.S. ATOMIC ENERGY COMMISSION; ACCOMPANIED BY DR. SPOFFORD G. ENGLISH, ASSISTANT GENERAL MANAGER FOR RESEARCH AND DEVELOPMENT

Dr. TAPE. Thank you very much.

The Atomic Energy Commission appreciates this opportunity to appear before you and discuss with you some of these problems of con-

cern to both the executive and the legislative branch concerning the effective utilization of the Federal laboratories.

Dr. English, who is our Assistant General Manager for Research and Development, is accompanying me here today.

The Federal laboratories are an asset which I believe can be employed more effectively than at present to meet national technological objectives. Their effectiveness can be improved by recognizing, in our assignment of programs to them, that both special laboratory competence and national technological needs cross the lines of Federal agency missions. To the extent that this is recognized and we are able to improve our ability to pair existing competence with priority requirements on a national rather than an agency basis, we will better our effective use, for national purposes, of the national resource which the Federal laboratories represent.

As we are able to do this, we will be better able to make sound national decisions regarding the creation of new laboratories; the phasing out of laboratories that have completed their assigned programs; and, most importantly, we will be better able to use laboratories for priority national requirements even though they may be currently heavily occupied with agency missions. In addition, when new Federal laboratories are created, careful attention should be given to the value of locating them where they can develop a mutually beneficial association with existing laboratories.

In my remarks, I will focus on AEC laboratories because I am directly acquainted with their programs, management, and problems. I believe much of what I have to say, with special reference to AEC laboratories, may be relevant to Federal laboratories generally; but I want to be cautious because Federal laboratories exhibit very few characteristics common to all and display numerous differences.

While I will use the term "Federal laboratories" to include all AEC research and development laboratories, I would make two distinctions which are directly relevant to the problem at hand. AEC laboratories, in contrast to most Federal laboratories, are, with the exception of two small laboratories,¹ staffed by non-Government scientists and operated for AEC by private contractors.

Some AEC laboratories, such as the Stanford Linear Accelerator Center, which is operated by Stanford University and the Knolls Atomic Power Laboratory, which is operated by the General Electric Co. under contract to AEC, have primarily a single program, while others, such as Brookhaven National Laboratory, operated for AEC by Associated Universities, Inc., and Oak Ridge National Laboratory, operated by the Union Carbide Corp., pursue a number of programs—no one of which overwhelmingly dominates the laboratory's activities. The Los Alamos Scientific Laboratory and the Lawrence Radiation Laboratory at Livermore, both operated by the University of California, are designated "weapons laboratories." They are, however, more than weapons laboratories, for they conduct several other programs responsive to AEC's mission, including basic nuclear research, biomedical research, reactor development, controlled thermonuclear research, and peaceful nuclear explosives development. The AEC designates seven of its laboratories as "multiprogram" laboratories, these are, in addition to the four which I have already mentioned,

¹ The Health and Safety Laboratory, New York, N.Y.; and the New Brunswick Laboratory, New Brunswick, N.J.

Ames Laboratory, Argonne National Laboratory, and Lawrence Radiation Laboratory at Berkeley. These seven laboratories report directly to AEC headquarters, while other AEC laboratories report to headquarters through field offices.

One advantage of multiprogram laboratories is that as individual programs are completed or assigned low priority, the laboratory resources may be effectively utilized by redistribution of effort amongst remaining mission-oriented programs. Only if several programs are simultaneously removed, does the question of completion of the laboratory's mission arise in the context of the broad operation of a multiprogram laboratory. Another advantage is that the spectrum of facilities and interdisciplinary talents associated with a number of programs permits a multiprogram laboratory to undertake new programs effectively for the AEC or for other agencies. The completion or cancellation of the program at a single-program laboratory is, of course, far more traumatic and it is difficult to utilize the specialized talents and facilities for a new program.

I believe that the biggest gains in effective use of the Federal laboratories for broad national programs are to be achieved, not by identification of laboratories without missions, but rather through increased use of Federal laboratories with viable programs by agencies other than their sponsoring agency.

In a report on the future of AEC's laboratories made to the Joint Committee on Atomic Energy in 1960, the Commission stated that it would "utilize these (multiprogram) laboratories and their staffs for other urgent tasks or projects of importance to the Nation," and we have done so. Other agencies support work at AEC laboratories at a level which exceeds \$50 million a year. The reverse also occurs. The AEC sponsors work amounting to approximately \$10 million a year at a large number of Federal laboratories sponsored by other agencies.

Our AEC programs are substantially more efficient for being able to draw upon the specialized facilities and talents available at a dozen or more Federal laboratories sponsored by the major Federal departments, and it appears that other agencies benefit similarly through their use of AEC laboratories.

I would emphasize that our experience to date indicates that work for other agencies conducted at AEC laboratories generally works to the benefit of the performance of AEC programs as well as to the benefit of the funding agency. Our laboratories become more diverse in their capabilities and they are able to broaden their technological base. This, of course, permits them to be even more responsive to a variety of technological requirements, whether AEC's or those of another agency.

Programs conducted for other agencies are, overall, only a small part of the activities conducted at AEC's laboratories, but over the past several years these programs have been growing at a rate substantially greater than the rate of increase of federally funded R. & D.

In 1966, Congressman Holifield, then Chairman—now Vice Chairman—of the Joint Committee, discussed with Chairman Seaborg the utilization of the AEC's laboratories in research aimed toward abating pollution. As a result of those conversations, Mr. Holifield wrote, in November of 1966, to the Director of the Bureau of the Budget urging that available resources such as the AEC's "outstanding laboratories" be used in furthering the national effort to abate pollution. Early last

year AEC Chairman Seaborg wrote to the Secretaries of Commerce, Interior, and HEW, expressing our desire to identify facilities and talents at AEC laboratories which might be used in support of pollution control efforts. We have, as a result, had a series of meetings with representatives of these departments and identified a number of areas of direct interest. To date, only two relatively small programs have been initiated as a result of these efforts, but several large programs are being considered and discussed. I feel confident that this effort will result in further utilization of AEC facilities and talents in programs conducted for other agencies at AEC facilities, and vice versa.

In line with a recent broadening, by the Congress, of AEC's authority to conduct work for Federal and non-Federal sponsors, we have recently initiated a similar effort in the broader area of health and safety. Our efforts in this area are not due to an anticipated diminution of AEC support at our laboratories, but rather because we agree with the desirability, as expressed by Congress, of increasing the effective use of national laboratories for broad national purposes.

Again, in your introductory remarks, you did refer to this legislation which was passed last year.

Effective use of Federal laboratories for national purposes in this way is not without problems and difficulties. The cooperating agency's authorities to undertake the work must be considered, the impact of proposed new programs on ongoing laboratory activities must be evaluated, and the performing laboratory must guard against becoming a job shop operation. In all cases the capabilities of other R. & D. performers, including universities and private industry, must be considered. None of these has, in our experience, presented insurmountable difficulties once a special capability at a performing laboratory and the direct interest of a responsible agency have been matched. I judge this matching to be, at present, the dominating difficulty in the extension of the process described above which in my opinion is the most desirable one at hand to achieve effective use of Federal laboratories for broad national purposes.

The director of a laboratory plays a critically important role and flexibility to examine new ideas and pursue them to a reasonable state of development is essential if he is to fulfill his role in insuring effective use of the laboratory whether it be for agency or broader national goals. Flexibility is not easily achieved. Federal R. & D. budget proposals are defended in an atmosphere which requires a strong and explicit statement of aims and objectives to be successful in the competition for funds. It is difficult to justify funds to exploit the bright idea which has not yet happened in the face of programs and objectives of demonstrated merit. This difficulty is encountered at all levels of the budget process—congressional, executive, agency, and laboratory.

A degree of flexibility does exist in the conduct of programs at AEC's multiprogram laboratories and single-program laboratories which pursue physical and biomedical research programs. Unanticipated developments are common in these programs and flexibility to pursue promising ideas is required by the nature of the work. Most frequently, these ideas are within the originator's research area and may be pursued without deviating significantly from broad budget categories. It is a limited flexibility and not an entirely satisfactory solution, for activities cannot be carried out at levels greater than es-

established budget figures, as is sometimes necessary to pursue the idea effectively.

It is, however, a partial solution to a difficult and important problem which bears directly on effective use of Federal laboratories for national goals. Additional flexibility would be desirable and it would be helpful if somehow Federal laboratories could be authorized to spend modest amounts to develop proposals in areas of national concern to submit to appropriate agencies. Such authorization would be made in recognition of the extreme importance of flexibility to the effective conduct of programs responsive to broad national needs.

The question of whether or not new laboratories should be created to respond to new missions or if the job can be handled within existing laboratories is complex. Certainly the contributions of existing laboratories should be considered as part of the determination. If Federal expenditures for R. & D. increase, I think one may reasonably anticipate that something like the present fraction will be utilized at Federal laboratories. In this case, it will be necessary to provide new facilities, either by expansion of present laboratories or by creating new ones. It would seem that the most suitable course will have to be determined on a case-by-case basis. To the extent that effective communications regarding capabilities of existing laboratories and agencies mission requirements exist, it will be easier to judge whether a given task may be carried out more effectively by expansion of activity at an existing facility or at a new laboratory. If a new laboratory is the more effective approach, consideration might be given to locating it at or adjacent to an existing laboratory since scientific exchange and common use of specialized facilities should have important mutual benefit.

Therefore, I repeat what I said earlier. To me, at the present time, the most effective process to foster greater interagency use of Federal laboratories, and, of course, at the same time to enable more informed judgments as to need for new laboratories, is the one of promoting that exchange of information that will pair the capability at a performing laboratory with direct interest of a responsible agency.

Mr. Chairman, that concludes the prepared remarks. We would be most happy to answer questions which you may have and discuss the problem with you further.

Mr. ROUSH. Thank you, Dr. Tape.

Mr. BROWN?

Mr. BROWN. I have no questions at this time.

Mr. ROUSH. Does counsel have questions?

Mr. FELTON. I have, Mr. Roush.

On page 8 of your prepared statement you refer to determining the most suitable course on a case-by-case basis. Who do you see as making this determination; would this be the agency, the Office of Science and Technology, or the Bureau of the Budget?

Dr. TAPE. I would look at this as a combined operation, and I can illustrate by a painful experience which we have had in making such determinations in the past. The question was the future of a particular laboratory when we realized that the program that is was pursuing, you might say, ahead of its time. The mission which it was trying to fulfill was so far down the road it might be they were working in the wrong direction. Should we try to maintain that laboratory at a low

level of work expecting at some future date the needs would develop and then one could come back and pick up at that time the necessary higher level of activity.

Or should one close out the facility realizing that there was plenty of time for a change to be made in the future or a decision to be made in the future to start again.

That necessitated an internal decision in the first place, to try to assess the situation and weigh the merits of each alternative.

We then had discussions with the Bureau of the Budget and with OST. Furthermore we asked ourselves whether or not the particular capabilities of the installation might be useful to other agencies of the Government, not necessarily in the particular line of work that we were following, but related lines perhaps in defense or perhaps in NASA.

We asked other agencies of the Government to investigate the facilities of that laboratory, the work which was going on there, the capabilities of the staff, and after a rather long period of time we all arrived at a decision that transfer to another agency was not appropriate and the laboratory should be closed down as far as the AEC's program was concerned. It was not a unilateral action on the part of the agency. We do involve the various agencies of the Government.

Mr. BROWN. Could I expand on that? Is it possible for you to identify the laboratory and the work?

Dr. TAPE. This was the Canel Laboratory in Connecticut, near Middletown. The work there was development, principally what I would call hardware development of a very advanced space-electric system that could be used in the future in powering electrical propulsion for space vehicles, and so on. We felt that the program which they were pursuing was a good solid technical program. It was an expensive hardware development program, but we were seemingly out of phase, if you will, with the mission as contrasted with our development at the time.

We had much, much more time to develop the hardware than we had anticipated some years earlier. So as a result of this, we decided that the prudent action was to terminate that type of development on the hardware side, and continue research and development in technology which was more appropriate within a national laboratory than it was within the particular contractor-operated facility we had there.

I might add as a note which I think is encouraging, that this facility was ultimately surplused. It was taken over by private industry and it has a very active, going program. As far as I know the community has not suffered and the capabilities and the facilities have been preserved.

Dr. ENGLISH. I might mention as a point of interest that this particular laboratory was originally established in the mid 1950's, to be a major center for the development of nuclear reactors for propelling aircraft. When that program was finally abandoned, it was converted, because space technology at that time was becoming important, to a laboratory for making use of the same facilities and the techniques and equipment for the space electric power program. It had a history of being established for one purpose and being converted to another purpose, but we eventually did have to close it down completely.

Mr. BROWN. Was there an adequate foundation for what they were trying to do?

Dr. TAPE. Yes, I think in terms of the hardware development that they were pursuing at the time we had a reasonably good foundation. What one must recognize here is that the science and technology foundations improve with time. So part of the question facing us was to look at what might be the development of the technology over 5 or 10 years and whether that would influence the hardware that would be developed 10 years from now. In effect, we came to the conclusion that we probably would be better off concentrating on the technology side for a while than we would to pursue more rapidly the hardware development.

Mr. BROWN. Let me ask a question that is in the realm of basic science. I am interested in how you make these determinations and how you develop roles for laboratories and so forth.

We are, I presume, at the early stage of developing the basic scientific foundations in the hydrogen fusion field. There have been some discussions of the proper funding levels, and I think there has been some increases of a fairly substantial nature within the last year or two. Could you explain to me how this process is arrived at? How you allocate resources for this kind of an operation?

Dr. TAPE. The particular program which we are talking about is the so-called controlled thermonuclear reaction program, and it is a program in which some years ago there was extreme optimism as to the possibility of proving it technically feasible. This is a question of a self-sustaining fusion reaction as you said, Mr. Brown.

In more recent years it was recognized that this was indeed a most difficult problem, scientifically and technically; the technical feasibility had to be demonstrated. There was a switch from emphasis on some of the more engineering aspects to a lot more emphasis on the physics or the understanding of the basic science.

In addition to our annual reviews of these programs, periodically we have more major reviews of a given area of interest. About 2 years ago we asked a committee of experts, some of them coming from the field itself, some of them coming from related fields on the side, so that you didn't have just the proponents of the activity, to actually examine the progress which had been made over the last years, to assess the status of the program at that time and to give us recommendations for the prospects for the future and how strongly this country should support such endeavors. There was a complete technical evaluation and assessment. There was also an assessment of what was going on in other countries, what was the extent of their support, and what were their evaluations as to the future for this field of research and development.

On the basis of that report, we then in the Commission did our own review and arrived at our own conclusion that this was indeed a time when we should increase support and set for ourselves certain objectives for the future. We were looking ahead a period of about 5 years; the committee urged that we should double or triple the work in a period of 5 years; the Commission felt that this was a little faster than was necessary under the conditions. The AEC program management has set up its own specialized committees to look at each facet in this series of stepping stones for the future, and as a new major experiment comes along, a special ad hoc committee gives us a complete analysis as to their evaluation of the feasibility and so on.

As a result, some of these proposals of 2 years ago are not being followed through; others are being followed through more vigorously, and the annual budget is set on the basis of these continuing analyses that are being made.

We all believe that the information that has been obtained from CTR research is even more encouraging than it was 2 years ago. This gives us the enthusiasm to take on more of these expensive experiments. That is why you see the budget increasing. These increases are something like 10 to 15 percent. They do not result in a 5-year doubling but they are keeping the program moving effectively. So that is the kind of a procedure through which we have gone to analyze the program and its future.

Mr. BROWN. This field is a very good example of a basic science where the ultimate results or even the rate of progress are actually unknowable in advance, or at least very far in advance. You have to make some educated guesses. However, we have seen some breakthroughs in research, and I guess lasers is a good example. Once the breakthrough is made, the level of funding for applications and for additional basic research seems to skyrocket as the implications become more broadly understood.

Dr. TAPE. This particular program is unusual too in that we know the basic work that has to be attacked. We know what kind of information we need to get. If the results of those lead us down the road to where this is technically feasible, we know what the payoffs are apt to be; they are tremendous. It is somewhat different from other research, where one can't necessarily predict what the application will be. In this one, if we are successful, we know what the application will be. And we know it will be an expensive engineering undertaking to produce a competitive new energy source, but we have that in front of us.

Mr. BROWN. Thank you.

Mr. ROUSH. In March of 1954 President Eisenhower issued Executive Order 10521 which directed in section 8 that:

The head of each agency engaged in scientific research shall, to the extent practicable, encourage and facilitate the sharing with other Federal agencies of major equipment and facilities.

And, secondly:

A Federal agency shall procure new major equipment for facilities for scientific purposes only after taking suitable steps to ascertain that the need cannot be met adequately from existing inventories or facilities of its own or of other agencies * * *.

Is this still our policy?

Dr. TAPE. Certainly, Mr. Chairman, this is a policy that the Commission is following. Let me go back to the reference in my testimony on the so-called work for other people and work that we ask other people to do for us. We recognize that our abilities in certain areas can be extremely useful to others. I think that Dr. MacArthur yesterday may have mentioned transfers between the DOD and the AEC. Although the AEC has the responsibility for weapons R. & D., development and production, the DOD has certain responsibilities on its side. Where the two of us find that one of our AEC laboratories can better carry out certain work for the DOD, even though it is through

DOD funding, we work out the program together. This is an illustration of the sort of thing that you are talking about.

In the same way, we feel that there is various expertise in the other agencies which, although we have some people in our agency and our laboratories and we could staff up to provide that service for ourselves, we are much better off and get better service by working with the others. We do this with Public Health, ESSA, and the Bureau of Mines, among others. We explore with others the facilities and capabilities they have, and we in the same way ask them to talk to us before we embark on one of these programs.

A rather interesting recent example of equipment transfer, which was not large, occurred in Cambridge, Mass. A rather extensive piece of cryogenic equipment which was at the Cambridge electron accelerator at Harvard University was no longer necessary to AEC work there and we made arrangements to move this to MIT where it was used in connection with the university reactor. Moving equipment back and forth can be useful.

Mr. ROUSH. How long have you been a Commissioner of the Atomic Energy Commission?

Dr. TAPE. Since July of 1963.

Mr. ROUSH. Were you with the Federal Government before that?

Dr. TAPE. I was at one of the national laboratories of the Atomic Energy Commission, the Brookhaven National Laboratory. I was there in the capacity of Deputy Director for some 11 years followed by about 2 years as an officer of the corporation, Associated Universities Inc., which holds the contract for operating Brookhaven for the Atomic Energy Commission.

Just before I became Commissioner I was president of Associated Universities Inc. This corporation managed not only Brookhaven, but the National Radio Astronomy Observatory for the National Sciences Foundation, so I had an opportunity to work with two agencies of the Government in a laboratory-Government relationship.

Mr. ROUSH. I asked the question as a preliminary to a question I will ask now.

Do you find that there is a greater or a lesser inclination on the part of the various agencies and agency heads to provide interagency co-operation in the field of research and development today as compared to a few years ago?

Dr. TAPE. I think there is probably greater inclination.

Mr. ROUSH. I worry about the nature of a bureaucracy thwarting this, and the selfishness that usually accompanies a bureaucracy. The Government has grown considerably from the standpoint of the number of agencies and from the standpoint of the work they are doing. I felt perhaps the answer might be otherwise.

Dr. TAPE. The reason I made my statement that way is that at that time the AEC laboratories were essentially working on AEC business only. We all were looking to the AEC and only to the AEC and we were flooding the headquarters with jobs that we wanted to see done. I am speaking from the laboratory side now.

On the other hand, I recall when I was in the laboratory organization that in several segments of the work we had only a few specialists, for example, in meteorology. I think we had two meteorologists on the staff who had played a very vital and necessary role in the laboratory

and were helping us with problems in the area of health and safety. These meteorologists, by virtue of having worked in this multi-program environment were interested in matters of biology, in matters of the physical sciences, and so on. It wasn't long before, as they went to meetings with colleagues and so on, they heard about problems in their field where their expertise could help. It wasn't very long before we had other agencies in the Government, starting with staff to staff discussion, finding out that we at Brookhaven could do things which could assist them. We worked out with the Commission the type of interagency transfer that we have talked about today.

The first one or two of such projects are hard to start. In other words, you have to do a lot to get them started. On the other hand, as more and more of this work is done it becomes more the practice or the pattern. People find that it does work, that one agency can have work in another agency's laboratory and they are able to have direction. They don't have to just turn it over and forget it. It is a little bit of success breeding success. So as these projects have developed successfully, I think there is a greater inclination to do more.

In part, my answer is "Yes," it is a little better these days as based on just that aspect.

I am not unaware of the point that you made and I am not unaware of the fact that anyone likes his own laboratory, to do his own work and not have to have too many bosses. It is human nature.

One of the ways that we in the Commission have tried to overcome some of this in major areas is through joint offices, and, for example, in the space area AEC and NASA have a joint office. Personnel from both agencies manage this program jointly and the program then is effected, parts in NASA laboratories, parts in our laboratories. This is interagency cooperation.

Mr. ROUSH. Mr. Felton.

Mr. FELTON. One way of fostering interagency work would be that the personnel ceilings which exist in Government-operated laboratories do not apply to interagency work. In view of what you just said, would you agree with this type of procedure?

Dr. TAPE. I will have to condition my answer, but I would tend to agree with that.

The condition I want to inject is the following. AEC through its contractor-type operations does not impose personnel ceilings per se on the contractor. The personnel ceilings generally have to come about because the sum of money that is available pretty much fixes what the personnel levels will be anyway.

The point I want to make here is that as an ex-manager in a Federal laboratory, I am fully aware if one has a job to do and has a certain budget in which that job must be done, the manager needs flexibility to decide on personnel numbers and specialties, for example, scientists, engineers, technicians, et cetera. The most important thing is to weigh costs, personnel versus services, and so on. We can't sit here in Washington and tell him to do the job with so many dollars and with so many people. We do have the advantage of letting the Director judge for himself the best way of getting it done.

However, there are other restrictions on the laboratories, and this goes back to some of the Economy Act provisions which say that in these Federal laboratories, if you do take on work for others of this

nature, it is supposed to be done without expansion of the laboratory. We have been applying it as a matter of judgment and without too much difficulty. However, I think this is something we should examine; I think there may be a potential limitation here.

Mr. FELTON. A couple of people had said "potential", but no one has said it is a real limitation.

Dr. TAPE. I think it could be a real limitation. The reason I say potential is we have walked around it. We have something like 6 percent of our laboratory effort in work for others, but if one looks down the road and finds that a particular Federal laboratory has the expertise to carry out a program for another agency, if it needs a new facility, this gets into slight complications. If it needs a substantial addition in personnel I think the Economy Act might provide limitations.

Dr. ENGLISH. Could I add, at this point, that the new authority that the AEC now has does not carry such limitation with it, the interpretation of it, so if we do work for other bodies, be they either Federal Government agencies or other entities, we can, if they support the program, acquire necessary equipment, or additional equipment and personnel.

It is also true that we do not have this particular limitation which exists under the Economy Act with respect to doing work for others in the nuclear field which we are authorized to do under section 31 of our act.

Dr. TAPE. I was trying to be specific to nonnuclear in our case.

Mr. ROUSH. Dr. English, could you compare the functions of your office to those of Mr. Edward Glass?

Dr. ENGLISH. Perhaps not very explicitly because I am not fully aware of exactly how they operate. I can give you a brief description of how the AEC laboratories operate.

Mr. ROUSH. Could you do that?

Dr. ENGLISH. As Commissioner Tape has indicated, our national laboratories, or multiprogram laboratories, are not strictly in-house as the term is sometimes used in the sense of being staffed with government personnel. They are staffed for the AEC by private contractors, in many cases a university, which means that we don't have the same kind of free exchange of personnel, if you will, between staff of the laboratories and Government personnel that staff the various divisions and offices of the AEC.

As Dr. Tape indicated, the multiprogram laboratories report directly to AEC headquarters, not through AEC field managers, for program matters, which means that our contacts, my office's contact, for example, and those of the program divisions that report to me, are direct and frequent, almost daily, with the laboratories. Thus, the laboratory management can come into us with program problems and also with, of course, budgetary matters, and we represent a focal point for deciding which of the laboratories will carry out specific programs in the various fields.

Mr. ROUSH. Thank you.

Are there any further questions?

Mr. BROWN. I notice on page 5 you make reference, Commissioner, to your efforts at exploring the possibilities of using an AEC labora-

tory in the field of pollution, and you indicate the degree of success there.

Has this effort been extended to other areas or other types of problems? I ask this with regard to transportation on which we will hear some testimony after you. One of their areas of research and development is in the tunneling field, and I gather from recent reports that I have seen that the AEC has done some substantial work in the area of tunneling which might actually represent a breakthrough in this field.

Now, has there been an exchange of technology between what you are doing and what the Department of Transportation might be interested in doing in this field?

Dr. TAPE. Department of Transportation—I do not know that we have been explicit with them on this subject, Mr. Brown.

On Housing and Urban Development I can answer in the affirmative. We have had exploratory discussions with HUD, first of all, concerning our laboratory operations complex and what facilities we have. I know they are most interested in getting their own research and development programs going and they will be faced, as I am sure you will hear, with the questions of how can they best carry out the work they need to do.

As to tunneling, we have talked directly to Dr. Rogers and I think there are two areas of our work which are of interest. One comes from the weapons area where there is tunneling going on. The technology of drilling large holes in the earth, some of the largest holes—

Mr. BROWN. Are you distinguishing between that and tunneling?

Dr. TAPE. I am distinguishing only because some people don't think of the vertical hole as a tunnel so I was going to include it by explicitly stating it.

This is an area in which we have done a lot of development not so much ourselves, but the industry, the miners, and so on, have developed it to meet our needs.

Another area which I think may have a tremendous carryover into housing and urban development is work that is going on at Oak Ridge under the heading of "Civil Defense" which is partially supported by Civil Defense and partially supported by us. Here the question of tunnels starts with Civil Defense. But it is related to many other facets of urban development. I see tunnels in future cities to be a basic part of transportation, communications, power distributions, and other services.

I don't think we have talked to transportation. On housing and urban development we have done a lot.

Mr. ROUSH. Thank you, Dr. Tape and Dr. English. We appreciate your appearance before the committee. There may be some questions the committee would like to propound in writing to you in the future, and we hope you would respond to those.

Dr. TAPE. We would be glad to respond.

U.S. ATOMIC ENERGY COMMISSION,
Washington, D.C., June 17, 1968.

HON. EMILIO Q. DADDARIO,
Chairman, Subcommittee on Science, Research and Development, Committee on Science and Astronautics, House of Representatives

DEAR MR. DADDARIO: Your letter of May 15, 1968, requested that I provide answers to questions related to effective utilization of Government laboratories. I trust that you will find the answers which I have enclosed useful in preparing the hearing report.

I would also like to take this opportunity to supplement my testimony of April 3, 1968, with a point which I neglected to make at that time.

You will recall that I said that an important characteristic of the multi-program laboratory is the presence of a variety of facilities and a broad spectrum of scientific, engineering and managerial talent. These are most effectively used in the execution of broad program assignments. While a multi-program laboratory may not immediately be able to address all aspects of research and development involved in a broad program assignment, the array of talent, facilities, and experience that is available can usually develop promising and original lines of attack promptly.

It is not always possible to take this approach. The tendency is to stress specific research projects and to avoid broad program assignments. Unfortunately, this is not the most effective way to use these laboratories. The assignment of a broad program responsibility and the investment by the sponsoring agency of money and time needed by such a laboratory to marshal its forces and talents to first study a problem and then to make a broad inter-disciplinary attack on it is the approach which best utilizes the capability of these laboratories. It is, I believe, an approach which is much more effective than using them as "job shops."

Project assignments can lead to broader program responsibilities as the sponsoring agency gradually acquires confidence in the laboratory through support of specific capabilities not initially identified. This is a slower process and there is the danger that it will never really develop to the point where the multi-disciplinary laboratory is used to its best and in its most effective way.

Sincerely,

GERALD F. TAPE, *Commissioner.*

Enclosure.

QUESTIONS SUBMITTED TO DR. GERALD F. TAPE BY THE SUBCOMMITTEE ON SCIENCE,
RESEARCH AND DEVELOPMENT

Question 1. In your testimony you spoke of the difficulty in matching the capability of a laboratory with the direct interest of a responsible agency, and said that to the extent that effective communications regarding capabilities of existing laboratories and agency mission requirements exist, it will be easier to judge whether a given task may be carried out more effectively by existing laboratory or at a new one.

(a) With this in mind, what information about Government laboratories should be collected? Where, and by whom?

(b) What thoughts do you have about the balance between the cost and effort of collecting such information against its utility?

(c) How feasible does it appear to have the Science Information Exchange set up a clearinghouse for information about capabilities and availability of special competences in the principal Government laboratories?

Answer.

(a) Information on major programs and laboratory facilities, staff composition and past accomplishment is relevant to this purpose. Reasonably detailed descriptions of current activities at the project level are also relevant. This sort of information, available to the parent agencies, might be distributed to other federal agencies, the Office of Science and Technology, and the Bureau of the Budget.

(b) The cost and effort required, as well as the utility, of such information, will be determined in large part by considerations regarding redistribution and effective use subsequent to collection. Information on major facilities and programs, staff composition, organization, and points of contact could be collected with minimal cost and effort since such material is commonly prepared for other purposes by many Government laboratories. Although this information might be compiled in a directory of major Government laboratories and distributed to agency officials, direct contacts between agency program officials and laboratory staffs are much more effective in determining common areas of interest.

Detailed descriptions of current activities at the project level while relevant would be more difficult to collect and redistribute.

(c) It should be feasible for the Science Information Exchange (SIE) to collect information on the capabilities and special facilities available at principal Government laboratories. SIE has considerable experience in methods of collection and redistribution of this sort of information.

In addition SIE collects for other purposes work in progress descriptions covering a considerable fraction of federally supported R&D. While at the present time coverage is incomplete, it is likely to be improved in the next few years and as this occurs SIE will be more able, in response to inquiries, to supplement general laboratory information with more specific information collected for other purposes.

Question 2. What is the policy of your agency respecting appraisal of the performance and the condition of your laboratories? How does this compare with your policy for appraising the performance of your research and development contractors. What procedures and standards do you have for such appraisals? Please illustrate your reply with copies of agency publications.

Answer. I am enclosing, as Attachment I, AEC Manual Chapter 0701 which sets forth procedures for appraisal of contractor performance. You will find those sections directly relevant to appraisal of multiprogram laboratory contractors underlined; you will also note that Part I of Appendix 0701 includes general appraisal guides used by AEC staff in evaluating contractor performance.

A large part of AEC's appraisal of the technical performance of major laboratories is done through AEC's evaluation of individual projects and programs. Procedures and standards for such reviews vary significantly from program to program. There is relatively greater and closer surveillance and evaluation by AEC staff in the more applied and developmental areas such as reactor and isotopes development where milestones, schedules and specific objectives are prevalent. There is considerably less surveillance and evaluation of details in the more basic areas of physical research, biology and medicine, basic weapons research, etc. Nevertheless, AEC staff appraises technical performance at the program level in all cases. It also evaluates overall laboratory performance in administrative and managerial matters. Regular reviews of this sort cover Health & Safety, Reactor Safety, Materials Management, Classification, Construction and numerous other financial and administrative activities. AEC expects its laboratory directors and contractor-sponsored review committees to make evaluations of overall performance, objectives and condition of its major laboratories, and, in fact, they do.

In addition, the AEC utilizes ad hoc panels for review of special topics involving generally more than one laboratory. Furthermore, the AEC's General Advisory Committee holds every other meeting at one of its major laboratories, and as part of its service it reviews one or more of these laboratory programs, consults with the directors and advises the Commission.

The procedures which AEC uses in its review of individual projects at its major laboratories differ from those it uses in the case of other contractors such as individual projects and programs at universities, industry, and not-for-profit laboratories. As a matter of policy, AEC generally calls upon experts from outside the agency to assist in the review and evaluation of individual projects and programs conducted by such contractors, particularly in the more fundamental areas of science. Since a continuing daily management is not present for university contracts, a closer examination of initial proposals and an evaluation of the competence available is made by the AEC staff. Any subsequent renewal is given the same close attention.

The directors of AEC's major laboratories have flexibility, which varies significantly from program to program, to set project priorities within overall program budget levels, established on the basis of individual project reviews conducted by AEC staff. There is less flexibility in the case of contractors conducting one or a limited number of projects.

Question 3. In your testimony you mentioned locating Government laboratories together at a common site. What significant advantages are there to co-location in your opinion? How do you balance these advantages with the increase in geographic concentration of Federal research and development that logically would follow?

Answer. As described in my testimony I believe potential significant advantages of co-location are the common use of specialized and expensive facilities, and the opportunity for beneficial scientific exchanges among staff members who taken together represent a broader spectrum of scientific talent than would otherwise be possible. It is also recognized that some economies can result through more effective use of land, services, and general administration. On the other hand, increased local geographic concentration of Federal R&D may be a consequence of co-location, and this would not assist a policy of getting government laboratories and other Federal R&D support into areas where no such support exists today. However, it could strengthen existing modest centers in

developing regions, and thus lead to a more uniform distribution of Federal R&D funds. Without making a value judgment as to desirability, it is clear that complete uniformity would, of course, require establishment of R&D centers in regions or States that presently do not have such centers.

Question 4. A sharp line is drawn between those Government laboratories that are directly operated and those that are contractor operated. In terms of your experience, what are the principal characteristics of each mode of operation and the difference between them that are significant to utilization of Government laboratories?

Answer. AEC's experience, as well as my direct personal experience, is limited almost entirely to contractor-operated Government laboratories.

Major differences between an in-house Government laboratory and a Government-owned, contractor-operated laboratory, in my opinion, arise primarily from the fact that the staff of Government-owned, contractor-operated laboratories, such as the AEC major laboratories, are not Federal employees. Personnel policies appear to be at the heart of the matter. Government promulgated policies tend to be Government-wide and attempt to cover all agencies and all cases. Thus they may be more restrictive or limiting than necessary or desirable for individual cases. When one can establish personnel policies for thousands, rather than millions, and for predominantly scientific, technical and management personnel as compared to other categories, one can have policies that specifically attract and retain the type of personnel required. Policies can in some cases also be consistent with those of academic institutions and thus permit and facilitate a desirable amount of turnover among scientific and professional personnel.

There is of course another important characteristic that should be considered, i.e., the relationship of the Government agency to the laboratory. The give and take of the contractor relationship as it exists in our major laboratories produces a climate, I believe, that is conducive to innovative approaches for differing task assignments.

Question 5. What authority do your laboratory directors have to deal directly with other agencies that may wish to engage their research and development services?

Answer. Directors of AEC's multiprogram laboratories are free to deal directly with other agencies for the purpose of identifying R&D which they might perform for another agency. Prior to submitting a formal proposal for such work, however, it must be reviewed by AEC staff to determine that proposed use of Commission-owned facilities is within the legislative authorities of AEC and that the proposed work will not interfere with the effective conduct of AEC programs. An actual transfer of funds normally requires a formal agreement between AEC and the sponsoring agency.

Question 6. In what ways are the directors of your large, multiprogram laboratories kept informed of the scientific and technological content of new or changed Government functions, such as those of the Department of Transportation or the Department of Housing and Urban Development? What incentives are there for your laboratory directors to give thought to such matters in addition to their primary responsibilities to your programs?

Answer. To a significant extent this information is acquired by laboratory directors by their own initiative and in proportion to their interest and those of their staffs. As outlined in my testimony, AEC has transmitted information on programs of national interest and new and changed agency authority to directors of its multiprogram laboratories. We have also transmitted to them and to their staff relevant information arising from our conversations with other federal agencies regarding effective use of resources at our multiprogram laboratories for national goals.

As mentioned in my testimony, AEC's General Manager has asked directors of our multiprogram laboratories to identify programs which they might undertake in the area of pollution abatement and control. In this he referred to Chairman Seaborg's letters to the Secretaries of major federal departments and to Mr. Hollifield's interest in the effective use of the multiprogram laboratories in the national pollution control effort. The direct benefits to the laboratory programs outlined in my testimony provide additional incentive.

Question 7. While the present Laboratories Committee of the Federal Council for Science and Technology is concerned with Government laboratories as such, with the exception of Dr. Astin its members are not working laboratory directors. What advantages and disadvantages do you see in having a small council of Fed-

eral laboratory directors at the Executive Office level that would represent the view of both directly and contractor operated Federal laboratories?

Answer. Most of the major AEC laboratory directors are today on national panels and committees. Their senior staff members are engaged in similar roles. Thus it appears that an input for laboratory directors participating in national advisory recommendations already exists. It is my belief that the establishment of an additional council would not appreciably add to the significant influence that the laboratory directors already have on national research programs. Within the AEC, laboratory directors on their own initiative meet annually as a group to consider mutual problems. While there are some common problems, it is an unfortunate fact that the difficult ones tend to be unique to one or at most a few laboratories. Nevertheless, learning about someone else's experience may be helpful for the future. The members of the Commission also meet privately (every six to eight months) with each laboratory director to discuss with him the status, programs, problems, plans, etc. of his laboratory. Additional opportunities for laboratory director inputs at Commission or staff meetings also exist.

Going beyond the AEC experience and as a general rule, it would appear that the advantage of participation in high level recommendations by laboratory directors permits input regarding current and potential laboratory capabilities at an early stage of national program planning. For the laboratories directly represented, and to a degree for other Government laboratories, this could lead to improved utilization of current laboratory resources.

The major disadvantage might be that possible recommendations could have an adverse effect on the mission of their sponsoring agency and of their own laboratory, and thus at times would place them in a situation with conflicting objectives.

Question 8. In your testimony you mentioned the need for some modest authorization to Federal laboratories to develop proposals in areas of national concern that might be submitted to other agencies. How would you provide such funds, as an overhead charge against all program funds spent in a laboratory, as a special allowance, through funds from a potential user agency, or otherwise? What type of monitoring or evaluation system would you use?

Answer. In my testimony I suggested that authorization to spend modest amounts in order to develop proposals in areas of national concern would be helpful. It is difficult to justify expenditure of agency funds for non-agency purposes. If this authority could be obtained, several mechanisms for providing the funds to laboratories could be used, such as overhead allocations, special funds, etc. Of these, my strong preference would be for a specific special allowance, since this would best permit evaluation and monitoring of such expenditures.

Question 9. In your testimony, you touched briefly on the AEC's new authority to perform research relating to public health for other agencies (P.L. 90-190). Please supply more details about your present plans to exercise this authority, proposals that have been generated, and any obstacles that you consider serious enough to bring to our attention.

Answer. AEC plans to use this authority for all non-nuclear work, in the areas of health and safety, which is undertaken at its facilities for non-federal Government sponsors and public-sector sponsors and for which we can make the determinations required under the authority. We foresee lesser use of the new authority in the case of work sponsored by the federal government, which is the major proportion of current and presently proposed work, since in the past we have experienced very little, if any, difficulty in conducting work of this sort under our other statutory authorities.

A number of the proposals listed in Attachment II have been received since the new authority was provided. Some of these might be authorized under this new authority.

Question 10. The Subcommittee is interested in AEC's initiatives that you mentioned to use AEC's laboratories for research aimed at pollution abatement. Could you furnish more details about the role of AEC laboratory directors in generating proposals for such research? What proposals resulted? To which agencies have they been submitted? And with what result? We are also interested in the role of AEC headquarters in handling the proposals, particularly as a point of contact with potential user agencies. To what extent could the AEC laboratory directors deal directly with potential users, and how much is being handled through the AEC itself?

Also, could you provide more detail about the arrangements for saline water research sponsored by Interior and AEC laboratories?

Answer. Generally the directors identify broad areas of capability, and staff and facilities which might be utilized. They assess proposed work in terms of its potential contribution and its impact on the programs and objectives of their laboratories.

Attachment II is a list of proposals and discussions now under consideration; the agencies involved, and a brief description of the current status of each.

AEC headquarters staff has arranged a number of meetings between AEC laboratory staff and the staff of various agencies. Dr. Spofford G. English, Assistant General Manager for Research and Development, has met with several representatives of each of the major departments and serves as point of contact between them and the laboratories in initial phases of the development of proposals. As discussions proceed and proposals are developed, AEC headquarters staff reviews AEC's authority to conduct the proposed work and evaluates potential impact on AEC programs, but direct contact between laboratory staff and scientists of the potential sponsoring agency is the most important element once initial contact has been made.

Proposals are reviewed by AEC prior to being forwarded to other agencies to determine whether AEC has authority to utilize its facilities for the conduct of the proposed work and to assess potential impact of the proposed work on AEC sponsored programs; otherwise, laboratory directors are free to deal directly with potential sponsors.

Funding of reimbursable work for others is handled through AEC by inter-agency fund transfers.

Dr. Weinberg, in his testimony, described the inception of saline water research at ORNL and arrangements for the conduct of work on desalination which is sponsored by the Department of the Interior and AEC. Currently the Department of the Interior (Office of Saline Water) provides direct technical direction to the two portions of this program which it supports. Studies of basic water chemistry related to desalination are supported on the basis of review of proposals submitted to Interior by ORNL. Evaporator system development studies are undertaken at ORNL on the basis of work orders prepared by the staff of the Office of Saline Water. In each case approved programs are funded by interagency fund transfers from Interior to AEC. The third facet of the desalination program at ORNL is nuclear technology related to desalination. This is supported directly by AEC.

Question 11. A different and unusual response of the AEC to the question of full use of its laboratories has been its experiment with diversification at Hanford and its arrangements for an AEC laboratory there to be used for private work. Please describe what was done and what the AEC hopes to accomplish. To what extent does your experience suggest this approach could be used by other Federal laboratories?

Answer. Since 1964 six contractors have been selected to operate portions of Hanford Project work formerly conducted solely by the General Electric Company. Each contractor is committed to, and has begun to make, significant private capital investment in diversified activities. Several of these contractors, including Battelle Northwest (a Division of Battelle Memorial Institute), have authorization to use government-owned facilities for the conduct of private work.

AEC hopes, through these actions, to assist in stimulating the diversification of the economic base of the Tri-Cities area (Pasco, Kennewick and Richland, Washington) and to help assure the maintenance of significant talent and facilities for the conduct of AEC's programs.

I believe that these arrangements have contributed significantly to AEC's objective of stimulating diversification of industry in the area. In addition it is possible that the arrangements are leading to more effective use of government-owned laboratory facilities for broad national purposes. Many factors including contractor commitment to development of the area, community cooperation and agency support have contributed to the apparent success of this approach. Where these are present and where diversification of the economic base of an area is the prime objective, I believe the approach could be used in the case of other Federal laboratories.

Question 12. The AEC's efforts to demonstrate the application of neutron activation to forensic analysis provide an example of applying a new technology to problems of crime control. To what extent was this work done in AEC laboratories? In particular, please describe the efforts of the Argonne National Laboratory and other AEC laboratories to encourage use of this technique by police.

Answer. The major portion of this work has been done by Gulf General Atomic utilizing privately owned laboratory facilities under contract to the Atomic Energy Commission. Important work related to control of drug abuse using nuclear activation analysis techniques has been done at Oak Ridge National Laboratory.

Argonne National Laboratory has conducted several briefings for the staff of the Chicago Crime Laboratory on application of nuclear activation analysis to crime detection. ORNL has worked with the Food and Drug Administration, the Treasury Department and with the Department of Justice to develop specific applications of nuclear activation analysis techniques.

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Chapter 0701 APPRAISAL OF AEC AND AEC CONTRACTOR PERFORMANCE

0701-01 POLICY

- a. To assure the effective management of AEC programs, responsible officials at all levels shall, as part of their regular administration of assigned functions, appraise the performance of AEC contractors.
- b. Except in the areas of nuclear safety, nuclear materials management, security, and audit, formal, routinely scheduled and repetitive appraisals of AEC Field Offices by Headquarters or of subordinate offices by Field Offices are not required.
- c. Periodic inspections of AEC interests outside the sovereign limits of the United States shall be conducted.

0701-02 PROGRAM OBJECTIVES

- a. To provide responsible officials with information as to the:
 1. effectiveness and efficiency with which assigned programmatic and administrative goals are met.
 2. quality of performance of organizational elements, including significant achievements and deficiencies.
 3. adequacy and effectiveness of AEC and contractor policies, procedures and management controls.
 4. compliance with applicable laws, rules, regulations and contract provisions.
 5. actions required for improvement.
- b. To provide contractor performance reports on those AEC contractors who are potential proposers for other AEC work to be awarded by the contractor evaluation board or selection board processes.

0701-03 RESPONSIBILITIES AND AUTHORITIES

- 031 The Director, Division of Inspection:
 - a. develops and recommends policies, procedures and general guides for the appraisal of AEC and AEC contractor performance. (See appendix 0701.)
 - b. determines whether systems for the appraisal of AEC and AEC contractor performance are adequate and are effectively carried out by responsible AEC officials.
 - c. determines whether programs for inspections conducted outside the sovereign limits of the United States are adequate and are effectively carried out by responsible AEC officials.
- 032 Heads of Divisions and Offices, Headquarters, in their respective functional areas:
 - a. keep informed on field office performance, including the adequacy of systems employed by the field office for appraising the performance of subordinate offices and major cost-reimbursable contractors, through such means as routine and special reports, conferences with key personnel, day-to-day contacts, results of inquiry into unusual or problem situations, and inspections.
 - b. upon request, provide the General Manager with an appraisal of field office performance.
 - c. inform the Managers of Field Offices of the substance of their reports to the General Manager.
 - d. for Headquarters-designated cost-reimbursable contracts with an annual operating cost over one million dollars:
 1. appraise programmatic performance when such responsibility is retained in Headquarters.

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2. prepare appraisal reports and provide copies to the appropriate field office.
 3. follow up on findings and assure that indicated corrective actions are taken.
 - e. on request, assist the appropriate Assistant General Manager in his evaluation of multiprogram laboratory performance by providing information, evaluations and advice.
 - f. conduct inspections of Field Offices, prepare written reports, follow up on findings and take indicated corrective actions:
 1. when problems arise which indicate the need; or
 2. when requested by Managers of Field Offices.
 - g. provide to the Director, Division of Inspection, information copies of:
 1. all written appraisal reports that are prepared.
 2. inspection and other compliance-type reports as the Division may request.
 3. trip reports as the Division may request.
 - h. provide contractor performance reports (form AEC-11) to the Director, Division of Construction or Contracts, on specified Headquarters-designated contracts for use by contractor evaluation or selection boards. (See appendix 0701, II.)
 - i. submit a schedule quarterly of planned foreign inspections to the Director, Division of International Affairs.
- 033 The Assistant General Managers for Research and Development and for Reactors, and the Director, Division of Military Application:
- a. periodically meet with the General Manager to discuss the strengths and weaknesses of the multiprogram laboratories (ANL, BNL, LASL, LRL, Ames, ORNL). Reports requested under subsection 032e, and reports prepared under subsection 038e, will be used, as appropriate, in preparing for the discussions.
 - b. follow up to assure that appropriate action is taken on specific problems identified by the General Manager as requiring attention.
- 034 The Director, Division of Operational Safety, the Director, Division of Nuclear Materials Management, the Director, Division of Security, and the Controller, in the areas of nuclear safety, nuclear materials management, security and audit:
- a. conduct inspections and appraise field office performance on a routinely scheduled and repetitive basis.
 - b. prepare written reports.
 - c. follow up on findings and assure that indicated corrective actions are taken.
 - d. prepare a schedule showing the appraisals planned for the following calendar year and provide a copy to the Director, Division of Inspection.
- 035 The Director, Division of Construction, for architect-engineering and construction contracts, and the Director, Division of Contracts, for all other contracts:
- a. maintain a file of performance reports received from Headquarters Divisions and Offices and Field Offices.
 - b. reproduce and distribute to contractor evaluation boards or selection boards or other authorized officials, upon request, copies of pertinent contractor performance reports.
 - c. assure that contractor performance reports are submitted promptly.
- 036 The Director, Division of International Affairs:
- a. develops inspection programs and procedures for and conducts inspections under agreements for

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cooperation with respect to verifying compliance with the safeguards and peaceful uses guarantee provisions of such agreements.

- b. reviews schedules of foreign inspections submitted by Heads of Divisions and Offices, Headquarters, and Managers of Field Offices as to the appropriateness of timing and scheduling in the light of the then current status of international relations with the country or countries involved.
 - c. informs the Director, Division of Inspection, quarterly of the schedules of planned foreign inspections to be performed by all Divisions and Offices.
- 037 The Director, Division of Military Application, and the Director, Division of Security, develop inspection programs and procedures for and conduct foreign inspections in their respective areas of responsibility.

038 Managers of Field Offices:

- a. appraise and prepare written reports of the performance of major cost-reimbursable contractors in those programmatic and administrative areas for which responsibility has been assigned.
- b. prepare written summary appraisals of the overall performance of major cost-reimbursable contractors for which both programmatic and administrative responsibility has been assigned.
- c. on a regular schedule, conduct inspections of subordinate offices and prepare written reports in the areas of nuclear safety, nuclear materials management, security and audit.
- d. conduct inspections of subordinate offices, prepare written reports, follow up on findings and take indicated corrective actions:
 - 1. when problems arise which indicate the need; or
 - 2. when requested by managers of subordinate offices.
- e. appraise multiprogram laboratory performance in areas where pro-

grammatic or administrative responsibilities have been assigned, and submit appraisal reports to the Assistant General Manager for Research and Development in all cases; to the Assistant General Manager for Reactors, and the Director, Division of Military Application, where appropriate; and to the appropriate Headquarters program divisions.

- f. appraise and prepare written reports of administrative performance under Headquarters-designated cost-reimbursable contracts with an annual operating cost over one million dollars and submit these reports to the appropriate Headquarters program division.
- g. follow up on appraisal findings and assure that indicated corrective actions are taken.
- h. prepare a schedule showing the appraisals planned for the following calendar year and provide a copy to the Director, Division of Inspection.
- i. provide contractor performance reports (form AEC-11) to the Director, Division of Contracts or Construction, on specified contractors. (See appendix 0701, II.)
- j. submit a schedule quarterly of planned foreign inspections to the Director, Division of International Affairs.

0701-04 DEFINITIONS

- 041 Appraisal is a basic and inherent managerial responsibility involving a systematic process by which a judgment is made of the quality of programmatic or administrative performance. It is a judgment of performance based on a more deliberate method than mere reaction to a succession of day-to-day happenings. It places emphasis on significant overall results rather than detailed processes through which such results are achieved. It is a critical process by which responsible officials utilize all available information gathering techniques. This information is then evaluated by applying appropriate

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criteria to arrive at informed judgments on the effectiveness with which assigned programs are executed.

- 042 Criteria are rules or tests against which the quality of performance can be measured. They are most effective when expressed quantitatively, but they may also be expressed qualitatively.

- 043 Inspection is a deliberate, systematic scrutiny or examination at the site of the activity. It is one of the techniques for developing information useful in the appraisal process.

0701-05 BASIC REQUIREMENTS

- 051 Applicability. This chapter and its appendix apply to Managers of Field Offices and Heads of Divisions and Offices, Headquarters.

- 052 Coverage. This chapter and its appendix apply to AEC and AEC contractor operations and AEC interests outside the sovereign limits of the United States, except that the appendix does not apply to foreign inspections performed by the Divisions of International Affairs, Military Application, and Security.

- 053 Appendix 0701. Appraisals shall be administered in accordance with the standards described in this appendix.

- 054 Contractor Performance Reports. Reporting requirements for submission of contractor performance reports are set forth in appendix 0701, II.

0701-06 NATIONAL EMERGENCY APPLICATION

In the event of a national emergency, as defined in section 0601-04, the provisions of this chapter and its appendix are suspended until further notification.

PART I

GENERAL AEC APPRAISAL GUIDES

A. INTRODUCTION

Appraisal includes evaluation of programmatic performance and the achievement of programmatic objectives as well as administrative performance and the achievement of administrative objectives. Programmatic performance includes not only the quality of end results derived from technical activity, e.g., concepts, products or reactors, but also the effectiveness and efficiency with which technical effort (people, equipment, etc.) is expended in pursuit of the end objective.

It is recognized that the measurement of programmatic performance is subject to less precision in some areas than in others. In research, the general reputation and acceptance of scientific work by peers in the scientific community are of prime importance in the evaluation of performance. So also are periodic status and progress reports, including topical and scientific journal reports. In the development, production and construction areas, more precise gauges of programmatic performance are available. Adherence to schedules, quality, quantity and cost of product, adequacy and timeliness of reports are examples of the latter.

To accomplish the objectives stated in section 0701-02a., the appraisal program must become an integral part of the management control system and it requires the full support of management. Appraisals include:

1. thorough consideration of pertinent data.
2. valid evaluations based on the application of appropriate criteria.
3. clear reporting of facts, conclusions and recommendations.
4. effective follow-up.

B. SOURCES OF DATA

Appraisals are based on such sources of data as routine and special reports, scientific publications, conferences with key personnel, reviews conducted by consultants and committees, day-to-day contact with operations, results of inquiry into unusual or problem situations, surveys, audits, and inspections.

C. OBTAINING PERFORMANCE DATA

Typical steps to obtain performance data are:

1. determine the types of information required for each of the areas to be appraised. Typical factors for administrative and programmatic appraisals are listed in H. below.
2. gather and centrally retain or identify pertinent information on a continuing basis such as: reports, audits, surveys, correspondence, notes on day-to-day contacts and problem-solving and field visits.
3. develop additional data by:
 - a. requesting specific information from the unit being appraised.
 - b. obtaining judgments and suggestions from knowledgeable third parties.
 - c. conducting inspections and interviews when the need is clearly indicated.

D. DEVELOPMENT OF CRITERIA

Ideally, criteria for judging performance should be developed prior to the gathering of pertinent data. This is the first and most important step in the evaluative process. As much as possible, appraisers should develop clear criteria from such recognized sources as AEC Manual chapters and appendixes, AECPRs and AECPIs, GSA regulations, Comptroller General decisions, applicable Federal statutes and BOB circulars. Wherever possible, the criteria should be quantitative.

For contractor appraisal, the contractor itself provides basic information such as schedules, quantities, reporting requirements, etc., from which valid criteria for appraising performance can be developed. Contractors' performance may also be judged against such valid criteria as comparable industry performance, his own commercial practices, performance of similar AEC and other Government agency contractors and performance of all AEC contractors.

Throughout the appraisal process, and especially in development of appraisal

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criteria, a major input is the experience and knowledge of the appraising organization. Familiarity with the performance, organization, problems, and personnel of the appraised organization combined with knowledge of management and technical principles are vital to the development of meaningful criteria. The value of this knowledge is most evident in making judgments where quantitative data is unavailable. For this reason, appraisal should be made by persons with experience in, or a thorough knowledge of, the area being appraised.

E. REPORTING

1. Reports in functional areas should be concise and prepared in a form that will be sufficiently clear for future reference and follow-up, and which can serve as a basis for determination by AEC management of the action required by the organization appraised.
2. Conclusions and recommendations included in the report should be based upon facts and findings clearly stated in the body of the report.
3. Facts and findings should be discussed by the appraiser with the appraised organization in advance of the report preparation to assure accuracy and common understanding.
4. After review and approval by higher level management, copies of the functional reports are normally given to the organization appraised unless there is some reason which is sufficiently sensitive to warrant a different course of action.
5. Distribution of appraisal reports should be restricted to those having a responsible interest in them.
6. The determination by AEC management of the quality of the appraised organization's overall performance should always be made known to that organization. Normally, this is in the form of a written statement from an authoritative source (e.g., Field Office Manager, Headquarters Division or Office Head). If the statement:
 - a. identifies significant deficiencies, it should serve as a basis for candid discussions between AEC management and the appraised organization's management looking toward

agreement on remedial courses of action.

- b. shows that performance has been generally good but there are some areas where minor improvements are needed, the statement should ask for comments with respect to the needed improvements.
- c. shows that performance has been generally satisfactory and there are no recommendations for improvements, its transmittal to the appraised organization is AEC's official recognition of satisfactory performance.

F. FOLLOW-UP

1. Appraisal recommendations are initially followed up within 90 days after the report is transmitted to the appraised organization. Additional follow-ups are scheduled as appropriate.
2. Records of follow-up actions are maintained, and the recommendation is considered open either until satisfactory corrections have been made or AEC management has agreed to an alternate solution. This record is a source of information for future appraisals.
3. The follow-up activities for each office should be centrally coordinated by officials with authority to expedite action.

G. SCOPE AND FREQUENCY

The scope and frequency of appraisals will be determined by management after consideration of the following factors:

1. Relative importance of the activity.
2. Management's need for information.
3. Past performance experience and appraisal results. Problem areas and key functions representing potential trouble spots should be identified for frequent review.
4. Interval since last appraisal. Ideally, every function should be appraised at least once every three years.
5. Age of organization. New organizations should be thoroughly oriented with respect to AEC program objectives and management policy as early as practicable. The first appraisal of such

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organizations should ordinarily be made within the first twelve months of operation.

6. It is not anticipated that a detailed review of all aspects of each function will be required to produce sufficient information on which to base an appraisal.

H. TYPICAL APPRAISAL FACTORS WHICH MAY APPLY TO EITHER ADMINISTRATIVE OR PROGRAMMATIC ACTIVITIES

1. Performance:

a. evaluation of end results:

- (1) adherence to schedules and requirements.
- (2) quality and/or quantity of final product or service.

b. costs:

- (1) total costs of activity.
- (2) unit cost and trends.
- (3) personnel costs and trends.
- (4) material costs and trends.
- (5) overhead costs and trends.

c. safety performance.

d. nuclear materials management.

e. effectiveness and costs of maintenance program.

f. responsiveness to AEC directions and changes.

2. Policy, organization and procedures:

a. adequacy of internal control systems.

b. extent to which policies agree with AEC standards.

c. extent to which there is a clear distribution of responsibility with commensurate assignment of authority.

d. degree to which organizational structure encourages effective communications and decisions.

e. degree to which personnel policies contribute to effective management.

3. Record in meeting program assignments on time, and within estimated costs, including:

a. ingenuity and aggressiveness in meeting or improving upon target dates.

b. responsiveness to AEC needs and requests.

4. Inventiveness in advancing the technologies involved, including resourcefulness in incorporating economy and safety into design.

5. Quality and originality of ideas and proposals.

6. Skill and diligence in planning and organizing work.

7. Effectiveness in preparing and presenting budgets, including quality of Schedule 189 estimates (Project Proposal and Authorization).

8. Discernment in determining when lines of inquiry become unprofitable.

9. Promptness, quality and frequency of technical reports, progress reports, project reports and general communications.

10. Stature of individuals and the organization within the scientific community.

11. Overall manpower levels in relation to work output.

12. Effectiveness of personnel policies in attracting and retaining qualified technical staff.

13. Relationship of overhead and support structures to other staff.

14. Environment for research.

15. Process improvements.

16. Overhead cost performance.

Activity	Estimated approximate annual cost	Status	Comment
Argonne National Laboratory:			
Pollution forecasting manual.....	50,000	Proposal sent to city of Chicago.	Joint AEC-HEW, city of Chicago program.
Chicago air model.....	200,000	Renewal proposal being reviewed by NCAPC.	
Storage battery:			
Study.....	50,000	Under review by NCAPC panel..	
Development.....	250,000		
Fluidized bed treatment of coal.....	200,000	Fund transfer being arranged between HEW and AEC.	Joint ANL-University of Illinois proposal. ANL and AUA modifying proposal.
Improvement of thermal efficiency.....	500,000	Proposal being reviewed by Office of Coal Research.	
Study of Salt Creek.....	150,000	Reviewed and deferred by HEW and Interior.	
Braille reader.....	50,000	Contract being negotiated with Office of Education.	
Trace metal analysis.....	50,000	Being discussed by NCAPC and ANL.	
Artificial kidney.....	250,000	Proposal being prepared for NIH.	
Brookhaven National Laboratory:			
Hydrogen storage.....	50,000	Under review by NCAPC panel..	Bituminous Coal Institute, Office of Coal Research, BNL meeting, May 2. Joint program (BCI, Interior, AEC, NCAPC) being formulated. In discussion stage only.
Combined nuclear fossil-fuel powerplant.....	100,000	Under review by Office of Coal Research.	
Radiation treatment of wastes.....		Joint FWPCA-AEC Headquarters study being completed.	
Stable tracers for SO ₂	100,000	Joint AEC-NCAPC study of economics in progress.	
Oak Ridge National Laboratory:			
Hyperfiltration and pollution control.....	300,000	Being forwarded to FWPCA.....	Portion of above study.
Hyperfiltration of municipal sewage.....	100,000	Transmitted to FWPCA.....	
Treatment of solid wastes....	100,000	Proposal to HUD.....	
Tunneling technology.....	100,000	do.....	
Thermal energy for urban use.....	100,000	do.....	
Algal growth.....	1,000,000	Being reviewed by FWPCA.....	
Heavy metal fuel additives....	1,000,000	Under discussion with NCAPC..	Meeting at ORNL, May 2.

Note: FWPCA—Federal Water Pollution Control Administration, Department of the Interior; NCAPC—National Center for Air Pollution Control, Department of HEW.

Mr. ROUSH. Our next witness is Frank W. Lehan, who is Assistant Secretary for Research and Technology, Department of Transportation.

I observe, Mr. Lehan, that you have several pages here single spaced. We will leave the choice up to you, but I think the committee might be pleased if you would perhaps summarize some of this and we will, unless there is an objection, include the entire statement as part of the record.

Mr. LEHAN. That would be quite satisfactory.

Mr. ROUSH. Proceed.

(The biography of Mr. Lehan follows:)

FRANK W. LEHAN

Mr. Frank W. Lehan was appointed Assistant Secretary for Research and Technology in the Department of Transportation on December 18, 1967.

Mr. Lehan has had a distinguished career in systems technology. He was born in Los Angeles on January 26, 1923, and attended the California Institute of Technology, where he received his B.E.E. Degree with highest honors in 1944. He was elected to Sigma Xi and Tau Beta Pi honorary fraternities.

Mr. Lehan joined the Jet Propulsion Laboratory of Caltech upon graduation and served from 1944-49 as Chief of the Telemetry Section. From 1949-51 he was Chief of the Telecommunications Section, and in 1952 he was advanced to Chief of Electronics Research. He served in that capacity until 1954, when he joined Space Technology Laboratory of the Ramo-Wooldridge Corporation, as Associate Director of the Electronics Laboratory.

Mr. Lehan then founded his own company, Space-Electronics Corporation, and served as its Executive Vice President from 1958-61. In 1961 he and his partner sold the company to Aerojet-General, and it became known as Space General Corporation. He served as Executive Vice President of Space General in 1961 and 1962, and as its President from 1962-66. Since leaving Space General, Mr. Lehan has been a consultant on a variety of scientific and engineering projects, including serving as a panel member of the President's Science Advisory Committee.

Mr. Lehan is a Fellow of the Institute of Electrical and Electronic Engineers, a member of the American Institute of Aeronautics and Astronautics, and the American Association for the Advancement of Science. He is an Associate of the California Institute of Technology.

Mr. Lehan is married and has one daughter. He resides with his family in Washington, D.C.

STATEMENT OF FRANK W. LEHAN, ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY, DEPARTMENT OF TRANSPORTATION

Mr. LEHAN. Let me make a very rapid summary and we can go back over the material.

First, I appreciate the opportunity to appear here before you because the particular question that your subcommittee is investigating is one that I consider most important in the field of research and development in the country, and one which I am personally very much interested in.

Mr. ROUSH. Is this partly because you must depend on other laboratories?

Mr. LEHAN. It is partly because I must depend on other laboratories. It is also because I feel that the future of research and development in the country depends upon the degree to which we are able to satisfactorily utilize the technology complex we have built.

As you know I have had only a short time in Government service. Hence I must draw on past experience, in large part, for my opinions.

I spent 10 years at the Jet Propulsion Laboratory under Dr. Pickering, who testified earlier, in electronic research and the direction of moderate-sized research and development programs.

Subsequently, I was involved in the early and middle development phase of the ICBM and IRBM programs as Associate Director of the guidance and control programs.

I regard both of these opportunities to have been valuable. They gave me some exposure of the kind of problems that you run into in the technical management of programs.

One observation, drawn from my past history and my short experience at DOT is that there is rather significant contrast in the technical vigor with which defense and space programs are pursued, as compared with the technical resources that are brought to bear in transportation-related programs. I consider one of my tasks is to try to modify that situation. In this task Government laboratories are an important ingredient.

Another general observation is that, in my opinion, the key to a successful development program is in what has been called the systems engineering and technical direction area. This activity is an art, not a science. Let me mention three ingredients of this art.

First, thorough planning and documentation at the start of a program.

Second, one has to make a very few but key technical decisions correctly.

Third, there is required a well organized program monitoring and program control.

I highlight these activities because I feel that it is desirable to use the existing Government technology base, and the key to using it successfully lies in the handling of these systems engineering and technical direction.

I don't have a facile solution to handling them. I simply wish to highlight the necessity.

These summarize my personal views. If you desire, I will now summarize the document which has been presented to you.

Mr. ROUSH. You may proceed.

Mr. LEHAN. Thank you.

In the Department of Transportation we spend directly about \$350 million a year for research and development. The exact number is a bit hazy because the exact definition of research and development is itself a bit hazy.

We have been able to identify in Department of Defense something like \$600 million a year that is spent for items related to civilian transportation and that are of direct interest to DOT.

Additionally, we have been able to identify in NASA about a hundred million dollars a year that are programed for similar purposes.

We are satisfied with both of these activities. If they were not in being we would wish to increase the scope of some of our programs. We are receiving good cooperation from NASA and the Department of Defense. The Transportation Department is relatively new.

Since I have joined I have met with Dr. Foster of the Department of Defense, Dr. MacAdams of NASA, and Dr. Lee of HEW to search for cooperative areas.

You highlighted, in earlier questioning, the bureaucratic tendency to have laboratories under direct control. I won't pretend that DOT doesn't have this problem. However, we are aware and concerned about it and, to the degree it is possible to do so, we are going to minimize its effect. We don't, however, want to minimize it at the expenses of good systems engineering and technical management.

I think that, with the shortness of time, this summarizes the document except for detail.

If there are questions, I would be pleased to answer them.

Mr. ROUSH. On page 4, you speak of a specific problem, the problem of transporting hazardous material.

Then you go on and say that the task of finding a laboratory that might be available to conduct a testing program related to this problem could be eased if an effective laboratory reference source were available.

Would you comment on that further?

Mr. LEHAN. Yes, sir. It is our feeling that, perhaps somewhere in Dr. Hornig's office, a laboratory referral or reference service might be useful.

We can go to reference services in NASA and DOD and elsewhere, but I think if there were a central laboratory reference service we would regard it as useful.

Mr. ROUSH. Was one of your problems in seeking solution to this specific problem that the departments and agencies conducting research and development did not have a reference service, or are you saying there should be a central reference service?

Mr. LEHAN. It would ease our task if there were a central reference service available. The Department of Defense and NASA, do have their own reference service, but I feel we would find a central service useful.

Mr. ROUSH. The same Executive order I referred to a moment ago, which was issued by President Eisenhower in March of 1954, had in section 8 a sub-paragraph (c) that states in part:

"Each Federal agency possessing such equipment and facilities shall maintain appropriate records to assist other agencies in arranging for their joint use or exchange."

Would you say there are sufficient records kept by the various agencies now so as to provide a source for you?

Mr. LEHAN. My feeling is there are sufficient records kept by all agencies we have contacted.

The difficulty has been no central point where those records are all available. I don't want to overstress the point, but I think that it is something that is worthy of consideration.

Mr. ROUSH. Mr. Brown?

Mr. BROWN. Looking at page 6 of your testimony, you indicate that the Federal laboratory capability for all modes of surface transportation is quite limited compared to that of air transportation.

The figures that you indicated earlier showing the importance of transportation in our economy as representing 20 percent of our gross national product, most of that is expenditures in ground transportation.

Mr. LEHAN. Yes, sir, it is.

Mr. BROWN. I am concerned very much about what procedures or steps are necessary in order to change that priority for the allocation of a research and development capability.

It seems to me that we perhaps are considerably out of balance in looking at the total problem of transportation as a national problem, which I think your agency is concerned with doing. What steps are necessary to examine this balance, determine if it adequate and proper, and if it isn't to make the necessary changes? What needs to be done by your agency, by Congress, and any other changes that need to be done?

Mr. LEHAN. This is a difficult problem and I can't propose a solution here. I am planning my first visit to the DOD Detroit Arsenal Command, because they have considerable ground transportation capability.

I think a major question is: Should, in any formal sense, the NASA mission be broadened or should they be given encouragement to work in other than the aeronautical and space research area?

Mr. BROWN. Well, I am not at all satisfied with what I see in this area. I do not think that any public spirited citizen should be satisfied. What we are seeing is a ground transportation system—and I think in air transportation the situation is completely different—but we are seeing a vast rail system which for a generation has been in the process of decay for lack of adequate R. & D. We also see an auto-

mobile transportation system which has actually created the major problems for our urban civilization. I am putting this very broadly, but I think it is factual.

In the automobile industry, which is an industry at the minimum represents \$80 billion a year or about 10 percent of our gross national product, most of the R. & D. goes into how to create new models to sell and thereby create new problems.

I do not think that the Congress or the public regardless of its past attitude, ought to continue to be happy with this. It is costing us billions in tax problems. It is creating the problem of pollution, and it is doing a lot of things that could be solved if we had adequate R. & D. in this country.

I think this is one of the most challenging things facing our society today. How long before you think you can come up with solutions to solve this?

Mr. LEHAN. The auto safety area is being discussed now with the Bureau of the Budget. Some more activity will be proposed for this coming fiscal year.

We are equally concerned about the problem. During the course of this coming year we will be considering plans involving the use of existing Government laboratories, university and industrial laboratories, or as well as the creation of additional Government laboratories to work on this problem.

Mr. BROWN. The success we have had, and it has been shown in the field of automobile safety, for example, does not lead one to assume a very promising future in additional areas of research and development. The safety problem in automobiles in one which involves thousands of lives, billions of dollars each year, and yet the total corrective expenditures required are in the neighborhood of a fraction of 1 percent of the annual production cost. Yet the industry has apparently resisted any improvement in this field. What is going to happen when they are faced with massive developments in the automobile industry? We are going to be confronted with a head-on collision here which will shake the foundations of this country if the safety factor is any indication.

I do not know what the answer is unless we can have some very broad ranging systems and analysis which are not getting publicized at the present time and can be used as a bludgeon over the industry to cooperate in some drastic changes in that direction.

Mr. LEHAN. As you point out, the problem is large and complex. It involves economic and policy as well as technical considerations.

I observe that the technological sophistication exists in the country if we can find constructive ways to apply it.

Mr. BROWN. That is correct.

Mr. LEHAN. It is obviously not an easy problem or it would have already been solved.

Mr. BROWN. What we need is a conceptual framework.

Mr. LEHAN. I have no further remarks regarding this question now, but we are very interested in it.

Mr. ROUSH. When you are dealing with a laboratory, do you deal directly with the laboratory directors, or must you go through the agency heads and through the bureaucracy and chain of command?

Mr. LEHAN. We do both. When contact has been started with the

agency head we find that our people can deal with the laboratory directly. To the best of my knowledge, no impediment exists here.

Mr. ROUSH. Do you receive assistance from the Office of Science and Technology?

Mr. LEHAN. We receive advice and assistance from them.

Mr. ROUSH. Does that office ever do the pushing, or do you do the pushing?

Mr. LEHAN. Both.

Mr. ROUSH. Are there any other questions?

(No response.)

Mr. ROUSH. Thank you very much, Mr. Lehan, and we are glad to have you appear before the committee.

(Mr Lehan's prepared statement follows:)

PREPARED STATEMENT BY FRANK W. LEHAN, ASSISTANT SECRETARY FOR RESEARCH AND TECHNOLOGY, DEPARTMENT OF TRANSPORTATION

Mr. chairman and members of the subcommittee, I consider the subject of this hearing to be important to the future of research and development in the country. It is also one in which I am deeply interested personally. I, therefore, appreciate the privilege of appearing before you today to present my views.

The size and scope of transportation, in Government and in industry, are indicative of a very large investment. It accounts annually for about 20 percent of our gross national product.

With respect to Federal expenditures for transportation research and development, the Department of Defense, for FY-1968 spent approximately \$600 million on transportation related R&D, and NASA spent nearly \$100 million, performed by an extensive complex of Federal and industrial research organizations. It is our intention in DOT to utilize fully this existing capability to support our evolving research and development requirements. Our FY-69 R&D budget is close to \$350 million.

To this end, I have recently visited with Dr. John S. Foster, DOD, Director, Defense Research and Engineering, and I have been most pleased by the responsiveness of DOD in offering such cooperation to our Department. Similar discussions have been held with Dr. Mac Adams, Associate Administrator for Advanced Research and Technology of NASA, as well as Dr. Philip R. Lee, Assistant Secretary of Health, Education and Welfare, and currently, we are actively searching for more cooperative areas. We intend to intensify these positive steps to insure the technology developed for defense and space efforts in both DOD and NASA is available to meet the needs of the Department of Transportation.

My following comments are based upon 10 years experience at the California Institute of Technology's Jet Propulsion Laboratory in the management of electronic research, under Dr. William H. Pickering, who has recently been here to testify, plus work as Deputy Director of Electronics Laboratories at the Ramo-Wooldridge Corporation. This experience has been of great value to me in the insight it has provided in technical management of laboratories pursuing large research and development programs. It has also provided a sound basis for appreciating the concepts of systems engineering and technical direction, as associated with such programs. I have also observed, first hand, many of the problem that have beset contractors during the accomplishments of major projects and am aware of many of the factors critical to determining whether the effort will be successful.

This background convinces me that the Department of Transportation must work jointly in three basic areas with all laboratories that provide support in R&D programs. First, we must assure that detailed planning of the program is *very* thoroughly accomplished and documented. The second key to success relates to the relatively few but critical technical selections and decisions that must be correctly made at the outset of a R&D program. This is the conceptual phase of systems engineering. It is the heart of systems engineering, requiring thorough knowledge of the needs, capabilities, and strong creative talent. For example, such key decisions were involved in the ballistic missile program, when it was decided to emphasize inertial over radio guidance, and ICBM's over IRBM's. With these two first steps successfully accomplished, the third essential ingredi-

ent is the application of organized technical direction to the program. This direction is designed to monitor and control the program on an adequate technical, financial and schedule basis, and to resolve the problems which inevitably develop.

The most important question related to the effective use of the capabilities of various laboratories is in insuring the proper attention to these three basic areas. Obviously, there is no single way to solve this problem. One extreme approach could be the close direct control from DOT which would generate various problems of staffing, communications, and motivation. At the other extreme would be an approach in which a transportation program would be initiated by the given laboratory under only the most general coordination with the Department of Transportation. Regardless of the manner and the degree of flexibility in the approaches, the three basic requirements itemized above must be satisfied—they are fundamental.

One of the first tasks of the Department of Transportation was to pull itself from the existing, but widely scattered, Federal agencies which were combined on its establishment on April 1, 1967. It is now one of the largest Federal agencies—about 95,000 persons—with an annual budget of more than \$6 billion.

The laboratory and the R&D direction capabilities of the Federal Aviation Administration, the Federal Railroad Administration, the Federal Highway Administration, and the U.S. Coast Guard differ widely. They must be enhanced and coordinated to serve as the focus for transportation research and development. In addition, the research laboratories of NASA and DOD, as well as other laboratories, are considered major resources for providing the necessary capability to support this new Department's requirements for advance technology and compliance testing associated with regulatory standards. Since each of these research centers conducts important projects as a means of fulfilling its own technical requirements, the additional requirements to assist DOT involves interagency coordination in handling DOT's research and development while simultaneously providing the opportunity for NASA and DOD laboratories to become more directly involved in practical transportation problems.

Among the transportation research and development activities that exist at the research centers of other agencies, for example, are the responsibility for developing the quiet aircraft engine at NASA Lewis Research Center; the wind tunnel projects aimed at determining the best aerodynamic design for high speed ground vehicles, at NASA Langley Research Center; and the earth tunneling project directed for us by the Bureau of Mines of the Department of Interior. These research and development requirements have been put into the workload schedules of existing Government laboratories. This, of course, is also providing a useful interchange for broadening the mission of specialized laboratories.

We are now in the process of formulating and planning for research and development relating to transportation, which includes a thorough analysis of the kinds of problems to be solved. The requirements that must be satisfied will be better identified and structured into the alternative solutions. From these various requirements will then emerge specific demands for R&D laboratory capabilities and support.

Recognizing the magnitude of our national investment in Federal laboratories, it seems to me, the next logical step should be to determine exactly what laboratory capability is available. The process to accomplish this task could be eased to a large degree if there were available a single source from which the capabilities of all Federally-owned laboratory facilities could be obtained.

Such a source must be able to provide the current and projected status of all laboratories, including programmed new facilities. It would allow each Government agency or organization to determine whether a laboratory exists with adequate capability to satisfy its particular requirements; or whether such a capability is programmed and would be available in the future; and assist in determining the necessity for establishing new laboratories or special test facilities.

In spite of the best planning and programming for laboratory support, there will be cases in which unexpected additional requirements may arise for which quick reaction from a laboratory would be desirable. For example, in transporting hazardous material, the problem of stress corrosion has recently been encountered in tank trucks due to anhydrous ammonia. The task of finding a laboratory that might be available to conduct a testing program related to this problem could be eased if an effective laboratory reference source were available. This is a subject which I think needs further study.

With reference to how mission-oriented laboratories can be responsive to other national problems, again, the first step would be the establishment of the requirements which will utilize laboratory support within a particular area. You have requested comments on how new technology available in laboratories could be applied to crime. We are all aware of the need for better methods to be used in "Signalling for Help" for any possible emergency. Although, I am not prepared to suggest a specific solution, I think the technology of micro-miniaturized transmitters and ground, airborne, or space located receivers to indicate the existence and location of an emergency is similar to that which has been used in the development of radios for air crew rescue in Viet Nam. Such technology could relate to auto, sea, air and medical emergencies as well as to the crime problem.

The laboratory support provided to DOT by NASA and DOD during the R&D phase of the Supersonic Transport aircraft is an example of major laboratory assistance from other agencies. This support has been invaluable. In large part, no doubt, due to the basic similarity of our requirements and capabilities of the specific laboratories. There was no difficulty in arranging for this support. I feel, however, there is much work to be done to make more effective use of the capabilities in other agencies within the framework of the basic policy presently utilized. Before I would be able to make any recommendations as to whether there should be any change in present policy or procedures, we will need to explore this matter in greater detail. The Department of Transportation is currently utilizing some 57 laboratory facilities within 12 other Government agencies and, I might point out, that seven agencies are currently provided laboratory assistance by the Department of Transportation.

Since the establishment of the Department one year ago this week, four different surveys have been conducted to determine the availability and best utilization of Federal laboratory capability necessary to satisfy particular transportation research and development requirements. The FAA, at its National Aviation Facilities Experimental Center (NAFEC) in Atlantic City, has completed a survey on a regional basis, for the Federal Executive Association. The purpose of this was to prepare and issue a directory of facilities, services, and equipment for all Government agencies located in the central and southern New Jersey area.

Last October, the Office of High Speed Ground Transportation, in the Federal Railroad Administration, completed the study, "Aerodynamic Testing of Vehicles in Tubes." This report contained, among other pertinent information, some detailed test facility requirements. The results were used to determine the suitability of existing Federal and industrial laboratories for this purpose.

In compliance with statutory requirements, a comprehensive national survey of laboratory capabilities is now in progress by the National Highway Safety Bureau of the Federal Highway Administration.

Within my own organization, the Office of Hazardous Materials currently is participating in a Departmental task force on hazardous materials, requiring a survey to determine the suitability of existing Government laboratories for the testing of hazardous materials involved in transport. The results are due soon and we hope they will lead to arrangements for utilizing existing Federal laboratories since, at the present, most all of such hazardous material testing is performed by contract or industrial laboratories.

Before any new facilities are recommended, the results of the above studies will be analyzed to determine whether our responsibilities could be best satisfied by expanding existing facilities or utilizing non-Government capability.

The Federal laboratory capability for all modes of surface transportation is quite limited, compared to that available for air transportation. However, as we look at the total dollar investment in the various modes, we find that the aircraft segment is less than 10 percent of the total (public and private), as indicated by the National Science Foundation.

I think we can be proud of the job FAA has done in starting the development of the National Air Space System for air traffic tracking and control and safety. However, I observe that the technological resources and sophistication in present systems are considerably below those used in the tracking and control of space vehicles. I am extremely interested in increasing the use of NASA's technological resources in this particular area. I think there is much to be gained by assigning new missions to existing laboratories. However, thorough analysis must be made to assure that the existing laboratory has proven capability to take on and accomplish new missions. There can be many advantages to the estab-

lishment of a new laboratory if the equipment, facilities, and staff of an existing laboratory are not compatible with or capable of performing the new mission.

The degree to which a laboratory director is provided undirected funds to respond to new areas of opportunity is, I think, a strong indicator of the confidence senior managers have in the leadership and accomplishment capability of the laboratory. I think such funds are vital to instill the motivation and challenging attitude that are necessary for a successful and dynamic laboratory. I believe these funds should be provided with the broadest of guidelines consistent with the basic mission of the parent agency. If the guidelines are detailed, requiring extensive administrative procedures, the initiative and motivation essential to the generation of new ideas will be missing.

An important ingredient for success of a laboratory is the ability to react quickly to new and creative ideas, either by in-house effort or contract support. Unprogrammed funds available to the laboratory director will provide for this quick reaction capability. Close monitoring of the laboratory use of undirected funds will provide a basis for determining further allocations or possible changes in laboratory leadership.

Until the total R&D program for the Department has been developed this coming year, it would be premature for us to establish specific guidelines for the allocation of current missions to existing laboratories or to determine the need for new laboratories. I certainly plan to obtain information and guidance on this subject from other departments with whom we will be working and who have had extensive experience in the establishment of such guidelines.

The development of DOT's research and technology competence is expected to be accomplished in several steps or phases, indicative of the type of mission with which Congress has charged us—to facilitate the development and improvement of coordinated transportation service and to stimulate technological advances in transportation.

Looking toward the future of our new Department, our research and development plans are still in an evolving state. However, we do have many areas in which planning effort is underway, such as noise abatement, airport planning, auto safety, VTOL, and air traffic control.

In summary, there are several points I would like to leave with you:

(1) It is essential that we make the maximum utilization of the high technological capability developed by previously expended funds in DOD, NASA, and elsewhere.

We must assure that the state of the technical art in the "high technology" areas is available and utilized in solving the problems of transportation research and development. In order to achieve this, it is essential that we recognize and devise means to specifically deal with the functions I described earlier: Those of detailed and documented planning, key technical selection and decision, and positive program technical management control.

(2) The Department of Transportation relies heavily upon the research laboratories of other agencies, foundations, universities, and those of private industry for technical competence to effectively carry out its transportation R&D responsibilities.

(3) The Department of Transportation's laboratory capabilities are a limited resource that has directed its efforts in the past primarily to development problems; therefore, requiring research support from other sources.

(4) The Department of Transportation is in the process of establishing greater technical competence within each modal administration.

(5) The Department of Transportation is supporting other agencies in program needs within the overall area of transportation and the technical competence within the limits of its resources available for carrying out its own programs.

I would like to close by stating that we strongly endorse the concept of utilizing these laboratories which have been established over long periods at great expense to the Federal Government, and either presently have or can be expanded to provide the capability and competence to react to the important R&D requirements of our Department.

QUESTIONS SUBMITTED TO FRANK W. LEHAN BY THE SUBCOMMITTEE ON SCIENCE RESEARCH AND DEVELOPMENT

1. How much research is DOT funding in NASA and DOD laboratories and what is the purpose of such research?

OFFICE OF THE SECRETARY

The amount of research currently funded by this Department in DOD and NASA laboratories is limited. It should be recognized, however, that various laboratories, particularly NASA's, undertake research on behalf of and of direct interest to this Department. This research is an support of activities such as aircraft noise abatement, SST design, air cushion vehicle dynamics, and transoceanic aircraft communications improvement.

FEDERAL HIGHWAY ADMINISTRATION

National Highway Safety Bureau

"Human Impact Tolerance.—Holloman Air Force Base, U.S. Air Force Systems Command. This effort is being funded at the rate of \$100,000 during FY 68. The purpose of this work is to establish by dynamic sled tests the impact of tolerance of humans of varying dimensions, weight, and sex. The results of this will assist the Bureau in establishment of motor vehicle safety performance standards relating to the crashworthiness of vehicle interiors."

"Wide Oval Tire Testing.—Army Tank Automotive Command, U.S. Army Materiel Command. This effort was funded for \$6,000 during FY 68. The purpose of this effort is to obtain selected measurements on Firestone wide oval tires with respect to determining alleged sidewall weakness in early production."

FEDERAL RAILROAD ADMINISTRATION

Office of High Speed Ground Transportation

"Presently none is being funded. However, OHSST has made a strong effort to utilize the capabilities of other Government agencies in work on advanced technology. As an example, NASA has made a major contribution to our Tracked Air Cushion Vehicle Project through the participation of their aerodynamic experts and the conduct of wind tunnel tests at their Langley Research Center (no transfer of funds).

"The Langley support is expected to continue. The Naval Research Laboratory has demonstrated for us the capability of high velocity projectiles fired by light gas guns to fracture rock (no transfer of funds).

"The Air Force has loaned three T-64 turbine engines which are being used on the linear motor testing program (no transfer of funds).

"Wind tunnel tests of railroad car models were completed by the Naval Ship R&D Center (funded at \$14,000)."

UNITED STATES COAST GUARD

"The Coast Guard is funding a few testing projects in DOD laboratories, but little or none of this work could properly be classified as research."

FEDERAL AVIATION ADMINISTRATION

FAA is not funding any work in NASA labs. The following projects are being funded in DOD labs.

Laboratory	Program	Fiscal year 1968 funds
Air Force Weapons Laboratory	High altitude radiation tests	\$63,000
U.S. Army Aviation Material Laboratory, Fort Eustis, Va.	Demonstrate to FAA a typical civil transport pilot's armored seat (510-004-18H).	4,000
Aviation Medical Acceleration Laboratory, Naval Air Development Center, Johnsville, Pa.	FAR-25 jet pilot reaction during flight in heavy atmospheric turbulence (540-011-01H).	25,000
USAF Flight Dynamics Laboratory, WPAFB, Ohio	Investigate force wheel steering (560-002-08H).	35,000
U.S. Navy Aircraft Engine Laboratory, Philadelphia, Pa.	Investigation of relative crash fire hazards of jet fuels (520-005-04X).	84,000
Total		221,000

The SST Office directly funds very little research in NASA and DOD laboratories. A great deal of support is provided the SST from NASA and DOD, and the funding of that research is accomplished through the normal budgetary process of those agencies.

This generally means that NASA and DOD would request funds for SST work and use their own appropriated moneys to carry it out. There are certain exceptions to this; for example, it is standard practice at the Air Force Arnold Engineering Development Center that the cost of using their facilities is paid for by the users. In the case of the SST program, the cost for using the Arnold Center facilities is paid under the SST contract with Boeing.

2. *In your statement, you refer to a single data source to provide current and projected status of all laboratories. Would you estimate what the cost of this operation would be, and do you believe it would be of sufficient benefit to agencies to justify the cost?*

OFFICE OF THE SECRETARY

The Committee on Federal Laboratories of the Federal Council for Science and Technology is presently considering this matter of a single source of information on laboratories. Considerations of benefits versus costs of collecting and maintaining such information should evolve from their findings.

3. *Please describe the extent to which other agencies have submitted proposals to DOT for the funding of research, the purpose of the research, and the status of the proposals.*

FEDERAL HIGHWAY ADMINISTRATION

Bureau of Public Roads

"At the present time, no proposals from NASA or DOD for the conduct of contract research are before the Office of Research and Development, Bureau of Public Roads. A project from AEC is under development, probably for FY 1969 funding, to evaluate a radioisotope method for determining cement content in plastic concrete."

National Highway Safety Bureau

The proposals received from other Government agencies and their status are as follows:

Agency	Subject matter	Proposal date
National Bureau of Standards.....	Occupant restraint performance standards.....	Dec. 29, 1966.
Do.....	Tire systems; occupant restraint systems; braking systems.	Revised Feb. 15, 1967. Mar. 10, 1967.

"These two proposals led to the following contracts:

Contract FH-11-6090—Tire Systems—due June 30, 1969:

Fiscal year 1967.....	\$870,000.00
Fiscal year 1968.....	990,000.00

Contract FH-11-6091—Restraint Systems—due June 30, 1969:

Fiscal year 1967.....	291,162.70
Fiscal year 1968.....	320,000.00

Contract FH-11-6092—Braking Systems—due June 30, 1969:

Fiscal year 1967.....	379,000.00
Fiscal year 1968.....	439,000.00

"Air Force Systems—Holloman Air Force Base submitted no formal proposal. However, an interagency agreement exists for the performance of Human Impact Tolerance in the amount of \$92,000, due June 30, 1968."

FEDERAL RAILROAD ADMINISTRATION

Office of High Speed Ground Transportation

"The Environmental Science Services Administration, Boulder, Colorado, is engaged in a theoretical and experimental study of the feasibility of surface wave transmission to provide required high speed ground transportation system communication without frequency allocation. (First year's funding, \$295,000.) A proposal for follow-on research is now being evaluated.

"The National Bureau of Standards is funded at a \$775,000 annual level to do adaptive modeling, network simulation, and data processing for the North-east Corridor Project. The Bureau of the Census is funded at \$300,000 annual level to determine reasons for changing travel habits. This involves a household survey and is being performed prior to and during the rail passenger demonstration."

3a. What steps has DOT taken to make other agencies aware of its research needs and the problems it wishes to resolve?

OFFICE OF THE SECRETARY

This Office, as well as offices in the operating administrations, devotes considerable effort in planning and coordinating research and development by serving on interagency committees which are concerned with subjects such as aeronautics, marine sciences, weather, standards, information, and communications. For example, this Department provides coordination of all Government activities in aircraft noise reduction through the Interagency Aircraft Noise Abatement Program. In addition, visits are made to the research facilities of not only other Federal agencies, but also academic institutions and transportation related industries. The specific purpose of these visits is to interchange information on ongoing and planned research and promote interest on the part of others to orient their research to complement and augment ours.

FEDERAL AVIATION ADMINISTRATION

"FAA communicates its R&D needs and problems to other agencies by liaison, coordinating committees, interagency agreements for services and equipments, information exchange programs, and distribution in certain instances of technical planning and program status of performance documents. The following are examples:

"The participation of military personnel in carrying out agency functions, as specified by section 302(c) of the FAA Act of 1958, acts as a means of coordination of R&D effort with the Department of Defense. Further, coordination of plans, programs, policies, and requirements with the Department of Defense, at the agency level, is accomplished by an exchange between the FAA Defense Coordination Advisory Committee and the DOD Advisory Committee on Federal Aviation. This channel provides a means of coordinating significant programs which have major impact upon either DOD or FAA.

"Within the framework of the Defense Coordination Advisory Committee, provision is made for subcommittees and working panels or groups. Through this arrangement, a number of working groups have been established for the purpose of coordinating major programs of going concern. As a further military coordination mechanism, agreement between FAA and USAF provides for liaison to FAA from the Air Force Systems Command, the Air Force Communications Service, and the Air Defense Command.

"Specific formal coordination of FAA R&D plans with the DOD is provided for by exchange between the agency Associate Administrator for Development and the Chairman, Research and Engineering Sub-group of the DOD Advisory Committee on Federal Aviation.

"Close and continuing liaison in regard to all R&D activities is also maintained with the NASA, other Government agencies, and industry. The principal focal points of this coordination are:

1. FAA/NASA Coordinating Committee
2. Government Task Force on Interurban Air Transportation
3. The Federal Council for Science and Technology
4. Interdepartmental Committee for Atmospheric Sciences (ICAS)
5. Interdepartmental Committee for Applied Meteorological Research (ICAMR)
6. FAA and the Environmental Science Service Administration Agreement
7. Council of Research Advisory
8. Science Information Exchange

"The purpose of such coordination is to avoid any duplication of effort, to produce appropriate divisions of labor, to obtain optimum utilization of Government resources and capabilities, to produce effort integration whenever appropriate, and to assure that maximum civil aviation benefit is derived from

military, NASA, and other Government agency expertise, facilities, and R&D program products."

In the SST program, there is a continuing technical interchange with NASA. In addition, there is a formal Data Exchange Program in which pertinent engineering and operational information is provided the SST program from various DOD laboratories.

"The Office of Aviation Medicine has made the Department of Health, Education, and Welfare (Public Health Service) aware of FAA research needs in the cardiovascular area and the effects of these conditions on safety in the National Aviation System, and has an agreement with the Public Health Service for partial support of FAA aeromedical requirements."

FEDERAL HIGHWAY ADMINISTRATION

Bureau of Public Roads

"We have made no particular effort to invite such proposals from other Government agencies for laboratory work in the fields of our concern, due to extremely limited availability of contract funds; for example, in the cast of bridge structural research, 0.22 of one percent of the cost of bridges. However, there are frequent interagency technical discussions along these lines, such as a current with NASA and AEC on non-destructive testing of structures."

National Highway Safety Bureau

"Procedures similar to those involved in informing private industry, i.e., publication in the 'Commerce Business Daily'. Also, we publish documents describing the work currently in progress which may be utilized to project what our future efforts and interests will be."

FEDERAL RAILROAD ADMINISTRATION

Office of High Speed Ground Transportation

"Annual reports have been published and over 100 research reports have been distributed through the Clearinghouse.

"Visits have been made to other Government laboratories by OHSGT and contractors for both acquainting the laboratories with the OHSGT and consultation on technical problems. These laboratories include the Lewis Research Center of NASA, the Air Force Materials Laboratory, the Army Mobility R&D Laboratories, the Bureau of Mines Laboratories, and the Army Communications Laboratory at Fort Monmouth."

U.S. COAST GUARD

"Awareness of Coast Guard R&D needs and problems is generated by the following methods:

"1. Personal contact with R&D personnel of other agencies who are working on projects of interest to, or possible application to, the Coast Guard.

"2. Exchange of information through such organizations as the Interagency Committee for Marine Research, Education, and Facilities; and the Interdepartmental Committee for Applied Meteorological Research."

3b. Do you believe that discretionary funds should be available to laboratory directors to fund research relevant to national problems up to the point where proposals may then be submitted to the responsible agency? What do you see as the advantages and disadvantages of such a concept?

OFFICE OF THE SECRETARY

We believe that discretionary funds should be made available to laboratory directors in an amount up to 5-10% of the laboratory's total funding. The criteria governing qualification for such funding should be determined by the laboratory's parent organization.

We do not believe that funds should be provided to all Government laboratories for the particular purpose of developing proposals to other agencies, but rather that truly discretionary funds should be considered an intrinsic part of the operation of a research laboratory and that the director and the agency operating such a laboratory should be constantly watchful for ways in which they can uniquely serve the national interest.

FEDERAL HIGHWAY ADMINISTRATION

Bureau of Public Roads

"We recommend a cautious and conservative approach to the authorization of discretionary funds for use by laboratory directors in support of research relevant to national problems. (See comments on question 6 also.) It is our understanding that the existing Federal laboratories have been legally established on rather firm functional bases that testify to the efficacy of such assignment and the enhancement of professional competence in their respective spheres of program responsibility. Moreover, we would construe that the continued existence and Congressional support of such mission-oriented laboratories have been appropriately predicated on the periodic provision of convincing evidence of staff responsibility and effectiveness in the performance of specified assignments. When the researches conducted in one functional laboratory produce a spinoff potentially applicable in another functional area, we believe that the pursuit of that potential would best be conducted by staff of the agency having background experience and program responsibility in that area."

National Highway Safety Bureau

"In response to the first question in this sub-paragraph, I feel laboratory and/or research Directors should definitely have a specified amount of discretionary funds available for use in response to highly promising unsolicited proposals. The advantages of such a concept far outweigh any disadvantages that may attribute to such a plan. It is inherent in the research and development field to receive, from either in-house or outside sources, such new and promising ideas, concepts, and approaches to the solution of a given problem. To delay the funding of such proposals due to the prior commitment of available funds, is to allow these highly promising areas to slip or go completely unfunded during a given program year. The only disadvantages to such a concept would be related to the inappropriate use of these funds, and the fact that with a predetermined dollar amount, some proposals would not be funded and this could create hard feelings on the part of those proposers who do not receive support."

U.S. COAST GUARD

"Coast Guard laboratories are now equipped and staffed for testing, evaluation, and prototype development work. The allotment of discretionary research funds to Coast Guard laboratories would not be appropriate at present. Considering research laboratories in general, advantages of the use of discretionary funds include the stimulation of creativity and generation of interest in problems among some of the scientists best able to attack them. Disadvantages include the diversion of some laboratory funds and man-hours from the parent agency's immediate needs, and the possible excessive generation of research proposals which cannot compete effectively for available support."

FEDERAL AVIATION ADMINISTRATION

"In a research and development environment characterized by the availability of unlimited funds, the provision of discretionary funds under broad guidelines and minimum of administrative controls to laboratory directors might be desirable in many situations.

"However, in the past and current research and development environment of FAA, funds have been limited, and inadequate to meet the burgeoning needs of increasing air traffic, larger and faster aircraft, congested airports, and obsolescing ground facilities. In the transportation field, in the words of the President (President's message, April 5, 1962, House Doc. 384, 87th Congress), 'research has been fragmented, unsteady, inadequate in scope and balance.'

"In this type of limited R&D funding environment, discretionary funds allocation to laboratory directors, as a general practice, would not appear desirable. Effective research and development management requires efficient technical program planning and close control of funds, as well as the provision of a mechanism for quick reaction to emergency projects. To the extent that discretionary funds would adversely affect technical program planning and conservation and management of limited funds, it would be undesirable.

"We believe a laboratory director should have some funds available to him to give him a quick reaction capability to respond to areas of opportunity, consistent with the basic mission of the parent agency; and that, if the guidelines are de-

tailed, requiring extensive administrative procedures, the initiative and motivation essential to the generation of new ideas will be missing."

4. *How many new laboratories are being planned by DOT for the next five years? For what purpose? What cost?*

OFFICE OF THE SECRETARY

This office and the operating administrations are currently reviewing the Department's needs for laboratories and are in the process of developing a facilities requirements plan. In this planning effort, the need to integrate the requirements of the several administrations, where practicable without compromise to the research function, is clearly recognized. In addition, serious consideration is being given to the utilization of research capabilities elsewhere in Government on a major scale.

5. *While the present Laboratories Committee of the Federal Council for Science and Technology is concerned with Government laboratories as such, with the exception of Dr. Astin, its members are not working laboratory directors. What advantages and disadvantages do you see for establishing a small Council of Federal Laboratory Directors that would represent the views of both directly- and Contractor-operated Federal laboratories at the Executive Office level?*

OFFICE OF THE SECRETARY

Although there might be certain merits to the establishment of a small Council of Federal Laboratory Directors, it might be difficult, if not impossible, to have such a small group set forth the views of a much larger group. As pointed out by the Federal Highway Administration, managerial problems could result.

FEDERAL HIGHWAY ADMINISTRATION

National Highway Safety Bureau

The primary advantage of the small Council of Federal Laboratory Directors would undoubtedly be the direct line of communication to the Executive Office regarding policy and procedural matters relative to the management and operation of Government laboratories. Disadvantages could be the bypassing of higher echelons within one's own Department, and the fact that laboratories of differing fields and different departments face different problems in their programming and execution. I would suggest the first consideration be given to Department-wide committees whereby laboratory directors could have a forum at the highest level where common problems could be examined and resolved."

FEDERAL AVIATION ADMINISTRATION

"There are more than 7,000 research and development industry and Government laboratories. The creation of a 'small' Council to represent the views of such a multitude would appear to be a complex project. On the other hand, if it was possible to establish a small Council which would be representative of these diverse laboratories, it would be advantageous to be able to deal with such an organization on many laboratory problems of national scope rather than trying to coordinate with individual interests."

6. *As a general policy, do you believe that discretionary funds should be made available to all laboratories or only those which have demonstrated quality work (a reward for competence)?*

OFFICE OF THE SECRETARY

Discretionary funds should be made available to all laboratories subject to the qualifications expressed in the answer to question 3b.

FEDERAL HIGHWAY ADMINISTRATION

Bureau of Public Roads

"As a matter of general policy, some discretionary funds might be made available to laboratory directors, perhaps at some initial minimal level, to encourage the development of innovative and creative research approaches to national problems. Some limitations may be advisable to restrain any tendency to merge specific program functions into an over-generalized composite structure such as might obscure significant aspects of specific researchable problems, per-

haps inhibit valid assessment of desirable priorities, and possibly lead to needless duplication of effort. It would appear desirable, in authorization legislation, to make provision that would insure close liaison between a laboratory utilizing discretionary funds to generate research proposals and the agency that would have program responsibility for carrying on the research. Close communication and exchange of ideas, even prior to the initial generation effort, should operate to improve both the relevancy and the coverage. As indicated in our response to question 3b, we would favor controls that would permit the withdrawal of a discretionary fund authorization in the event of failure to demonstrate progress and accomplishment in its use."

National Highway Safety Bureau

"Discretionary funds should be made available to all laboratories, but obviously the amount should be controlled by the past performance of the laboratory. This past performance evaluation should be performed on the general and discretionary funds. Laboratories with prior records of nonquality work may well have found that the lack of discretionary funds had hindered their performance by restricting their response to promising unsolicited work."

U.S. COAST GUARD

"Making discretionary funds available only to laboratories which have demonstrated quality work might stifle efforts to improve other laboratories. A limited award of discretionary funds could be a significant impetus to generate enthusiasm and creativity in the laboratories which have not produced the most outstanding results."

FEDERAL AVIATION ADMINISTRATION

"Making discretionary use of funds available to laboratories on the basis of competence would, in our opinion, be extremely difficult since we know of no widely accepted criteria to judge the competence of laboratories. It appears that all laboratories should be provided some level of discretionary 'quick reaction' capability as outlined in our comment to question 3d above."

7. The DOD witness proposed the elimination of manpower controls on cross-agency work in order to achieve flexibility similar to that available to the AEC contract laboratories. What is your opinion of this proposal?

FEDERAL HIGHWAY ADMINISTRATION

National Highway Safety Bureau

"Manpower controls need not be eliminated as long as each Agency or Department recognizes requirements for cross-agency efforts."

FEDERAL AVIATION ADMINISTRATION

"Eliminating manpower controls on cross-agency work could be used as a method of circumventing national resource allocation decisions made in the fiscal process. If such controls were eliminated, some other means would need to be used to prevent this."

Mr. ROUSH. Our next witness is Thomas F. Rogers, Director, Office of Urban Technology and Research, Department of Housing and Urban Development.

(The biography of Thomas F. Rogers follows:)

THOMAS F. ROGERS

T. F. Rogers, Director of the Office of Urban Technology and Research in the Office of the Secretary of the Department of Housing and Urban Development, was born in Providence, R.I., on August 11, 1923. He attended elementary and secondary schools there, and received his B.Sc., cum laude, in Physics, from Providence College in 1945. In 1949 he was awarded the M.A. degree, in Physics, from Boston University.

During his professional career, Mr. Rogers has held industrial, university and Government positions.

Among those held were the following: research associate, the Radio Research Laboratory of Harvard, 1944-45; TV project engineer, the Bell & Howell

Company, Chicago, 1945-46; electronic scientist with the U.S. Air Force Cambridge Research Center, Bedford, Mass., 1945-54; associate group leader with the Lincoln Laboratory, Massachusetts Institute of Technology, Lexington, Mass., 1951-53; laboratory head, U.S. Air Force Cambridge Research Center, Bedford, Mass., 1954-59; head, communications division and member of the steering committee, Lincoln Laboratory, M.I.T., 1959-64.

Early in 1964, Mr. Rogers took leave from M.I.T. to accept an appointment with the Department of Defense as an Assistant Director (Communications & Electronics) of Defense Research and Engineering in the Office of the Secretary of Defense. In 1965 he was promoted to a Deputy Director (Electronics and Information Systems). In this capacity, he was responsible for managing large research, development, engineering and systems programs in such areas as electronics, communications, data handling, reconnaissance, and command and control—programs budgeted at billions of dollars during his tenure. In particular, he was instrumental in bringing into being D.O.D.'s satellite communications global network.

Mr. Rogers has received several special awards including the Outstanding Civil Service Performance Award in 1957, a Certificate of Commendation from the Office of the Secretary of the Navy in 1961, and the Meritorious Civilian Service Award from the Secretary of Defense in 1967.

In May, 1967, Mr. Rogers was appointed by Secretary Robert C. Weaver as the first Director of the newly created Office of Urban Technology and Research. This Office serves as the focal point for the stimulation, coordination, analysis and evaluation of all research and development activities related to H.U.D. programs and responsibilities.

His scientific and engineering publications reflect his professional work on various aspects of radiowave propagation, communications, electronic memory devices, ultrasonics and molecular physics.

Mr. Rogers has been a member of several inter-Agency Government groups, including the Aeronautics and Astronautics Coordinating Board (i.e., the AACB). He has served on such Government advisory groups as the Communications Satellite Panel of the President's Scientific Advisory Committee, and was a member of the United States delegation to the United Nations' Geneva meeting on the Application of Science and Technology for the Benefit of Less Developed Areas.

He is a Member or Fellow of several national and international scientific and engineering institutes and societies, a Fellow of the Institute of Electrical and Electronics Engineers, and a past member of its Board of Directors. He is also a member of the Cosmos Club.

STATEMENT OF THOMAS F. ROGERS, DIRECTOR, OFFICE OF URBAN TECHNOLOGY AND RESEARCH, DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Mr. ROGERS. Good morning, Mr. Chairman.

Thank you for your invitation to appear before your subcommittee to allow the views of the Department of Housing and Urban Development to be expressed on the subject of your interest here: how best to utilize the Federal laboratories.

Appearing with me is Mr. Albert Weinstein, my Assistant Director.

If I may, Mr. Chairman, since I have not heretofore appeared before you, I would like to submit my biography for the record—simply observing, at this point, that by professional education and experience I am a physicist—electronics engineer who, through the years, has gravitated toward the administration of scientific and technological activities. Immediately prior to joining the Department of Housing and Urban Development, I was a Deputy Director of Defense Research and Engineering in the Office of the Secretary of Defense. At present, I am the Research and Technology Director of HUD.

Studies and research concerning housing, metropolitan growth, and other urban problems were authorized in the Housing Acts of 1948 and 1956. Additional legislation has authorized studies and so-called

"demonstrations" in discrete areas related to urban renewal, housing, planning, and transportation. Each of these authorizations was granted by the Congress in recognition of the expanding need for new ideas and new approaches to cope with the emerging problems of our urban areas.

The past few years have seen greatly increased recognition given to the need to apply both the methods of scientific inquiry, and the techniques and products that can be developed by modern technology, to the solution of our many pressing urban-related problems.

The 89th Congress, when it created the new Department of Housing and Urban Development, called upon the Secretary to "conduct continuing comprehensive studies and to make findings available with respect to problems of housing and urban development;" and, subsequently, the Demonstration Cities and Metropolitan Development Act of 1966 directed the Secretary to:

(1) Conduct research and studies to test and demonstrate new and improved techniques and methods of applying advances in technology to housing construction, rehabilitation, and maintenance, and to urban development activities; and

(2) Encourage and promote the acceptance and application of new and improved techniques and methods of constructing, rehabilitating and maintaining housing, and the application of advances in technology to urban development activities, by all segments of the housing industry, communities, industries engaged in urban development activities, and the general public.

In response to this charge, the President requested funds to allow the Department to inaugurate a general research and development program in 1967, and Secretary Weaver established an Office of Urban Technology and Research, and selected its head, all before midyear 1967.

Also, late in 1967, the Department of Housing and Urban Development, by Executive order, was made a member of the Federal Council of Science and Technology; the Director of the Office of Urban Technology and Research was appointed as the Department's representative.

The Congress appropriated \$10 million for the Department's general research and technology program in fiscal year 1968. Taken together with previously authorized R. & D. programs in specific areas—for example, transportation, low-income housing, urban renewal, et cetera—the Department's total program level for urban-related contract and grant research activities approximates \$25 million in the current fiscal year.

The Department's new Office of Urban Technology and Research, which I head, has been assigned a "line" responsibility for the management of specific research and technology programs; but beyond this, and acting in conjunction with the Department's Assistant Secretaries, the Office is expected to serve as a focal point for HUD's entire research, development and demonstration program, and for the coordination of that program both within the Department and with other Federal departments and agencies.

The Department continues to gather the nucleus of a professional and administrative staff. We now have about fifteen in my office and that many again in the other Departmental Offices. Also the Department is initiating fundamental internal R. & D. administrative procedures; appropriate professional personnel have been appointed in each

Assistant Secretary's office to work with the staff of my office on both the planning and operating levels.

The general areas of proximate research and development concern to HUD can be described under the following general headings:

- (1) Housing.
- (2) Land use and community environment.
- (3) Public facilities and services.
- (4) Efficient local administration.

The Department of Housing and Urban Development bears the principal responsibility for a unified Federal approach to urban problems. Consequently, in response to a suggestion of the Special Assistant to the President for Science and Technology, the Department has taken the initiative to establish contact with the other Federal departments and agencies now conducting urban-related research and development programs.

The Department has maintained close contact with the President's Committee on Urban Housing (the "Kaiser Committee"), the National Commission on Urban Problems (the "Douglas Commission"), and elements of the Department of Commerce and the Department of Defense concerned with low-cost housing research and development.

Similarly, assistance has been provided to the President's Commission on Civil Disorders (the "Kerner Commission"), in its effort to identify the sources of urban riots and unrest, and the President's Task Force on Communications Policy (under Eugene V. Rostow) in its concern for new urban-related communications technology development.

In this context, the Department is endeavoring to identify the most critical areas requiring research and development activities, recognizing that the formulation of a truly comprehensive and balanced R. & D. program will require further study and experience.

The professional R. & D. staff has been making searching inquiries into the problems facing the Department's operating programs in order to express those of a scientific or a technological nature in useful scientific and engineering terms; to rank-order them in importance and urgency; to try to imagine analytical and/or experimental studies that might be mounted to ameliorate or solve them; and to lay out such programs and projects as would effectively address them.

Two important steps were taken immediately to obtain extra-departmental assistance in analyzing the broad spectrum of urban problems from a scientific and technological viewpoint:

(1) The Rand Corporation was supported in its conduct of two intense summer studies (one in concert with the Department of Transportation) employing both its own staff members and individual experts of appropriate discipline and experience background.

(2) The National Academy of Science and the National Academy of Engineering agreed to study, deeply, certain of the Department's fundamental research and development goals and needs, and to identify broad strategies addressed to harnessing both the social sciences and the physical sciences in a search for solutions to our most pressing urban problems. Here, emphasis on the behavioral and social sciences gives clear formal recognition to the important fact that a comprehensive, objective and quantita-

tive understanding of the basic needs of those of our people who now reside, or will reside, in our urban regions is fundamental to the prompt, effective, and efficient structuring of Federal and local programs addressed to meeting them.

It has been clear for some time that the Federal and local governments simply do not have available to them a sufficiently large number of sophisticated and disciplined minds capable of studying urban problems truly comprehensively, and in such a fashion as to offer prompt and confident assistance to officials responsible for formulating and administering urban-related policy. Therefore, under the direction of the President, planning is well advanced toward the establishment of an Institute of Urban Development. The Institute is visualized as a nongovernment agency, but one which would maintain continuous relationships with the Government across the areas of national policy and the programs involved in the problems of our urban regions. It would be so constituted as to be able to draw freely upon the best talent available in private enterprise, public administration, and the academic community.

As a result of very careful thought, the following areas thus far have been judged to be of such overriding importance as to warrant our greatest and most immediate R. & D. attention:

- (1) Volume production of low-cost housing.
- (2) Study of the social and behavioral problems related to the provision of housing to lower income families.
- (3) Improvement of urban mass transportation.
- (4) Development of the model cities program.
- (5) Exploitation of the Federal surplus urban land program.
- (6) Establishment of an effective information exchange network.

While there are, of course, many other urban problem areas that clearly require early study, and a substantial number of them will receive such study in 1968 and 1969, these are the ones which have been selected to receive our greatest early emphasis.

Against this general background, then, I would make a few observations directed toward the specific concerns of this hearing.

First, we have met with those responsible for the research and development activities of 14 other Federal departments and agencies—and agencies in certain cities as well—and, as might be expected, have learned that the vast majority of them do have programs with urban-related concerns. In these preliminary discussions we touched briefly on the subject of laboratories and test facilities.

Second, the limited time and staff available to date have not allowed us to proceed beyond this first step in the establishment of an inter-agency information "network" designed to ensure that the results of these programs are truly effective when examined in the context of urban needs. But this is our firm intention, and we are holding conversations with the Department of Commerce and the National Science Foundation to obtain their advice and, perhaps, assistance in this endeavor.

Third, in those areas of concern to us that have a potentially high technological content, for various reasons we have decided to concentrate, by far, the bulk of our immediate attention on that of low-cost housing. And here, we have concluded that, for the immediate

present, we are not constrained in reaching our departmental goals by important technological limitations. As a consequence, we do not believe that we now need special test facilities, or large laboratory programs of development or engineering. In time, the situation may well change, but that is our present view. Rather, in this and other areas, we consider the cities in a sense to be our "laboratories"—or, at least, the environment of the cities is that in which we must concentrate our early attention so that we may begin to obtain the data, information, and experience required to allow us to make confident judgments regarding our future R. & D. course.

Fourth, we have transferred funds to the Department of Commerce for three separate activities: (a) earthquake damage studies by the Environmental Science Service Administration, (b) housing market surveys by the Bureau of the Census, and (c) a study of low-cost housing performance specification by the National Bureau of Standards.

Fifth, we have entered into a joint study with the Department of Defense of the opportunities for cost reduction in low-cost family housing through the creation of large coherent housing "markets."

Sixth, we are discussing the possibility, with the Atomic Energy Commission, of their undertaking studies for us of certain areas in which they have particular competence and interest.

Seventh, we have reached agreement with the Department of Transportation to develop, jointly, a program of projects and priorities for urban-related transportation research development and demonstration.

In conclusion, then, I would make two general observations:

First, one the basis of my experience at HUD, and the information presently available to me, I would agree with the view expressed by Dr. Hornig earlier in these hearings. I have not encountered any policy or procedure that has hindered this Department from using another's capabilities.

Second, as R. & D. programs grow from their present infancy and, I trust, develop to meet the massive, complex and urgent problems of our cities, this Department will continue to exercise consistent initiative in exploring the possible use of Federal laboratories in their solution. Before we can do so on a large and effective scale, however, it is my judgment that we shall have to develop both a deeper comprehension on the part of the scientific and engineering community of our true urban problems, and greater experience in applying very broad professional teams composed of behavioral and physical scientists, engineers, planners, and so forth, to their solution.

Mr. ROUSH. Thank you. There is one thing that is apparent. You have enough problems which need solution.

Mr. ROGERS. Yes, Mr. Chairman.

Mr. ROUSH. I wonder if you could just perhaps elaborate on your experience with the National Bureau of Standards and its building research program as an illustration of HUD obtaining R. & D. from other agencies? How was this initiated? How has it proceeded?

Mr. ROGERS. There has been both a pragmatic and a formal method in which this arrangement came about. The remote routes to the present arrangements lie in the simple fact that I have been a professional acquaintance of the former Assistant Secretary for technology in the Department of Commerce, Dr. Holloman, and worked with him when

I was in the Department of Defense on a number of problems of joint concern.

Therefore, because of that acquaintancy, and because of the fact that in my previous professional life I have been close to the Bureau of Standards scientific and engineering community, I did know of their general areas of interest and of their general competence.

Within the past 6 months we have begun to develop a fairly broad strategy throughout the Department for beginning to attack the problem of producing much larger quantities of low-cost housing for our lower income families. For various reasons, it appeared important to us that we examine the question of performance specifications.

Now, this is a fairly well-known way of designing, developing, and procuring materials in Defense and other areas. It is not a common way of specifying housing needs. That is to say, we would like to be able to specify what we wish in a low-cost house, not in terms of the components and the materials alone, but rather in the performance of the building that you would expect in terms of its safety, its sanitary characteristics, and so on.

Since the Department of Commerce's National Bureau of Standards has a very competent group in the building area, I spoke informally to John Eberhard who is the head of the group containing that activity and we gradually came to the conclusion that, in fact, the Bureau could and would be willing to study the matter of performance specifications. Later, we formally transferred some funds to them to work against a specified work statement and a schedule, and they are engaged in that activity now.

The hope here—more than that, I would say in my view, the trust here—is that when we learn how to describe our low-cost housing needs in terms of performance, and we further learn how to test for this performance, this will allow and encourage innovation in the housing field of a sort that would profit industry, the Government, and our lower income families.

Mr. ROUSH. Thank you.

Mr. Brown?

Mr. BROWN. This Institute of Urban Development that you mentioned, is this a facility or an organization which you contemplate would be doing broad research on the total problems of urban development?

Mr. ROGERS. Mr. Brown, if I may, and I believe you will appreciate this, I would exhibit just a bit of hesitancy in responding in detail to your question, since the precise form and character of the Institute is being developed under the President's direction at the moment.

But I do think it fair to observe that, at least for the moment, I would not expect it to need laboratory facilities beyond, say, computational facilities. I don't expect—again, for the moment—that it would be engaged in technological activities. Rather, I would imagine that it would bring together people of various scholastic attainments and experiences in the broad urban field to begin to make a consistent, detailed, and a comprehensive study of the urban scene, focusing attention on our deep urban problems and, hopefully, coming to conclusions that would be of value to those in the government—and not the Federal Government alone, I might add—those in the government who have policy responsibilities.

Mr. BROWN. In other words, this is a policy research rather than a scientific or developmental research? I have seen it described as an "Urban Rand Corp.," and, of course, the Rand Corp. does policy studies for the Air Force. I do not know if they engage in any laboratory- or hardware-type activities, although some might be done incidentally, but I gather this is the concept that is involved here?

Mr. ROGERS. Without precluding the possibility of their eventually being concerned with development, I again believe it fair to observe that, at least for the predictable future, it would be concerned with analytical work.

Mr. BROWN. The funding that you have indicated for the type of programs within your surveillance is \$25 million, as I recall. Is it contemplated within the Department, or do you have any reason to anticipate that this level of funding is likely to increase substantially or increase moderately? What do you see in that area?

Mr. ROGERS. I might make three observations about this, Mr. Brown. At the present moment we have 30 professional people, roughly in the Department and, in that sense, \$25 million is a somewhat fulsome amount. It is certainly enough to warrant very careful attention, but it is all, frankly, that we can prudently cope with at this time.

Secondly, I do expect that we shall need more money than this soon, and we have testified to this effect within the past month before the appropriate subcommittee of the House Appropriations Committee.

Beyond this, I would make a more general observation. The Department of Housing and Urban Development has many operating programs, so to speak: Public housing, mortgage insurance, planning grants, and so forth, through which funds are given usually in the form of grants or otherwise to municipal agencies. It is my judgment that, if properly structured and properly managed, these operating programs for some considerable time could be used to yield data and information that we badly need, and one of my keen interests is to learn how we can take relatively small amounts of general research money and map them into the operating programs in such a way as to get very useful early information and experience.

Mr. BROWN. I would think that would be a continuing part of your overall management process to make sure that you had adequate feedback from the expenditures in the same way, for example, that the poverty program attempts to evaluate and measure whether or not it is having any impact on poverty. I would think that HUD would want to do the same thing.

I am struck by the fact that a department like DOD, for example, spends about \$25 million a year on social science research in other countries. Sometimes it comes back to haunt them. On the basic research and development in your Department which is concerned with the problems of about 80 percent of our total population who live in cities or surrounding areas, you have, I assume, a set of goals which are used to properly direct this effort. One thing that has come to my attention recently is the importance of vastly improved information systems in all of our urban areas. They are chaotic to say the least. It is practically impossible with any degree of accuracy to identify the basic data necessary to analyze the problems of our cities.

There are a few efforts being made in developing information systems using computer technology and so forth. This seems to be promis-

ing, but the further you get into it the more it becomes obvious that you really have to do a fairly fundamental job in restructuring the urban organization to be compatible with an information system. This area is one in which literally tens of millions of dollars could be expended to help achieve a national information system compatible with a rational structure of organization. They can't be separated really.

Mr. ROGERS. Well, I certainly agree with you, Mr. Brown, and reaffirm my agreement with the chairman's initial observation that we have far enough number of problems in this area.

I would make two or three further comments with respect to this. In the first place, we have got to know how to get at, more rapidly and more easily, the information already available. As far as R. & D. itself is concerned, this is one of Mr. Weinstein's primary responsibilities in the Department, and we already are in conversation with the National Science Foundation and the Department of Commerce in this regard. We are holding conversations with them which we believe will eventually identify a useful form of information "network" that at least will tie all of our Federal departments and agencies together in the R. & D. area.

In addition to that, one of our first activities (and I did lay this out as one of our first and most important activities) in the establishment of an effective information exchange "network," and we have out now, or will shortly have, a request for proposals for some clearing-house studies for the dissemination of information generated by, and of interest to, the concerns of the Department.

Going beyond this, I would further submit that there are—it is becoming more and more evident that there are large bodies of data, there is information that we need, that our present systems are simply not set up to find.

We will find this out, I am sure, in detail and in a most useful way in our model cities program where some of our earliest concerns are those of understanding what is going on in the cities during these programs and how the cities themselves are going to monitor their activities, how we are going to monitor the entire program, and how the cities and the Federal Government can measure the impact of the programs on the residents and the institutions brought to bear on the problems of the residents.

Now, we have a long, long way to go, Mr. Brown—not only quantitatively, that is in bringing the talents and the resources, the professional talents and resources to bear on this very complex and new area for the cities, but also in the quality of these talents and resources.

There are data, there are experiments, data that must be obtained and experiments that must be conducted in the cities, and this, in my view, is going to be one of the more complex and difficult, but at the same time one of the more important and exciting research and development activities engaged in by the country in a long time.

Mr. BROWN. I would have to agree with you on that. It is going to be difficult and exciting. As you indicate, the cities in effect become your laboratories for this research, but I have not been impressed with the research and development content of some model city proposals I have seen.

For example, you should go into an area such as Los Angeles and should you try to find out the key sociological data with regard to that

area. It would be almost impossible, now particularly since it changes all the time. The system isn't organized to produce the information. This should be, of course, a fundamental part of the framework of every model city proposal. Yet, it has not been from my knowledge of the proposals that I have seen, particularly in Los Angeles. This disturbs me because I do not believe at this time there is adequate coordination of the total research and development needs of Los Angeles or any of the cities, and there will be no fundamental progress made until there is. I do not care how much you do in terms of housing or the development of other community facilities and that sort of thing. I do not think they will have the impact unless they are accomplished within this research and development framework.

What I really am saying is I think your job is a lot more important and requires a lot more resources than is being devoted to it at the present time, and I hope this situation will be remedied, if possible.

Mr. ROGERS. Mr. Brown, the absolute level in terms that you or Mr. Roush or even I previously in Defense have been used to dealing with is indeed small—small by orders of magnitude.

On the other hand, the rate of change in magnitude is important. The amount of money the Department had for general research activities in fiscal year 1967 was \$500,000. This year it is \$10 million. So, viewing it from that point of view, we are at the beginning point of a curve of growth, so to speak.

The second point I would make, I believe is that—well, it is more than a point that I would make, it is a confession. I know that I and many of us that now must be “coupled in the load” of the city defined by city problems have a great deal to learn.

As you know—as you and I both know—recently I learned a great deal, and am in the process of learning more, in the Los Angeles area. Therefore that is why I very carefully offered the second of the two concluding observations which I did in my opening statement; until the national scientific and technological community much more broadly and much more deeply begins to comprehend its urban problems, it is going to be difficult to expend much more money sensibly and prudently, so that is one of my first concerns. We are going to have to learn how to attack these problems in a much broader context even than in other areas, say Defense and NASA, in my view. We are going to have to have very broad and variegated groups of people, behavioral scientists, physical scientists, engineers, architects, city planners, city administrators, financial people, all having to learn how to relate themselves one to another and to very complex urban problems.

Mr. BROWN. You come to this job with a background in physical science and systems type work which, of course, is badly needed. However, as you indicated, there will have to be a large amount of research and development work outside of the physical science area. There is going to have to be research in the social sciences and planning and things of that sort.

Do you see any difficulty in providing the proper integration of these fields in connection with the work of your office?

Mr. ROGERS. Within the Department, I am very fortunate in having a very close working relationship with Under Secretary Robert Wood, who is one of the Nation's outstanding political scientists. At times

he describes himself as a "soft scientist," and one of the reasons why I was chosen for my present position is that I am what you might describe as a "hard scientist"; so, between the two of us at the moment, we have a balanced and a reasonably effective team.

Beyond that, we have asked the National Academy of Sciences to give very careful consideration to this matter of how we might bring the "hard" and the "soft" sciences together—and not only them, but other professional people, the architects, the city planners, and so on.

We now have, and I expect for some time to come will continue to have certain difficulties in this regard.

We have semantic difficulties. We have just an entirely different "view of the universe" in many fundamental ways. Perhaps the thing that we lack the most is a large, a broad, and a continuing experience in the behavioral scientist area addressed to very large and comprehensive studies of complex social problems—and, beyond the studies themselves, the actual conduct of experiments, and then the beginnings, I would hope, of systematic social development and social engineering. The ratio of the magnitude, complexity, and urgency of our urban problems to the assets in the behavioral science area that have so far been available to be applied to their study—well, that ratio is simply enormous.

Mr. BROWN. I noted an ad in one of the news magazines just recently by the General Electric Co., progress is our greatest product, or something like that.

Mr. ROGERS. "Most important," I believe.

Mr. BROWN. Most important, and they had a layout of a city and indicated they could design a pollution-free city, or something of that sort.

Have you been in touch with them about this, or is this just an advertising gimmick?

Mr. ROGERS. No; I have not been in touch with them in that sense. I have talked to some of the General Electric professional people about some of their interests in seeing studies of this type conducted. Perhaps our largest effort in the "new city" area is the activity which we, and other agencies in Washington, are jointly supporting at the University of Minnesota there under Professor Vivrett. The University of Minnesota has gathered together a very broad faculty group to address the problems and the opportunities associated with the design of new cities, and, quite by coincidence to your interest here, the Tempo group in GE has been a subcontractor or consultant to Professor Vivrett.

Mr. BROWN. Is there any information available to the progress they are making? I am quite interested in this field, and I knew that General Electric at one time was thinking in terms of a major role in the new city concept.

Mr. ROGERS. I believe that the work at the University of Minnesota is within some 2 to 3 months of reaching a completion. I don't know that we have a useful interim progress report. If we have, I would be pleased to furnish it to you.

Mr. ROUSH. Thank you, Mr. Rogers, for your very fine testimony.

QUESTIONS SUBMITTED TO T. F. ROGERS BY THE SUBCOMMITTEE ON
SCIENCE, RESEARCH AND DEVELOPMENT

Q. 1. Please supply for the record a copy of the agreement reached with the National Academy of Science and the National Academy of Engineering, and a copy of the agreement reached with the Department of Transportation.

A. 1. a. Attachment (1) is a copy of the contractual agreement between this Department and the National Academy of Science and the National Academy of Engineering.

b. Formal agreement as to all details has not yet been reached with the Department of Transportation. We now expect that this will be accomplished in the next two weeks for transmission to the Bureau of the Budget. They will then prepare a determination order which will formally define the agreement between the two Departments. We now expect that this determination order will be completed by June 30, 1968. We will be pleased to forward a copy to you when it becomes available.

Q. 2. Please describe the extent to which other agencies have submitted proposals to H.U.D. for the funding of research, the purpose of the research, and the status of the proposals.

A. 2. Attachment (2) summarizes the proposals received from other Federal Departments and Agencies, the purpose of the research and the status of the proposals.

Q. 2a. What steps has H.U.D. taken to make other agencies aware of its research needs and the problems it wishes to resolve?

A. 2a. By his letter of October 11, 1967, attached, Dr. Hornig informed each of the appropriate Federal Departments and Agencies of the establishment within H.U.D. of the Office of Urban Technology and Research, and invited their cooperation in assisting this Office to fulfill its responsibilities. To assist them to obtain an understanding of H.U.D. research needs and problems, I forwarded to each of these Departments and Agencies a copy of our proposed "FY-69 Research, Development and Demonstration Program of the Department of Housing and Urban Development." After they had an opportunity to review this document, I, or representatives of my Office, met with the appropriate representatives of 15 of the Departments and Agencies for an exploratory discussion and a preliminary identification of areas of mutual interest and activity. Attachment (4) was developed on the basis of these meetings, and indicates, on a qualitative and tentative basis, areas where some urban-related research and development, or potentially urban-related R&D effort is being carried out. In some cases the magnitude of effort is relatively small, whereas in others we consider it to be quite significant. It is our present intention to define these activities in more specific and detailed terms, and then to proceed to develop methods that would maximize their effectiveness. In particular, it is important to provide a means for a timely interchange of information on these activities. We have initiated discussions with the National Bureau of Standards relative to the design of an appropriate information network for this purpose.

Q. 2b. Has H.U.D. been in contact with the Department of Justice, Office of Law Enforcement Assistance regarding the crime and safety aspects of H.U.D.'s programs? With what result?

A. 2b. Yes. Representatives of this Department, particularly Mr. Arnold Sagalyn, Special Assistant to Secretary Weaver on Public Safety, have met with Mr. Robert Emerich, Science Advisor, Office of Law Enforcement, Department of Justice. Mr. Emerich is responsible for monitoring the contract between the Department of Justice and the Institute for Defense Analysis (IDA) for the design of a comprehensive Federal Public Safety Research and Development Program. H.U.D. is alert to the possibilities for public safety research and development in the Model Cities Program which is concerned with all significant aspects of public life in selected neighborhoods. We intend to remain particularly close to these Justice/I.D.A. activities to ensure that H.U.D.'s R&D program is properly responsive to the broad scientific and technological needs of the Law Enforcement area.

Q. 2c. Do you believe that discretionary funds should be available to laboratory directors to fund research relevant to national problems up to the point where proposals may then be submitted to the responsible agency? What do you see as the advantages and disadvantages of such a concept?

A. 2c. This Department does not now have any government laboratories under its direct management and therefore, I cannot submit a useful Departmental view. From my own past experience, however, I am of the belief that laboratory

directors should have a small fund available to them for the purpose proposed. However, any "proposal" to other Departments should be made either through, or with the full knowledge of, the appropriate level of authority within the "parent" Department. In my judgment, such flexibility would make possible, and encourage, a more rapid response of the total national Federal laboratory capability to changing national concerns.

Q. 3. How is H.U.D. made aware of the research being conducted by other Federal agencies and the available facilities? Should there be a central clearing-house? Would it be worth the cost involved? What would you propose?

A. 3. Formal and informal methods are employed. H.U.D. representatives participate in various inter-Agency committees; for example, I am the Department's member in the Federal Council on Science and Technology and members of my Office serve on other committees. In addition, there are direct but more informal discussions amongst representatives of the Departments at various staff levels. The answer to Question 2a above, indicates the more formal and comprehensive approach that we are taking. The Department is now undertaking a detailed study of its "clearinghouse" needs. This study should identify "user needs" as well as sources of information relating to urban problems. Discussions are being held with the "Clearinghouse" under the National Bureau of Standards to explore the role in which it might serve to satisfy H.U.D.'s requirements.

Q. 4. The D.O.D. witness proposed the elimination of manpower controls on cross-agency work in order to achieve flexibility similar to that available to the A.E.C. contract laboratories. What is your opinion of this proposal?

A. 4. The H.U.D. research and technology program is relatively new and very modest in size. Within the limits of our activity, as indicated in the response to Question (2) above, we have not encountered any difficulty of the nature indicated by the D.O.D. witness.

Q. 4a. Have personnel ceilings inhibited other Agencies doing work for H.U.D.? To what extent?

A. 4a. None to my knowledge.

ATTACHMENT 1

Department of Housing and Urban Development Contract No. H-829,
(incorporating Suppl #1)

CONTRACT FOR STUDY AND REPORT ON LONG-RANGE PLANNING FOR URBAN RESEARCH AND DEVELOPMENT

This negotiated contract entered into as of June 30, 1967, between the United States of America (hereinafter called the Government), acting by and through the Contracting Officer, Department of Housing and Urban Development, Washington, D.C. 20410, and the National Academy of Sciences (hereinafter called the Contractor), a Federally chartered nonprofit corporation incorporated under the Act of March 3, 1863, as amended (36 U.S.C. 251-254), having its principal office at 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

Whereas, the Department of Housing and Urban Development, under Title VI of the Housing Act of 1956 (12 U.S.C. 1701d-3), and section 301(a) of the Housing Act of 1948, as amended, and section 502(c) of the Housing Act of 1948, as amended (12 U.S.C. 1701c(b)(2)), is authorized to undertake research projects to support urban programs by contract; and

Whereas, the department desires to engage the contractor to make a study and render a report concerning long-range planning for Urban Research and Development; and

Whereas, the contractor is equipped and qualified and desires to conduct the study and render the report; and

Whereas, this contract is entered into without advertising under section 502(c)(2) of the Housing Act of 1948, as amended (12 U.S.C. 1701c(b)(2)), and is payable out of Urban Studies and Housing Research funds appropriated under P.L. 89-555.

Now, therefore, the parties agree as follows:

I. STATEMENT OF WORK

A. The contractor shall advise the Department of Housing and Urban Development on certain important elements of its long-range R&D program which is addressed to improving the Department's capability to deal with current and

emerging needs of the Nation's cities and towns. Two parallel study efforts shall be established. Particular emphasis in one shall be placed on those social, economic, and institutional factors which affect the selection, introduction, and use of new techniques and programs to meet the social needs of the day and which underlie the emerging requirements and needs of tomorrow. Particular emphasis in the other shall be placed on developing new technologies and improved cost-reducing approaches by industry to meet social needs. Both study efforts shall consider the means of attracting and training the professional manpower required in these fields.

The substantive efforts of this advisory activity shall be focused on five major tasks:

1. *To identify the broad alternative and complementary strategies which are available for encouraging industry to develop and put into practice useful new technologies and cost-reducing approaches to the problems of housing and urban affairs.* The effort would attempt to identify the strengths and weaknesses of each strategy and the inherent risks. It will also examine the factors that have restricted the applicability of these approaches in the past, and means for overcoming these obstacles.

2. *To specify the kinds of major social, economic, political, and institutional questions that would have to be raised and answered in order to establish a reliable basis for long-range research and development plans and programs.* These questions would presumably involve review of the conceptual frameworks, the data base, and other fundamental questions which would have to be considered in mounting attacks, under HUD's leadership, upon the major problems of housing and living in metropolitan areas. The assumption is that an agenda of broad research themes could then be derived from an analysis of the questions specified, that groups of relevant research projects could be identified for each theme, and that the research projects could be ordered in terms of their feasibility, data and manpower requirements, timing, anticipated payoff, and the like.

3. *To delineate the kinds of research capabilities which HUD should either strengthen or, if lacking, seek to establish, so as to assure that its research dollars would be spent most effectively.* Presumably, such research capabilities could be national, regional, or State and local in scope and emphasis, and be both governmental and non-governmental in character. Such research capabilities could, moreover, be perceived as constituting the parts of a decentralized but coordinated national research "network" which, as a whole, would represent the broadest range of relevant, scientific and technical knowledge and skills, approaches, and emphases. Such a research "network" would also make available to HUD an additional instrument through which research findings could be widely and promptly disseminated and readily incorporated into governmental industrial and university plans and operations.

4. *To assure that the behavioral and social science research capabilities of academic institutions are optimally organized and effectively utilized in HUD's long-range research and development activities.* In this task, the strengths and weaknesses of academic research both in relation to the needs of the engineering community and to those of governmental, industrial, and non-profit research capabilities would presumably be critically and frankly assessed.

5. *To make recommendations not only to bring the many facets of urban problems into focus and define these problems more sharply, but also to mobilize and augment the capabilities now available for solving these problems, i.e., consider the applicability of a "total systems approach."*

B. In carrying out the study, the contractor shall brief advisory members on the phase of evolution in which the HUD R&D program now finds itself.

1. Past national failures to sponsor large-scale, effective research in these areas and the current near-crisis stage of urban affairs in many cities place a heavy demand on the Department for useful results over the relatively near term.

2. There is a pressing need to integrate the various social science disciplines, to refine conceptual frameworks to produce a problem orientation, and to identify and correct past deficiencies.

3. The search for necessary conditions for a powerful long-range, R&D program should be begun as soon as possible, even though much of the effort in early years must, of necessity, emphasize those activities which would allow prompt and important applications.

C. The contractor shall seek to identify, but not consider as controlling influences, the constraints imposed by tradition, present practices, and the present Federal organization and legislative authorities.

D. *Phase One*.—The first phase of this project shall consist of necessary activities to establish two divisional committees of about ten members each who are agreed to be preeminent in their respective fields and to plan the approach for the substantive phase of the project. [deletion made as amendment to implement phase two.]

The members of one divisional committee—which might tentatively be labeled “Advisory Committee on Socio-Economic Urban Research Problems”—would include one or more physical scientists and engineers concerned with the analysis of housing and urban problems and a senior liaison member on part-time assignment from HUD. The final product of this committee in Phase One will be a proposal for Phase Two.

The members of the other divisional committee—which might tentatively be labeled “Advisory Committee on Urban Technology”—would include one or more social or behavioral scientists concerned with the analysis of housing and urban problems and a senior liaison member on part-time assignment from HUD. The final product of this committee in Phase One will be a proposal for Phase Two.

E. *Phase Two*.—The second phase of this project would be planned and implemented separately by each of the two advisory committees established in Phase One, with the advice and assistance of other relevant NRC Divisions and other specialized personnel as may be appropriate. Upon acceptance of the proposal, this second phase would be funded by HUD at a level which would permit it to be competently staffed and to conduct its work in part through conferences. The Government elects and the Academy agrees to execute Phase Two of Contract H-829 effective October 30, 1967.¹

F. *Time of Submission of Reports*.²—Phase Two shall be completed by August 1, 1968.

1. Informal advice and interim reports will be submitted by the Contractor not later than May 1, 1968.

2. A final, coordinated report by the Contractor which reflects consideration of the five major topics outlined in Clause I, A and other topics as may be appropriate will be submitted not later than August 1, 1968.

G. *Reports and Coordination*.³—The National Academy of Sciences, in coordination with the National Academy of Engineering, through appropriate operating divisions of the National Research Council shall conduct the work of Phase II, as planned by the NAS-NAE Advisory Committee on Urban Technology and the NAS-NAE Advisory Committee on Social and Behavioral Urban Research and as executed by these two committees and such subcommittee and consultant groups as the committees may establish. The activities of the two committees shall be coordinated by appropriate means established by the presidents of the two academies. The Government Technical Representative shall attend meetings and conferences as appropriate.

1. The coordinated final report shall seek to set forth a long-range strategy for research and development on urban affairs which will warrant broad non-partisan support. The strategy shall seek to set forth a time scale for R&D efforts, e.g., “immediate”, “short-term”, and “long-range”, and options within each. Immediate and short-term efforts should be oriented toward immediately useful results and toward establishing the necessary conditions for long-term success of the Department’s R&D efforts.

2. Final reports and principal interim reports shall be delivered concurrently to the following, or their successors designated in writing by the Contracting Officer:

(a) Mr. T. F. Rogers, Director, Urban Technology and Research, Department of Housing and Urban Development.

(b) Mr. William B. Ross, Deputy Under Secretary for Policy Analysis and Program Evaluation.

(c) Mr. George W. Wright, Office of the Deputy Under Secretary (Government Technical Representative for liaison, under Clause II, B).

¹ Last sentence added in Amendment #1.

² Replaces an earlier section F with same due dates.

³ Added by Amendment 1 for Phase Two.

II. CONDUCT OF WORK

A. The contractor's work hereunder will be carried out under the National Academy of Sciences through Messrs Kohl and David.

B. The Government Technical Representative for liaison with the contractor as to the conduct of the work hereunder (including acceptance of the contractor's reports and approval of invoices) will be Mr. George W. Wright, Office of the Deputy Under Secretary, Department of Housing and Urban Development, or a successor designated in writing by the Contracting Officer.

III. CONTRACT PERIOD

The contractor shall commence performance of the work hereunder upon receipt of the contract signed by the Government and shall complete such work including delivery of the final report, not later than August 1, 1968⁴ unless extended by Contract amendment.

⁴ Date for Phase Two substituted for date for Phase One in Amendment #1.

OFFICE OF URBAN TECHNOLOGY AND RESEARCH
PROPOSALS SUBMITTED BY OTHER FEDERAL DEPARTMENTS AND AGENCIES TO HUD

Department or Agency	Title, purpose and remarks	Amount proposed or funded	Status
Advisory Commission on Intergovernmental Relations.	Case studies in 12 metropolitan areas of fiscal disparities.	\$60,000	Contract completed; now preparing data for publication.
Atomic Energy Commission.	Analysis of alternate methods of solid waste conversion.	\$50,000	Proposal under review.
Do.	Systems analyses of urban utility tunneling.	\$100,000	Do.
Do.	Analysis of potential use of thermal energy from nuclear power-plants.	\$100,000	Do.
Do.	Development of a technique for demolition of building structures with gas air explosives.	\$150,000	Do.
HUD, OEO, HEW, Department of Labor, Department of Interior (cooperative project).	A joint project which establishes a plant to employ 100 Sioux Indians to produce prefabricated homes for 375 Rosebud Reservation families.	(\$658,000 HUD (construction materials) \$642,000 OEO (training and labor) \$367,000 HEW (water and sewage facilities) \$100,000 BIA (prefabrication plans, equipment).	Project nearing completion.
Department of Commerce (Bureau of the Census).	Participation in small area test (New Haven, Conn.) of 1970 census, several phases: 1st phase augmented to mesh census and local data; 2d phase additional related tasks.	\$415,000 \$115,000 \$150,000	1st phase, agreement completed. 2d phase, proposal under review
Department of Commerce (National Bureau of Standards).	Methods for collection and interchange of information among Federal departments and agencies.	Undetermined	Proposal in preparation.
Department of Commerce National Bureau of Standards (joint project).	Performance standards for low-cost housing (a study to examine the adequacy of presently available performance standards; to estimate the time and cost of developing the additional standards required; to rank order those that need to be developed in terms of their impact upon construction costs of low-cost housing).	\$120,000 HUD \$50,000 NBS	Project progressing on schedule. Final report expected June 1968.
Department of Commerce (National Bureau of Standards).	Tests and analyses necessary to determine the safety and adequacy of the Neal Mitchell building system proposed for erection in Detroit as part of Project Phoenix.	\$55,000	Project progressing on schedule.
Department of Commerce, Coast and Geodetic Survey.	To study the alternative programs for financial assistance to victims of earthquakes.	\$180,000	Interim report due by October.
Department of Interior (Bureau of Mines).	Research needs in tunneling.	\$10,000	Project completed.
Department of Labor.	Study of urban planning and administration manpower requirements.	\$50,000	Project progressing to schedule.
Department of Labor coordinating with Department of Commerce (Bureau of the Census).	Joint effort for the collection of a 1-percent sample of employment data by occupation, agency, function, and various levels of government, State, local.	\$125,000 estimated	Proposal under review.
Department of Transportation, Federal Aviation Administration.	An aircraft noise abatement planning study.	\$25,000	Do.
Department of Defense.	A joint venture to study cost reduction potential in low-cost housing; being conducted by Institute of Defense analysis.	(\$200,000 HUD \$50,000 DOD	Project progressing on schedule.

FEDERAL DEPARTMENTS AND AGENCIES AND THEIR URBAN RESEARCH AND DEVELOPMENT ACTIVITIES

Departments and agencies	AREAS OF INTEREST													
	Physical sciences							Social sciences						
	Housing	Communications	Hydrology	Transportation	Waste disposal	Power generation and distribution	Environmental pollution and control	Laboratory and test facilities	Urban planning	Urban administration and intergovernmental relations	Urban renewal and community facilities	Public safety	Earthquakes, floods, etc.	Social and behavioral sciences directed to urban problems
Department of Agriculture.....	X	X	X	-	X	X	X	X	X	X	X	-	X	X
Department of Commerce.....	X	X	-	-	-	-	X	X	-	-	-	-	-	X
Department of Defense.....	X	X	-	-	-	-	X	X	-	X	-	-	X	X
Health, Education, and Welfare.....	X	X	X	X	X	X	X	X	X	X	-	X	X	X
Department of Interior.....	-	X	X	X	-	-	-	X	X	X	-	X	-	X
Department of Justice.....	-	X	-	-	-	-	-	-	X	X	-	-	-	-
Department of Transportation.....	-	X	X	X	-	-	X	X	X	X	-	-	X	X
National Science Foundation.....	-	X	-	-	-	-	-	X	X	X	-	-	X	-
Housing and Urban Development.....	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Atomic Energy Commission.....	-	X	X	-	-	-	-	-	-	-	-	-	-	-
National Aeronautics and Space Administration.....	-	X	X	X	-	-	X	X	X	-	-	-	X	-
Post Office Department.....	-	X	-	X	-	-	X	X	X	-	X	-	-	-
Department of Labor.....	X	X	X	X	-	-	X	X	X	-	X	-	-	X
Arms Control and Disarmament Agencies.....	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Advisory Commission on Intergovernmental Relations.....	-	-	-	-	-	-	-	-	X	X	X	X	-	X
Office of Economic Opportunity.....	X	-	X	X	-	-	X	-	X	X	-	X	-	-

ATTACHMENT 3

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY,
EXECUTIVE OFFICE BUILDING,
Washington, D.C., October 11, 1967.

Dr. JOHN S. FOSTER, Jr.,
Director of Defense Research and Engineering,
Washington, D.C.

DEAR JOHNNY: The establishment by the Department of Housing and Urban Development of an Office of Urban Technology and Research provides a much needed focal point for the planning and coordination of urban-related research and development undertaken by the Federal Government.

I have asked the Director of that Office, Mr. Thomas F. Rogers, to take the lead in identifying research programs throughout the Federal Government which bear upon the following five HUD PPBS categories:

- Housing
- Land use and community environment
- Public facilities and services
- Assistance to local government in administration
- Management of urban programs and resources

His objective is to ensure that the HUD research program is sensibly related to other programs of common interest and to avoid unnecessary duplication. Of course, your understanding of HUD research plans should make possible refinements of program plans within your own and other agencies.

Mr. Rogers will communicate with you directly, provide you with a copy of the HUD FY '69 research and development program-budget document, and discuss specific areas of common interest. Your cooperation in this matter is greatly appreciated.

Sincerely,

DONALD F. HORNIG, *Chairman.*

IDENTICAL LETTERS SENT TO THE FOLLOWING FCST MEMBERS, INFORMATION COPY TO THOMAS F. ROGERS, HUD

- Dr. John S. Foster, Jr., Director of Defense Research & Engineering 3E1006 The Pentagon, Wash., D.C. 20301 STOP 103
- Dr. Leland J. Haworth, Director, National Science Foundation, Wash., D.C. 20550 STOP 19
- Dr. John F. Kincaid, Asst. Secy for Science & Technology, Department of Commerce, Wash., D.C. 20230 STOP 206
- Dr. Philip R. Lee, Asst. Secy for Health & Scientific Affairs, Dept. of Health, Education, and Welfare, Wash., D.C. 20201 STOP 367
- Dr. George L. Mehren, Assistant Secretary, Dept. of Agriculture, Wash., D.C. 20250 STOP 209
- Dr. Milner B. Schaefer, Science Adviser to the Secretary, Dept. of the Interior, Wash., D.C. 20240 STOP 43
- Dr. Glenn T. Seaborg, Chairman, Atomic Energy Commission, Wash., D.C. 20545 STOP 4
- Dr. James E. Webb, Administrator, National Aeronautics & Space Administration, Wash., D.C. 20546 STOP 85
- Alan S. Boyd, Department of Transportation

Mr. ROUSH. The committee stands adjourned until 10 o'clock tomorrow morning.

(Whereupon, at 11:55 a.m., the committee was adjourned, to reconvene at 10 a.m., Thursday, April 4, 1968.)

UTILIZATION OF FEDERAL LABORATORIES

THURSDAY, APRIL 4, 1968

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND ASTRONAUTICS,
SUBCOMMITTEE ON SCIENCE, RESEARCH, AND DEVELOPMENT,
Washington, D.C.

The subcommittee met, pursuant to adjournment, at 10 a.m., in room 2325, Rayburn House Office Building, Hon. Emilio Q. Daddario (chairman of the subcommittee) presiding.

Mr. DADDARIO. This meeting will come to order.

This morning we change the emphasis of our hearings from the broad question of the utilization of Federal laboratories to the specific question of how can technology be applied to a national problem such as crime.

We are pleased to have as our first witness Dr. Alfred Blumstein, of the Institute of Defense Analysis. Dr. Blumstein provided the overall direction of the Science and Technology Task Force report to the President's Crime Commission, and is perhaps one of the most knowledgeable men in this field.

Our second witness is Mr. Quinn Tamm, executive director of the International Association of Chiefs of Police. The association represents some 7,000 independent police departments in the United States and Canada, and we look to it this morning for guidance about how to best bring about the marriage of technology to police requirements.

Our final witness today is Mr. Joseph M. English, director of Georgetown University's Forensic Sciences Laboratory. Mr. English has worked with NASA's Goddard Space Flight Center and the Armed Forces Institute of Pathology in applying space- and defense-developed technology to the needs of law enforcement officials, and his testimony should add a new dimension to the information already developed by the subcommittee.

Will you proceed with your testimony, Dr. Blumstein?

Dr. BLUMSTEIN. I have a prepared statement, and if you care to, I can read from it. If you would prefer, I could just submit it and elaborate on some of the major points.

Mr. DADDARIO. We would like to have it included in full in the record, and then have you handle the presentation any way you see fit, recognizing that we have to go into session a little early this morning.

(Dr. Blumstein's biography follows:)

DR. ALFRED BLUMSTEIN

Alfred Blumstein is a member of the Research Council of the Institute for Defense Analyses, and is the director of IDA's Office of Urban Research. At IDA, he directed the work of the Science and Technology Task Force of the President's Commission on Law Enforcement and Administration of Justice. He had previously been a principal operations analyst with the Cornell Aeronautical Laboratory. In 1963-64 he was a Visiting Associate Professor of Operations Research at Cornell University.

Dr. Blumstein is a member of the Board of Directors of MORS, and in 1964-65, he served as President of the Washington Operations Research Council. He is now Chairman of the Cost-Effectiveness Section of ORSA.

Dr. Blumstein has conducted and directed operations research studies in the fields of naval operations, air traffic control, counterinsurgency and criminal justice.

Dr. Blumstein received the degrees of Bachelor of Engineering Physics from Cornell University, the M.A. in statistics from the University of Buffalo, and the Ph.D. in operations research from Cornell University.

STATEMENT OF DR. ALFRED BLUMSTEIN, INSTITUTE FOR DEFENSE ANALYSES

Dr. BLUMSTEIN. Mr. Chairman and members of the subcommittee, I am honored to have the opportunity to contribute to your deliberations concerning the need for research and development in the control of crime, and on the possibilities of using the resources of the Federal laboratories to meet these needs.

Although I speak today only as a private individual and not as a representative of any organization, my remarks are based on the investigations I conducted as Director of the Science and Technology Task Force of the President's Commission on Law Enforcement and Administration of Justice.

It was during that period that I became impressed with both the urgent needs for a research and development program and the important contribution it could make in creating a criminal justice system that is both more fair and more effective.

In my testimony I would like first to demonstrate the urgent need for such a research and development program and the potential improvements that could result from it. I would then like to indicate some of the requirements for laboratories that will participate in that effort.

Need for research and development

Our Task Force on Science and Technology was composed largely of scientists and engineers experienced in modern technology, much of it deriving from work with military weapon systems. We were all amazed at the primitive level of technology with which the criminal justice system is forced to do its job.

In general, we were surprised to learn how undercapitalized is the criminal justice system: A \$3,000 investment in a police car supports a \$100,000 annual patrol operation; over 85 percent of most police budgets are used to pay salaries.

Some policemen are forced to stand idle on a street corner even though there may be an emergency nearby simply because they have no portable radios by which headquarters could reach them.

Motorized policemen who leave their radio-equipped cars cannot call for help if they are attached because they now have no link to

the car's radio. In contrast, many appliance repair companies now maintain continuous radio contact with their repairmen out in the field.

The car sent to an emergency is often other than the closest one because the dispatcher does not now know its correct position and availability, a capability that can be provided automatically.

In confronting a crime suspect or an unruly citizen, a policeman is forced to choose between a billy and a pistol—the same choice he was offered a century ago. Nonlethal weapons with a longer range than the billy but without a pistol's disabling characteristics are needed.

Although most of a patrolman's activities center about his vehicle, most police cars differ only slightly from the car a suburban housewife uses for her grocery shopping. Cars designed specifically for police use would include convenient radio controls, cathode ray tube displays, teleprinters, nonlethal weapons, cameras and other evidence collection kits, audio or video recording equipment, and specially designed rear compartments for the transport of prisoners.

Fingerprints left at the scene of a crime cannot normally be traced to an unknown suspect, partly because the systems used are little different from those first introduced at the beginning of this century.

New instrumentation techniques, permitting identification by voice, hair, blood, or clothing, are becoming increasingly effective. Unfortunately, their high cost and technical complexity have prevented most police departments from using them more widely.

Court records are written and rewritten by hand even though many small businesses use central computers to help maintain their inventories.

More generally, computers can be used throughout the system to help in providing immediate access to information needed for solution of specific crimes, for help in making sentencing and correctional decisions regarding the roughly 2 million convicted persons each year, and for more efficient management of the more than a half million persons employed by the criminal justice system.

Even more important than all these technological needs and opportunities, however, is the fundamental need to discover the impact on crime of the many actions taken to control it. Very little is known to even a rough approximation about how much any prevention, apprehension, and rehabilitation program will reduce crime. And without such knowledge, how can we intelligently choose among them?

Patrol by marked police cars which demonstrate a visible threat to a potential criminal is widely accepted as good police practice, being known as preventive patrol. But it is not clear what kinds of crime such patrol prevents, and how much of each. Nor is it clear under what circumstances patrol in marked police vehicles is more effective than patrol in unmarked vehicles, or whether using police resources in this way is more effective than assigning these same police officers to detailed followup investigation on specific crimes or to other kinds of preventive activity.

I don't presume to have answers to such questions. However, neither do the most vehement advocates of either side. Only through a carefully developed research program will we be able to identify the factors that give rise to various kinds of criminal behavior and the

consequences of each of the many kinds of possible actions that might be taken to control them.

The work of our Science and Technology Task Force identified some of the basic questions in a form that now makes them amenable to research.

In some of our early discussions, we wondered about what portion of our society is ever arrested. By analysis of various data on arrests and on arrest records we calculated that approximately one-half of the boys in the United States today will be arrested some time in their lives for a nontraffic offense. This estimate may not be exactly correct, and in any event, is not a literal prediction of the future.

Rather, it is a projection based on current trends—changes in the future could well reverse these trends. Perhaps even more shocking than the the figures itself, however, is the fact that so fundamental a question had not been explored previously.

Furthermore, when the answer to so basic a question is surprising to so many, we can only conclude that much too little is known about what is going on in the criminal justice system.

Mr. DADDARIO. How can you predict that this 50-percent figure will hold up if, in fact, you do not know some of the answers to these questions? How do you reach that particular point, and then say we do not know what the problems really are? I don't follow that logic.

Dr. BLUMSTEIN. First, let me say that it is not a prediction, but a projection, and I make that distinction.

Mr. DADDARIO. Going up to a certain point you take these—

Dr. BLUMSTEIN. If we use current arrest rates rather than projecting their trend—the trend has been increasing—and if we project population trends into the future, then we can estimate the chance that a boy will be arrested at any age.

Mr. DADDARIO. At any rate, the point is that you are arriving at this figure in a statistical way?

Dr. BLUMSTEIN. Yes, sir.

Mr. DADDARIO. Then, the other problem is getting to the heart of the problem; why this is so?

Dr. BLUMSTEIN. That is right. Once the issue becomes one of concern, then you ask why it is so. And no one knows why. Some of the possibilities are derived from increasing urbanization, leading to people having less knowledge of each other, with more frequent resort to a formal system for the resolution of problems.

Mr. DADDARIO. If we have better answers to our social and economic problems, and we attack them in the right way, they might have the effect of turning these statistics of yours downward?

Dr. BLUMSTEIN. That is right.

Mr. DADDARIO. And if not that, 50 percent could perhaps become a low figure?

Dr. BLUMSTEIN. That is right.

Mr. DADDARIO. It is important that we come to some realization of the nature of these problems.

Dr. BLUMSTEIN. We need figures like that to highlight where the critical issues are. For example, it may be that we are spreading the criminal sanction too thin and so that when you arrest many people, there maybe less concern about being arrested in the future. One of the things that prevents me from committing crime is the fact that

I don't want an arrest record, but once I have an arrest record I might be less concerned about having a second. I don't know, but these are some of the things that have to be considered.

We also need such analysis techniques to decide where to invest technological resources so that they can be effectively applied to our basic objective or reducing crime. To illustrate this, we collected data from Los Angeles on the factors that give rise to apprehension of criminals. We found, as we expected, that rapid police response to a crime call gave rise to more apprehensions.

But we were surprised to find that unless the suspect is caught at the scene of the crime, or is identified by a victim or witness, the chances of ever catching him may be less than 12 percent. We then compared alternative technological means for getting to the crime scene faster: more patrol cars, more telephone clerks answering citizens' calls, car-locator devices to find the closest patrol cars, and computer-assisted command and control systems in the command center. For the conditions of the hypothetical city we examined, we found that delay could be reduced most inexpensively by the most expensive investment: computer automation of the command center, and this needs further development and adaption to particular cities.

This was the best investment to reduce delay, which is correlated with apprehension by the police, which by the theory of deterrence is presumed to reduce crime. Such a chain of reasoning is necessary to make optimum technological choices, and all the links in any such chain need considerable strengthening.

Another place such analysis techniques can be beneficial is in the management of the courts. Through a computer simulation of the processing of persons arrested for felonies through the District of Columbia court system, we were able to show that the processing through the grand jury was the critical bottleneck, and to experiment with various possible changes in the operation of that court system—all without disrupting the critical ongoing operations of the court.

These very preliminary steps we have taken in only a few areas have convinced us that there is a significant contribution to come from a major research and development program. And we have not even touched on such areas as identifying basic causes of crime, treating drug addiction, planning a strategic attack on organized crime enterprises, selection and training of criminal justice officials, and many other areas that properly belong in a research and development program. In view of this potential, it is surprising that until the Office of Law Enforcement Assistance was established in 1965, the Justice Department was the only Cabinet Department in the Federal Government with no research and development program.

Need for a Federal role

It may very well be that the application of science and technology to criminal justice has been retarded so long as a result of the fragmentation of the criminal justice system. Only a handful of criminal justice agencies are large enough and rich enough to undertake major research or equipment development projects on their own. There may be little incentive for them to do so, since that would probably be an inefficient investment of resources for any one of them. Although the results would benefit all, the innovator alone would have to bear the high cost. Even if the individual agencies independently conducted

their own projects, we would probably see many of them pursuing identical questions not knowing of the work and results of the others.

Furthermore, there would be little incentive for an individual agency to disseminate the results of its work to other agencies that might be able to use them.

This is a typical situation which calls for some centralized stimulation and coordination. Ideally, this should be done by the Federal Government, which would coordinate the work throughout the Nation.

The National Crime Commission recommended four mutually supporting approaches to an R. & D. program. Their program comprised the following elements:

(1) Support of an R.D.T. & E. program supporting specific projects at specific operating agencies, universities, industry, or any other source of technical skill.

(2) Establishment of an agency to provide technical assistance to criminal justice agencies as a county agricultural agent does for the farmer. The agency or a related one would also establish common equipment standards, thereby providing some of the advantages of a large market to this highly fragmented one.

Mr. DADDARIO. Don't you consider that the FBI presently serves this purpose?

Dr. BLUMSTEIN. No, sir; the FBI does not evaluate police radios. They don't establish standards for police radios. For instance, they don't serve as that Bureau of Standards kind of function. They do serve in providing central crime laboratory services. They don't set standards. They don't publish the equivalent of a Consumer's Report.

Mr. DADDARIO. What is your view as to that? Should they have been giving this kind of assistance or do you feel they are doing what they should do? Since this seems to be something that needs to be done, and has been reported by the Crime Commission as being a requirement, why, in fact, haven't law enforcement people whose job it is to analyze these things, come to this assumption on their own?

Dr. BLUMSTEIN. Why hasn't the FBI moved?

Mr. DADDARIO. Yes.

Dr. BLUMSTEIN. I really couldn't say why the FBI hasn't done it.

Mr. DADDARIO. It would appear to me without analyzing it further that those of us in communities throughout the country who support the FBI Academy and the training of local police officers do so because we believe that these men will have training in techniques that are not available to them at home.

Dr. BLUMSTEIN. They will have training in the techniques.

Mr. DADDARIO. But you don't believe that goes far enough?

Dr. BLUMSTEIN. We are talking about a rather specialized technical function, establishment of equipment standards and evaluation of equipment, that a police officer is not normally called upon to do. It probably would not be a worthwhile part of the FBI Academy curriculum to spend very much time on issues like that. It is sort of a service that has to be performed as new equipment comes out and as needs start to crystallize. It is much more technical than operational, but it must have an operational input. It is a service like the Bureau of Standards, like Consumer Reports, like Underwriters.

Mr. DADDARIO. I am not saying that the FBI should do it or should not do it. I am just trying to probe the reason why. It would appear to

me that if these techniques, in fact, could be helpful in solving some of our problems as far as crime is concerned, that it is deplorable that they have not been done. This is not a charge, yet you raise the point. You say it ought not to be done. If it is not done by the people who have the law enforcement responsibility, who is it that should do it?

Dr. BLUMSTEIN. The FBI has the prime authority of enforcing the Federal law; in many cases, the enforcement of the Federal law involves operating like a local police department.

Mr. DADDARIO. We are kind of chasing ourselves around. The fact is we are under the assumption, notwithstanding what you are saying, that the FBI can give help. In almost every community of the country we send men to the academy with the expectation that when they come back they will be better able to perform their local duties.

Dr. BLUMSTEIN. That is right.

Mr. DADDARIO. What you are saying is that this does not necessarily happen?

Dr. BLUMSTEIN. No. I am saying is that doesn't happen in every respect, and I don't think anyone would expect it to happen in every respect. The FBI is not universally wise and able and can't perform all the functions that might be needed to help local law enforcement. Here is one function that is needed that they have not, in fact, taken a major role in.

Mr. DADDARIO. Mr. Brown.

Mr. BROWN. Would it be appropriate at this point, because I think this is a very interesting aspect that you bring up, to ask from the appropriate source that the FBI curriculum for training be inserted in the record together with the nature of their crime laboratory facilities. I have a feeling that we do not have too much information about this, just how broad their operations are, and I think it is relevant at this point. I have seen many local policemen come back here to training. I have felt that perhaps the greatest problem was that these people were not, by their own training and background, capable of absorbing, for example, concepts of systems analysis or high-level technology with regard to the local police problems. I am interested to know if there is any effort made to do this in the school.

Mr. DADDARIO. Mr. Brown, you raise a good point. We will inquire into that. I frankly have been of the opinion that they have been doing a good job and that they have, in fact, been providing some of this kind of technical assistance.

(The following information has been furnished by the FBI:)

FBI NATIONAL ACADEMY CURRICULUM

Set forth below is the general curriculum of the twelve weeks' course of training of the FBI National Academy.

LAW AND INVESTIGATIONS

Criminal law and court procedures

Legal Aspects of Interrogations and Confessions
 Evidence
 Federal Civil Rights Statutes
 Law of Arrest, Search of the Person, Premises and Vehicles, Legal Aspects of Stop, Frisk and Detain and seminar on related legal problems
 Legal Aspects of Lineups
 Legal Aspects of Roadblocks
 Medical-Legal Aspects of Homicide Investigations
 Police Legislation
 Police Liability
 The Constitution and the Bill of Rights
 The Judge's View of Criminal Law
 The Law Enforcement Officer and the Courts
 The Juvenile Court

Investigations and case preparation

Auto Theft
 Bank Robbery
 Bombings
 Counterfeiting
 Investigative Aids and Techniques
 Major Case Investigations
 Narcotics
 Sex Crimes
 Unlawful Flight to Avoid Prosecution

POLICE ADMINISTRATION

Management and policy

Crime Analysis—Prevention, Planning, Allocation and Distribution of Forces
 Development and Training of Supervisory Personnel
 Disciplinary Problems
 Inspections
 Management of Auxiliary Police
 Mob and Riot Control—Practical Problems, Police Procedures and Demonstration
 National Crime Information Center
 Police Budgets
 Police Management including Administrative Devices and Controls, Selection and Recruitment, Police Cadets, Police Personnel Management, Evaluation of Personnel, Supervisory and Executive Development, Decision Making, Evaluation of Personnel and Practical Problems on Management Matters
 Police Records
 Policy and Planning
 Supervision of Reports
 Uniform Crime Reports

BEHAVIORAL SCIENCES

Social psychology

Caustive and Psychological Factors in Mob and Riot Control
 Gaining Support for Law Enforcement
 Human Relations in Management
 Nation of Islam
 Police Ethics
 Police Techniques in Handling Juveniles
 Psychology in Law Enforcement
 The Chief of Police as a Community Leader
 Relations Between Press and Law Enforcement

Sociology

- Communism and Related Movements
- Criminology
- Espionage
- Jurisdiction of Federal Agencies
- Organized Crime
- Police and Community Relations
- Sociology
- Social Aspects of Crime

Education

- Classroom Orientation; Making Notes in Class; Use of Typewriter
- Dynamics of Instruction
- Evaluating Results of Training
- Human Relations in Learning
- Operating Police Training Schools
- Research Methods
- Subsidized Police Training

Physical education

- Physical Training Program Including Defensive Tactics, Judo, Operation of a Physical Training Program
- Techniques and Mechanics of Arrest

Vocational education

- Firearms Training
- Public Speaking—Techniques and Practical Work
- Surveillance Photography
- Photography in Law Enforcement

SCIENCE

Biology and serology

- Blood and Body Fluids
- Hairs and Fibers

Chemistry

- Chemistry in Crime Detection

Identification techniques

- Document Examinations
- Identification of Disaster Victims
- Fingerprint Identification
- Matters Including Latent Fingerprints

Laboratory techniques and research

- Organization of FBI Laboratory
- Soils and Minerals
- Metals Examinations
- Firearms, Toolmarks, Glass Fractures and Explosives
- Shoe Prints and Tire Examination
- Physics in Crime Detection and Radiation Hazards

FBI LABORATORY

In the early 1920's very little use was made of science in law enforcement. Occasionally the FBI called on a scientist to perform a specific examination, but this left much to be desired since most of these men had neither the facilities to do the work nor the training to intelligently present evidence before a court and jury.

FBI Director J. Edgar Hoover realized that most scientific techniques and their application to the examination of physical evidence were outside the realm of most law enforcement officers. He was convinced, however, the technological aid offered by science could become a most valuable partner in the fight against crime and could make available important evidence in a court of law when properly interpreted by a highly qualified expert witness.

In the early 1930's Mr. Hoover launched a program to locate scientists whose knowledge and experience might be used to guide a new scientific laboratory. On August 1, 1932, purchase of the first equipment for research purposes was approved. One piece of scientific equipment slowly followed another, but this simple collection was far from being a real laboratory. There followed the immense task of staffing the new Laboratory and training its personnel.

The FBI Laboratory was officially established on November 24, 1932. Gradually, scientists were recruited from specialized fields such as geology, metallurgy, mechanical engineering, mathematics, and other physical and biological scientists. Today, all Agents and many technicians assigned in the FBI Laboratory have at least one college degree and some hold Ph. D.'s in chemistry, physics, and other sciences. In addition, all have received extensive training in the FBI. The Agents assigned in the Laboratory have attended the same course of training which is received by all new FBI Agents. They also have served some time in one of the FBI's 58 field offices where they obtained investigative experience before returning to FBI Headquarters to undertake their scientific assignments.

Training is a never-ending process for the personnel assigned to the FBI Laboratory. They are in constant touch with other specialists in their field, attend and participate in numerous seminars, and constantly review scientific publications in their field of interest and responsibility. Many of them are continuing their formal education on a part-time basis or taking special courses.

The evidence examination work in the FBI Laboratory is highly specialized. For this reason, the Laboratory is divided into sections and units.

The units of the Document Section deal with examinations of handwriting, hand printing, typewriting, and forgeries. This Section also makes examinations of fraudulent checks, paper, inks, printing, obliterated writing, indented writing, charred paper, shoe prints, tire treads, photographs, and related matters.

The Physics and Chemistry Section is composed of several units which handle examinations involving chemistry, toxicology, firearms, toolmarks, hairs and fibers, blood and other body fluids, metallurgy, petrography, number restoration, glass fractures, spectography, and a wide variety of related matters.

The Radio Engineering Section consists of units which design and develop new radio communications equipment for use in the field, set up and maintain a network of radio stations for use in the event of an emergency, and serve in a consulting capacity in a large number of other matters relating to communications.

The Cryptanalysis-Translation Section is primarily responsible for examining cipher messages and translating documents encountered during the course of Bureau investigations or referred to the FBI by local law enforcement agencies.

In addition to a wide variety of precision scientific equipment, the FBI Laboratory maintains a number of reference collections which are a valuable aid to the scientist. One of these, the National Fraudulent Check File, contains nearly 100,000 specimens of the work of fraudulent check artists. Others include firearms, ammunition, automotive paints, hairs and fibers, tire treads, watermarks, typewriter standards, anonymous letters and bank robbery notes.

To insure that the FBI derives the maximum benefits of modern science, FBI Laboratory personnel are in regular contact with other scientists in Government, educational and private industry laboratories to keep abreast of new techniques and developments which might be applicable to scientific crime detection. Research in the FBI Laboratory also plays a vital role as FBI Laboratory personnel strive to develop new information and techniques which will assist the Nation's law enforcement profession maintain law and order. The knowledge and expertise so gained are disseminated through training lectures, scientific papers, and personal appearances.

During its first full year, the fiscal year ending June 30, 1934, the FBI Laboratory made 963 examinations. The number of examinations increased to 2,337 in the next fiscal year. The general acceptance that law enforcement has given to the importance of scientific analysis of evidence is illustrated by the fact that in the fiscal year 1967, some 330,516 examinations were made in the FBI Laboratory. These examinations often are responsible for the conviction of law breakers. Of equal, if not greater, importance is the fact that they frequently result in clearing the innocent.

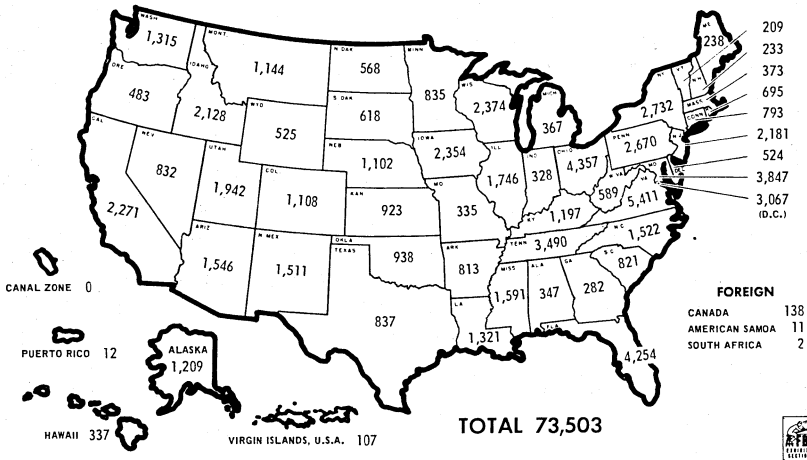
The facilities of the FBI Laboratory are available without charge to all duly constituted State, county, and municipal law enforcement agencies of the United States and its territorial possessions. In addition to making examinations of evidence submitted to the Laboratory for examination, the FBI will also



FEDERAL BUREAU OF INVESTIGATION
UNITED STATES DEPARTMENT OF JUSTICE
JOHN EDGAR HOOVER, DIRECTOR

FBI LABORATORY EXAMINATIONS MADE FOR NON-FEDERAL LAW ENFORCEMENT AGENCIES

FISCAL YEAR 1967



furnish the experts necessary to testify in connection with the results of their examinations in either State or Federal courts, all without cost to the law enforcement agency.

Accordingly, the question of whether any such agency makes use of science in its investigations is almost entirely a matter of local option since the facilities and the service are available merely for the asking.

Dr. BLUMSTEIN. Let me continue then with the third component of this program:

(3) Establishment of operations research groups within operating criminal justice agencies. These groups would conduct research on the operating problems of their organizations, and would serve as the technical link between the technically unsophisticated agencies in the criminal justice system and the broader technical community.

(4) Creation of a single major research institute to conduct and actually carry out fundamental research in a continuous and coordinated way necessary to bring about the major reexamination needed by any system that has remained unchanged for so long.

Mr. DADDARIO. Do you contemplate this as being separate and apart from any existing capability that we presently have? Do you support the idea that this should be a brand new research institute?

Dr. BLUMSTEIN. I think it should be a brand new research institute but—

Mr. DADDARIO. Under whose guidance?

Dr. BLUMSTEIN. I think it should be brand new, but it probably should be created by existing institutions, a multiuniversity consortium appended to something like the Rockefeller Institute, appended per-

haps to something like the Rand Corp. There are many forms which it could take, but I think it has to begin to assemble a unique collection of resources.

Mr. DADDARIO. Not under the control of the Attorney General's Office and within the jurisdiction of the Justice Department?

Dr. BLUMSTEIN. I think it must be outside the Government.

Mr. DADDARIO. How then would it relate itself back to the law enforcement people?

Dr. BLUMSTEIN. It should be in a major metropolitan center and operated in close coordination with operating criminal systems. It should not be serving under any operating system. It must have the freedom, I think, to really ask the basic questions that the system may find it uncomfortable to have asked if it is part of the system. The operating agencies would get their support from their own operations research groups. I think you need something that is separate and independent of these operating agencies.

Mr. DADDARIO. Why should anybody feel uncomfortable about this taking into consideration what you have said earlier? When I asked you a question about No. 2 you said that this really is outside of their province, and if it is, then they should not be uncomfortable. The reason I am asking you these questions is to find out whether or not you are critical about what is being done, and I am not able to elicit that from you. This would be extremely important if, in fact, you support this. You say that it should be outside of the present criminal justice activities, and if someone who is presently doing this work would be uncomfortable, then it would not be borne out by the questions I asked you regarding No. 2 would be within that same logical stream of authority.

Dr. BLUMSTEIN. I am sorry. First, very little is being done now in this whole area of research or development.

Item No. 2 refers primarily to equipment to support operating agencies. I think that should be very responsive to their needs and very closely linked to the operating problems.

Mr. DADDARIO. How can you create equipment to meet the problems you indicate exist and need to be met, without having the research that could lead to the development of the equipment needed?

Dr. BLUMSTEIN. The basic research I am talking about is not technological research. I think the equipment needed in operating police departments is almost all on the shelf somewhere. It is a matter of choosing from what is available and tying it together in the right way. Although there are some exceptions to that, basically the equipment can be made available. It is not that you need basic physical research to provide new physical knowledge to get new equipment. The research that is needed is research into the operations of this system, into social causes of crime, into the impact on crime of the various things done in the name of controlling it. It is not basic physical research that is the critical bind. Item No. 4 is directed much more at research into the criminal justice system, into the process of police resources allocation, and not specifically the research that will lead to better radios. We know how to make the radios. It is a matter of coagulating the market, organizing the demand, and providing the wherewithal to get the radios introduced.

These four functions are embodied in title III of the President's Safe Streets and Crime Control Act. The current bill, H.R. 5037, which passed the House on August 9, 1967, calls for the creation within the Department of Justice of a National Institute of Law Enforcement and Criminal Justice. This agency, modeled in part after the National Institutes of Health, would support both an internal R. & D. program and external contract or grant activity.

In addition, the bill calls for the creation of regional institutes serving one or more States and conducting research, development, and training for the prevention or reduction of crime.

And these regional institutes would have a much closer relationship to the operating agencies.

Mr. DADDARIO. You conceive of this being regionally motivated rather than an itinerant type of task force which could give help where needed and where required without having to develop within the Federal structure?

Dr. BLUMSTEIN. The regional institutes themselves would end up being itinerant. Even if we had 10 of these, they would have to travel around and provide technical support to the many departments within their area of concern.

Mr. DADDARIO. You are not indicating any real rigidity. You are leaning toward the idea that we ought to take the ways and means necessary to get help in these areas?

Dr. BLUMSTEIN. That is right.

I believe we are now witnessing the first steps by the Federal Government to provide major support to State and local governments to help them carry out their own crime control functions.

Requirements for new institutions

As these developments occur, we will need many kinds of new institutions to provide the technical support in our efforts to control crime and operate the criminal justice system. New institutions could be used in each of the four points I listed previously. These institutions will take many forms. I will leave it to those who have studied Federal laboratories more extensively and deeply than I to fit the functions to individual Federal laboratories where the Federal laboratories seem appropriate.

Of these new kinds of institutions, some will necessarily be attached to operating criminal justice agencies as internal technical or operations research groups. Others will be in a similar technical relationship, but as independent consultants, perhaps serving one or many operating agencies. Still others will serve as the National Bureau of Standards, Underwriters' Laboratories, and Consumers' Union serve their respective clientele.

Much of the equipment development work would be contracted to industry or other R. & D. organizations. University research centers would be expected to develop a growing competence in specific theoretical areas of investigation, examining such basic questions as who is deterred from what behavior by what social controls.

The basic research institute, in order to bring together the required range of disciplines, and still retain the required mission orientation, would probably have to be created anew, perhaps appended to a multi-university consortium or to an existing research institution of very broad scope.

The critical problems to be addressed by all these kinds of institutions are generally not those of enormous technical complexity. Two major exceptions to this generalization, where major technological advances are needed, are the problems of developing automatic fingerprint recognition systems and nonlethal, noninjurious, but effective police weaponry.

Rather than technical, the problems are more often ones of selecting from a menu already rich in technical possibilities. That selection must take into account the operational needs of operating agencies, the danger of excessive invasion of privacy, as well as the technical characteristics of a new system. Then, there are additional problems in adapting a technical design to an operationally desirable form—human engineering, but in a very broad sense—and finding the best means of incorporating the innovations into regular operations.

This last task—of intimate technical adviser—is the kind of role performed by the service laboratories in the Department of Defense. Any organization that is to participate in this process for the criminal justice system must commit itself to a continuing involvement with the problems of crime control, including intimate interaction with the operating system. It must use that system as its laboratory, to collect data, to try out different innovations—always making sure that these do not violate basic rights of privacy, justice, and due process. After both the direct and side effects of an innovation are evaluated, the technical adviser can then identify the next round of innovations, thereby becoming involved in a continuing process of evolutionary improvement.

In considering retreading of existing Federal laboratories, many of which are in remote parts of the country, location may be an important consideration. The requirement for direct involvement with the operating system requires that such an organization be close to a major metropolitan area, just as our oceanographic institutes must be on the water and our radio and optical astronomy observatories must be separated from their respective interfering noise sources.

The technical skills of the organization must match those called for by the problems. Any institution working on crime control must possess a broad range of technical skills, including computer sciences, electronics, and the physical sciences. It should be especially strong in systems analysis and the social sciences.

Mr. DADDARIO. Are you going to give us some advice as to how to rate the cities?

Dr. BLUMSTEIN. I suspect that the process of choosing any location will apply. The resource availability, the opportunity for innovation, the pull of interests reflected in any decision—

Mr. DADDARIO. Do you think in this case it might work the other way, that the city might not want to be known as the one where the crime institute is located?

Dr. BLUMSTEIN. I know several cities that would love to have the crime research center located there, cities that are really interested in innovation.

I might add that the institution should be prepared to add lawyers and legislators to its staff.

Any such laboratory must get the insight that we on the Science and Technology Task Force were most fortunate to be able to get

from the Crime Commission staff. A separate laboratory will have to get it into their own staff.

To the extent that a Federal laboratory can meet these requirements, can establish the close and continuing relationships with the ongoing operations, and is ready and able to recruit the appropriate range of professional skills, to that extent it can make a significant contribution as a Federal laboratory devoted to the problems of crime control.

Mr. DADDARIO. Thank you, Dr. Blumstein.

Mr. Roush.

Mr. ROUSH. Mr. Chairman, even as a lawyer, I can appreciate the testimony which has been given here today. I am sorry that we are so restricted on time because it happens to be one of my favorite subjects, and it happens to be one of those areas of endeavor that my office has been connected with. But there are just one or two areas I would like to explore.

Mr. DADDARIO. May I say this? Recognizing that and understanding that the House is meeting an hour earlier today, please ask all the questions you have, and we will proceed on the basis that we will have another opportunity to discuss this if necessary. It was never our intention to do it in 1 hour.

Mr. ROUSH. At this time I will be as brief as I can.

Doctor, I would imagine that there are certain cities in America which are far ahead of other cities in this matter of using innovations and using our technical and scientific skills. Could you identify some of these cities for us?

Dr. BLUMSTEIN. I would certainly rate Los Angeles high. I would certainly rate New York high, with its attempt to introduce a major command and control system. I would certainly rate Chicago with its sophisticated crime laboratory, and I would certainly rate St. Louis with its advanced computer system high, and there are many others.

Mr. ROUSH. What research is done by the FBI, if anything?

Dr. BLUMSTEIN. I would say that the FBI's research is in the crime laboratory itself. And even there, there is not very much of what one would call research. The major part of the FBI's technical activity in the crime laboratory is the provision of additional services.

The FBI is supporting the development of a fingerprint recognition system in its initial phases.

The FBI does do some research, which has been challenged by many criminologists, on criminal career data, on the course of development of criminal careers. This research is published in the Uniform Crime Reports.

Although I wouldn't call it research, the FBI has taken the technological lead in developing the National Crime Information Center, which provides police departments around the country with instant access to a national file of stolen cars, wanted persons, and a certain class of stolen property.

Mr. ROUSH. I appreciate the FBI and the work they are doing, but I am wondering if as legislators and as people in Government and as citizens if we aren't trapped by the thought that the FBI is doing everything. The feeling that the FBI is the unit in charge of crime control, detection, and what have you in this country. As a result of that, I believe we have neglected this area tremendously. You were very kind, I think, in outlining what the FBI is doing by

way of research and development. I believe that Congress has given them every penny that they have requested, and I do not believe they have asked for enough. I do not believe the FBI is doing enough in using the modern science and technology in this matter of crime detection, prevention, and control.

I do not want to put you on the spot, but isn't it true that the FBI is very jealous of their prerogatives as the outfit in charge of crime detection and control in this country?

Dr. BLUMSTEIN. Let me make a few comments that you stimulate. No. 1, I think, and I think most people in the country would agree, that it would be wrong to expect one Federal agency to do everything about crime control in the United States because of the concern of centralization. So I think we should not look to the FBI to do everything. I think we should look to spread some of this around so that you don't have the concern when with one agency controls all aspects of the Federal role with regard to law enforcement.

No. 2, I think an agency that is going to be an effective research and development organization must provide a climate in which it can attract very good people. I think some of the issues are illustrated by the problems the Defense Department has had with its service laboratories and their difficulty in recruiting first-rate people. These problems led the Defense Department to go outside to set up nonprofit corporations to create the right working environment in order to attract the kind of people they need. This illustrates that the FBI, being basically a police organization, is not likely to be able to attract the best scientific talent that is needed to be applied to this problem.

Mr. DADDARIO. Mr. Roush.

Mr. ROUSH. Would it apply to the Justice Department, generally?

Dr. BLUMSTEIN. Certainly, but less so. There is always a trade-off between closeness to the problem and closeness to action on one hand and separateness, independence, and the danger of ivory tower thinking on the other. I think putting the major research effort directly within an operating police agency probably puts you too close to the problem. Setting it up in a very sterile situation out in the mountains somewhere gets you too far from the problem, and the results don't get implemented into action. So I think the kind of compromise that was made in putting into the Justice Department is probably as good as a compromise as you could get on this balance of interests. There are still many people who are concerned about it being in less receptive an environment than they might like.

Mr. DADDARIO. Mr. Waggonner.

Mr. WAGGONNER. It seems that you have been a little bit contradictory. You have a criticism of the FBI for being a little bit too centralized, and you yourself have just recommended that this new research institute should be a single institute and should be highly centralized.

Dr. BLUMSTEIN. Are you referring to item No. 4 in the list? That is a single research institute which might have on the order of 50 to 100 people. It is not a program management operation. It doesn't run things other than its own research program. You need that research institute centralized in order to get a critical mass of scientists working together in a continuous and integrated way on crime problems. You always have some degree of centralization. The one in the research

institute is far less centralized than anything that I referred to with regard to the FBI.

Mr. WAGGONER. If you followed that to the ultimate conclusion over in the Department of Defense, there should just be one research agency.

Dr. BLUMSTEIN. That is why I don't like to follow things to their ultimate conclusions. I argue very strongly for diversity and for multiple opportunities to do things, but to have 40,000 independent opportunities to do things and thereby spread the wealth so thinly so that no one has time or money to do anything is too decentralized.

Mr. WAGGONER. Having two institutes for consideration?

Dr. BLUMSTEIN. The issue was the one of getting enough of the right, good people together. We would like as many as we can support because the problems are important and complicated enough, but when you have one that is really a great institution, you have a much better chance of bringing together the right kinds of numbers of people. That was the consideration that gave rise to one research institute.

Mr. DADDARIO. Mr. Roush.

Mr. ROUSH. I have followed this question rather closely as to what type of institute we need, and I was pleased with your testimony. I was disappointed with the House action in placing this institute under the jurisdiction of the Justice Department. I had introduced a bill proposing that we set up a separate institute patterned somewhat after the National Science Foundation. I gather this would not be entirely what you had in mind either? Is that correct?

Dr. BLUMSTEIN. That is correct. My personal view on this—

Mr. ROUSH. I might say my reasons were exactly the same reasons that you have given.

Dr. BLUMSTEIN. Let me make a distinction between the research institute which is item No. 4 on this list from the Crime Commission, and the National Institute which is a governmental bureaucratic agency. The research institute is an independent research institute such as Brookhaven or the Rockefeller Institute or Rand. It is an organization that works at research. The National Institute, which was created in the bill, is an agency that partly runs its own research program, but exists primarily to support research around the country.

One could set that up as an independent agency like the NSF. That way, it would have much more freedom. That kind of environment might be more conducive to a more independent research program.

On the other hand, if you are going to set up in the Justice Department a subsidy program to distribute hundreds of millions of dollars to help local law enforcement in planning, to help new programs get established, to help innovate within the criminal justice system, then I think you gain more by attaching the research arm to that program. It should not be too close and not subservient to the grant program. But by creating them close together, the results of the research can help in the subsidy program, can provide evaluation of the subsidy program, and can provide guidance where the subsidies should best be allocated. I would opt for that.

Mr. ROUSH. I was not thinking in terms of an arm of the Justice Department which would be allocating funds, subsidizing local units. I was thinking in terms of a research institute.

Dr. BLUMSTEIN. For the research institute, I would go even further than yourself and ask that that not be within the Federal Government

and actually outside the Federal Government, where with some few exceptions research is much better able to thrive. But I would ask that it be subsidized by the Federal Government.

Mr. ROUSH. This is the thought of how we can best bring the potential of industry into this matter. I think that there is a tremendous potential here, and I would like to cite my own experience as an example. The President's Crime Commission made a recommendation that we have a uniform telephone number for reporting crime, and I have since gone one step further and proposed that we have one telephone number for reporting all emergencies. As a result of this endeavor, and even more so as a result of the influence of Mr. Loevinger, of the FCC, A.T. & T. has agreed to make available a single emergency telephone number, 911, which will cost A.T. & T. over the next few years in excess of \$50 million to install or make the necessary modification of equipment. This, of course, includes modifying telephones so as to permit an immediate reaching of the operator without the use of a dime.

I wonder if we are directing our endeavor toward not only the communications industry, but other industries such as the computer industry. Is anything being done now, and do you see how we might enhance this endeavor and let these people work on specific problems?

Dr. BLUMSTEIN. I think you raise a really basic question that has not yet been adequately addressed. That is the question of how the Federal Government can bring together the needs of these diverse agencies. Even without the Federal Government, how can the needs of these diverse operating agencies be represented to industry to give them an assurance of a continuing market to warrant their investment in R. & D. One of the ways I see this happening, for instance, is through the equipment standards organization which would represent police needs. To a degree, IACP has done some of this, but in a very informal and relatively nonfocused way. Here is a role for some national agency to work with police departments and, in effect, coalesce their diverse demands into standard designs, standard requirements, which can then be presented to industry.

Another role the Federal Government might undertake could be to underwrite the initial production run of certain equipment so that there is a guarantee that the production volume will be large enough to warrant the R. & D. investment and the tooling-up costs. There are many other ways in which the Federal Government can coalesce the demands. It needs far more thinking than it has yet been given. I think Federal agencies, without running police departments, without exerting excessive influence over them, can bring the police interests together, present them to industry, and then provide feedback on how well the devices and new systems are performing, so that future installations can be modified appropriately.

Mr. DADDARIO. Mr. Roush.

Mr. ROUSH. Thank you.

Mr. DADDARIO. Mr. Waggonner.

Mr. WAGGONNER. You seem to be contradicting yourself. You wound up by saying we need more centralization in answer to Mr. Roush's statement.

Dr. BLUMSTEIN. I think the major theme of my presentation has been that we need more coagulation, centralization, of the very dis-

parate demands and needs of operating agencies. In no sense do I say we don't need centralization. I am saying we don't need a single centralized control over all State and local law enforcement agencies, and I am sure you would agree with that.

Mr. WAGGONER. The Crime Commission report had to do with the establishment of this research institute. You took the position that it should be independent of the Federal Government. You wound up your statement on page 11 advocating this with a Federal laboratory. How do you explain that contradiction?

Dr. BLUMSTEIN. First, at the end of my statement, where I was talking about Federal laboratories, it was not just in the context of the major research institute that I identified as item No. 4.

Second, some of the Federal laboratories are, in fact, independent of the Federal Government. Contract agencies like the Jet Propulsion Laboratory are independent of the Federal Government, but are nevertheless classed as Federal laboratories. The discussion at the end of the statement refers to the wide range of kinds of uses that Federal laboratories might serve in the criminal justice system rather than just as the specific research institute.

Mr. WAGGONER. Would you agree that somebody will have to make a personal judgment, about how much centralization we can stand and how much decentralization we ought to have?

Dr. BLUMSTEIN. I think there will have to be a whole sequence of judgments and decisions that weigh the virtues of bringing interests together against the concern about excessive centralized control and power. These decisions are made every day.

Mr. WAGGONER. This single research institute you talk about which should have 50 to 100 people; could you tell me a little more detail about how you would channel this information into the Federal Government. If the Federal Government is going to pay for the operation of this institute, It should receive its findings even though it is independent of the Government?

Dr. BLUMSTEIN. I think it will be outside the Federal Government. I think the findings will appear as reports. The reports will be disseminated not only to the Federal Government but to other people doing independent research outside the research institute. The findings would be disseminated to operating agencies so that they could take advantage of them. There is the basic question of what problems they study, which I suspect is the question that you are much more directly interested in. The problems that they study must ultimately be of real interest to the Federal Government and the kind of decisions that are to be made both federally and locally.

Mr. WAGGONER. How do you propose that the people who participate in the work of this institute be chosen? Who would choose these people?

Dr. BLUMSTEIN. The choice would have to be made by the management of the research institute just as staff is hired by any research institute—on the basis of their technical proficiency and ability to address the problems.

Mr. WAGGONER. You would agree that part of our problem stems from bad habits in law enforcement? We get into habits that are bad, and we do not recognize them until it is too late. What would you do with these people, give them lifetime contracts or give them

work on short-term contracts? Isn't there the danger that these people would just become monoliths themselves and would sooner or later fail to bring forth anything new? You have just a small number of people and in the end you stand the real risk of having these people after a while grow stale themselves?

Dr. BLUMSTEIN. I would certainly hope that the environment as created and the management is effective so that the institute attracts good people and provides a continuing healthy environment so that good people stay and those who are not good are weeded out.

Mr. WAGGONNER. How do you determine what is a good man in this type of law-enforcement work?

Dr. BLUMSTEIN. Based on the quality of the research he does. That is the problem of managing research. In my own work, among the people who work with me, I know who is putting out good work and who isn't. There is amazing agreement on who the good guys are and who the not so good guys are. That is not a terribly complicated issue.

Mr. WAGGONNER. But that involves personal judgment?

Dr. BLUMSTEIN. Yes; no question.

Mr. WAGGONNER. That is all.

Mr. DADDARIO. Mr. Brown?

Mr. BROWN. Let me ask you this question. The United States is the wealthiest country in the world and has a standard of living that goes up 5 percent a year. Obviously we are a very affluent society. What simple answer would you give to the question of why our crime rate in almost every category is increasing every year?

Dr. BLUMSTEIN. There are no simple answers. Some heroic attempts at providing still inadequate answers took, I believe, nine volumes of the Crime Commission report. There are just so many factors involved. I could start enumerating some of them, but I don't know that it would help very much.

Mr. BROWN. Do you think it is a matter that will be solved by more effective law enforcement?

Dr. BLUMSTEIN. I think more effective law enforcement will solve some of it. I don't think there is any simple solution. There is a whole range of attacks that need to be used in making it more clear that those who do violate the law will, in fact, be apprehended. More effective law enforcement is a part of it, but only a part.

There are much more fundamental issues that we have got to get at. We have got to recognize that what we define as crime is not something that is going to be eliminated. In many respects the price we would have to pay to really eliminate crime is a price that none of us want. I think we have got to view crime as one aspect of an evolving social order that must be viewed in perspective of the things we do and don't want in our lives.

Mr. BROWN. I have no other questions.

Mr. DADDARIO. Dr. Blumstein, thank you ever so much.

Because we are in a little bit of a rush this morning, I hope we might send to you some additional questions for the record?

Dr. BLUMSTEIN. Thank you very much, Mr. Chairman.

Mr. DADDARIO. Thank you.

QUESTIONS SUBMITTED TO DR. ALFRED BLUMSTEIN BY THE SUB-COMMITTEE ON SCIENCE, RESEARCH AND DEVELOPMENT

Q. 1. In your testimony you cited certain police needs and indicated the technology is now available to meet those needs. What, then, in your opinion, are the reasons why law enforcement agencies are not using the available technology?

A. The reasons for the limited introduction of technology into police operations are multiple and complex. They also differ for different kinds of technology. Included in the reasons would be the following :

1. Equipment budgets are typically separate line items in police budgets, so that the cost of additional equipment may appear as a large increase in the equipment budget, even when it would be small compared to the total police budget or compared to an appropriately formulated program or functional budget.

2. Many of the smaller police departments do not know about some of the technological possibilities available to them.

3. In many cases, equipment developed for other purposes may require some adaptation to police use ; that adaptation may not yet have been done.

4. Many police departments are unable to evaluate among alternative possibilities, and so, end up choosing none.

Q. 1a. In your opinion, why hasn't industry filled the void as it would with normal consumer demands?

A. The market is small and fragmented and so selling that market could lead to a high sales cost per unit sold. Also, the police market is an unknown to most companies and it would require the development of special marketing skills to address that market. In many cases there are some research and/or development costs required and industry may be reluctant to make the required investment as long as the market uncertainty exists.

Q. 1b. What can be done about these problems?

A. Create a coordinated national program to provide proper guidance and incentives to industry to provide the products necessary for the police markets. Provide the information to help police departments learn of currently or potentially available products and help them select from among these products those that best meet their needs. Finally, help them incorporate these innovations effectively into their operations.

This program would be supported by actions such as the following :

1. Federal support of research and development.

2. National establishment of equipment standards and unified requirements.

3. Field evaluation and collection of field reports on performance of new equipment and methods.

4. Creation of an information center to disseminate such information to police departments.

5. Creation of an organization with a staff able to provide technical advice and assistance to police departments.

6. Federal underwriting of the initial production run of a new item to guarantee a reasonable market.

7. Creation within the larger police departments of internal technical and operations research functions. These functions would include liaison with external groups which could serve as technical advisors. The external groups could be consulting firms, technical professional societies, or committees of disinterested citizens or industry scientists and engineers.

8. Adoption of program budgeting by police departments.

Q. 2. What do you consider to be the three most important needs in law enforcement where technology can make the greatest contribution? Why?

A. The magnitude of contribution that would result from any particular technological innovation would naturally depend strongly upon the size of the department, the nature of the crime problem it must deal with and the current state of its technological development. For instance, a department that had a major part of its force on foot patrol and unequipped with portable radios could probably benefit most by equipping all its officers immediately with portable radios. Another department, equipped with current model radios, would benefit less from a new generation of radios. If forced to generalize across the nation, however, I would probably rank the technological innovations as follows :

1. The introduction of computers (locally for the larger departments and with a terminal on-line to a remote computer for the smaller ones) for handling the mass of information collected in police operations. Most of this information goes unused because of the difficulty of retrieval and manipulation. The growing availability

of software for police functions will enable the departments, perhaps through a police computer users' organization, to make use of the information both for more effective tracking down of criminals and more efficient use of their resources.

2. Improvement of the police command and control function (housed in the police communications center) through improved design of these facilities for more rapid and complete information transfer, more intelligible display of the current crime or disorder situation, and more rapid and effective dissemination of control orders to the units on patrol. This improvement could make a significant dent in the 20-50% of response time attributable to delay and processing in the communications center. The use of on-line, real time computers could make a significant contribution here but much could be done, even without introducing a computer, through better display of information and reorganization of the functions and facilities.

3. The development of a light-weight low-cost portable police radio so that every police officer can be in continuous contact with headquarters at all times.

Q. 3. In your testimony you refer to a new research institute which should be outside of government. What do you consider to be the advantage of having such an institute outside of government?

A. In order for such an institute to conduct basic examinations into the causes and nature of crime, and to conduct fundamental re-examination of the criminal justice system, it must be able to recruit the nation's best scientists and their investigations must be free of any responsibility or commitment to current methods of operation. It would be very difficult to recruit these people into the government.

Q. 3a. How would it be funded and what would it cost?

A. It should be funded by government grant in a manner similar to the funding of the recently created Urban Institute. It should be started by the Justice Department, but it should be free to accept additional funding from other sources, especially foundations. The cost, of course, would depend on the size it reached, but about five million dollars a year or 100 research staff, should be appropriate after about a three-year buildup. Funding should be with a sufficiently long lead time, about three years, to assure continuity of operation. The funding formula might be 100% for the coming year, two-thirds for the second year and one-third for the third year.

Q. 3b. How would the institute disseminate its results to local law enforcement agencies?

A. There are a number of mutually complementary methods by which its results would reach implementation. These include the following:

1. Primarily through close liaison among the institute's staff, the staff of regional technical assistance groups, and internal operations research or technical groups in operating departments.

2. Publication and wide dissemination of its reports directly to law enforcement agencies.

3. Maintenance of its results in a central information center.

4. Creation of a new criminal justice research journal to which it would contribute.

5. Distribution of a quarterly publication translating its research results into operational recommendations.

Q. 3c. Would such an institute still be necessary if the institute as specified in the Safe Streets Bill is authorized?

A. Yes. The National Institute of Law Enforcement and Criminal Justice called for in the Safe Streets Bill is a governmental agency whose primary function is the dissemination of funds for research and development. While such an agency would be likely to have an internal research component, it could not be expected to be of the quality nor have the independence required in the research institute discussed above.

Q. 4. Roughly speaking, what do you estimate it would cost per year to reverse the increasing crime rate, or at least bring it into harmony with the population rate? In what broad field would you apportion these funds (training, operations, research, etc.) and why?

A. This seemingly simple question is the best argument for the need for a major national research program. We simply do not know what are the effects on crime of any of the various things we might do to try to control it. Furthermore, we do not even know if *any* degree of additional expenditures on law enforcement would reverse the increasing crime rate without addressing some of the more basic long-term social causes of crime. I wish I could even guess at an answer, but I am unable to.

Q. 5. In your opinion, what type of assistance could Federal laboratories now provide to law enforcement agencies or to the Department of Justice?

A. This is so broad a question that any general answer would be almost meaningless. The number of possible contributions is limitless. All of the technical roles discussed in the Science and Technology Task Force Report, for instance, could possibly be handled by Federal laboratories, although in many cases, industry, universities or other research institutions might be more appropriate. The important point in my testimony is that a Federal laboratory could either take on a specific project (just as could any other industrial, university, or non-profit research organization) or it could establish a special private relationship with a local, state, regional, or national criminal justice agency or technical support organization. If it were to do the latter, then it would have to make a commitment to become intimately familiar with the operating problems and to hire the appropriate specialists on its technical staff.

Q. 6. To what extent should government laboratories test and evaluate equipment and hardware in order to provide law enforcement agencies with performance information?

A. There should be at least one central laboratory that tests and evaluates equipment and hardware for law enforcement agencies. This could well be an existing government laboratory, but it need not necessarily be a government laboratory.

Q. 6a. What was the basis for Task Force recommendation that an agency such as the National Bureau of Standards "coordinate the establishment of standards for equipment to be used by criminal justice agencies and to provide those agencies technical assistance?" Was the Bureau consulted? Would this function be handled by the institute if the Safe Streets Act is passed?

A. The basis for the recommendation for a standards agency derives from the considerations mentioned in answer to Question 1. The needs are as follows:

1. To collect the needs of the dispersed police market and aggregate them into a more cohesive demand, thereby providing better guidance to industry in conducting its development.

2. To provide an opportunity for more sophisticated development of standards than would be possible by any single police department.

3. To make the standards reflect police needs rather than only a manufacturer's decision, where that decision may have been dictated more by existing products or by a related but different market.

4. To provide standards to which all manufacturers would adhere, thereby permitting interchangeability of modules, ease of modification, more free choice of suppliers, and larger volumes of identical units (and hence lower unit costs).

The National Bureau of Standards was used only as an illustration of an agency that could perform this function; no formal request was made of them, although the possibility was discussed informally with NBS staff members. Responsibility for creating this standards agency would be a responsibility of the National Institute of Law Enforcement and Criminal Justice called for in the Safe Streets Act. I would not expect, however, that the Institute would perform this function internally; rather it would probably contract with a government or private organization.

Q. 7. To what extent do Federal policies and scientific and technological matters conflict with law enforcement needs (for example, possible FCC decision on frequency allocations as between television, police or citizens' communications)?

A. The most significant Federal technical policy area impacting on police is in the FCC policies with regard to police radio communication problems. These issues are discussed in detail on Pages 29-33 and Pages 132-136 of the Science and Technology Task Force Report. In addition, there is, of course, significant interaction with much of the research and development performed by the Defense Department (e.g., non-lethal weapons, command and control) since much of the technology resulting from Defense could be applied to police problems.

Q. 8. It has been proposed that the directors of Federal laboratories have funds available to them to pursue research relevant to national problems (such as crime) up to the point where proposals could then be submitted to the agency having the primary mission responsibility. What do you see as the advantages and disadvantages of such a concept?

A. From the viewpoint of crime control, there could only be advantages to this concept. The Federal laboratories are institutions of considerable technical competence and I would think that if the scientists in them had the opportunity to think about and do some research on the problems of crime control, we would

undoubtedly see some significant proposals being generated. I would hope to see some of them working on problems such as fingerprint recognition, the development of safe and effective non-lethal weapons, police car locators, inexpensive radio scramblers and other technical concepts that may or may not derive directly from their past technical experience. The only disadvantage that I would see in such a concept is that this would be a diversion of resources from the needs of the agencies supporting them. I would hope, however, that this process would result in serving a greater national good.

Q. 8a. How would Federal laboratory personnel be aware of the specific needs of law enforcement agencies?

A. The laboratory personnel would become aware of the needs through the normal processes of familiarization. They would meet with law enforcement personnel individually and in groups, they would ride in police cars and observe and participate in the operations directly. They would also, of course, read the reports of the President's Commission on Law Enforcement and Administration of Justice.

Q. 9. Insurance companies report research and standard setting in an effort to lessen the losses due to fire. Why, in your opinion, hasn't this occurred in the crime field, either with support by insurance companies or industrial trade associations?

A. I believe that insurance companies should provide greater incentives to people to protect their property. I do not know the exact amount of insurance payment for stolen property, but it is probably not too large since the total value of property other than automobiles reported stolen was \$227.1 million in 1966, according to the FBI's Uniform Crime Report. Thus, since the insured losses are relatively low, the insurance premiums are relatively low. It is probably difficult for the insurance companies to provide very strong economic incentives for self protection when the rates are very low. There are, however, reductions in insurance rates for various kinds and degrees of self protection. Furthermore, standards are established and administered by Underwriters Laboratories for various kinds of safes and alarm devices.

Q. 10. To what extent has the Task Force Report on Science and Technology been sent to Federal agencies?

A. The Task Force Report was distributed widely, with over 3000 sent free across the nation, and another 12,000 purchased from the Government Printing Office. It has been distributed widely to Federal agencies interested in problems of law enforcement as well as those engaged in related research.

Q. 10a. Would it be useful to send the Task Force Report to Federal laboratory directors and request them to match the report's identification of opportunities for research and development with their capabilities?

A. Yes.

Q. 11. If it were decided to announce a Federal policy calling for positive and energetic cooperation of Federal laboratory directors with law enforcement organizations, would it be desirable to concentrate the resulting relations with national or regional organizations of law enforcement groups, or with individual agencies? Why? What are the major national and regional organizations?

A. The relationship of Federal laboratory directors should be with both national as well as local groups for different purposes. They should relate to the national groups for identification of requirements which exist across the nation and for widespread dissemination of their research findings. For simple reasons of convenience, however, they should relate closely to the individual agencies in their immediate area so that they can become more intimately familiar with the operating problems and so that they can have a field laboratory for testing under careful supervision and control the results of their investigations. The principal national professional police organization is the International Association of Chiefs of Police. The executive director, Mr. Quinn Tamm, would be best able to identify the most useful regional groups.

Q. 12. To what extent would it be desirable to establish at one of the Federal laboratories a clearinghouse to collect, hold, and send out information about Federal research and development that reasonably relates to problems of law enforcement and crime control?

A. Such a clearinghouse is needed now and will certainly be needed after a Federal research and development program becomes more fully developed. The National Institute of Law Enforcement and Criminal Justice called for by the Safe Streets Act is specifically charged with establishing such a clearinghouse. It is not clear, however, that the best place for such a clearinghouse would be at a Federal laboratory. It might well be more desirable to have it housed di-

rectly within the National Institute of Law Enforcement and Criminal Justice or with a private contractor experienced in such operations.

Q. 12a. If you are familiar with the NASA Technology Utilization approach and with that of the Office of State Technical Services in the Department of Commerce, please comment upon the possibility of such systems to get information to law enforcement agencies. Would you suggest other approaches?

A. I am not sufficiently familiar with the details of those approaches to comment on them directly. I have indicated in my previous answers, however, that I feel strongly that an important part of the problem in improving the technology of law enforcement depends critically on the dissemination of the information coming out of industry and the laboratories and the translation—almost “hand holding”—to the operating needs of the individual departments. A technical clearinghouse serves only part of the need. There must be people in the loop. These people must be familiar with the technology (which in most cases is not terribly complicated) and with the operational problems of police departments. This must become a professional specialization. Some of the larger departments will hire their own. In most cases, however, there will have to be state or regional offices employing these specialists in technology transfer—modeled after the agricultural county agent—who will provide the information link between the technically sophisticated products and reports and the operating needs of the technically unsophisticated police departments.

Mr. DADDARIO. Our next witness is Mr. Quinn Tamm.

Mr. WAGGONER. Mr. Chairman, I do not know how many of the members of the committee are personally acquainted with Mr. Tamm or his background, but I doubt seriously that it would be possible to bring a man before this committee more knowledgeable on this subject. Mr. Tamm is an authority on this subject, and he is a rather practical man in everything he does. I consider this committee extremely fortunate to be able to receive his testimony.

Mr. DADDARIO. Thank you, Mr. Waggoner.

Mr. TAMM. Thank you, Mr. Waggoner.

(Mr. Tamm's biography follows:)

QUINN TAMM

Mr. Quinn Tamm, Executive Director, International Association of Chiefs of Police, Inc., is a native of Seattle, Washington. He received his early education in Butte, Montana, and graduated from the University of Virginia in 1934.

Mr. Tamm served in the Federal Bureau of Investigation, Washington, D.C., from 1934 to 1961 in the capacities of Special Agent, Inspector and Assistant Director. At the time of his retirement in January 1961 he was the Assistant Director of the Laboratory Division. Prior to that time he had served as Assistant Director of the Identification Division and the Training and Inspection Division of the FBI.

Mr. Tamm is married and the father of two sons.

Mr. TAMM. I do have a prepared statement that I would be very pleased to submit to the committee rather than to take the committee's time to read the statement which has been given you.

Mr. DADDARIO. It may be submitted. You can proceed as you would like.

STATEMENT OF QUINN TAMM, EXECUTIVE DIRECTOR, INTERNATIONAL ASSOCIATION OF CHIEFS OF POLICE

Mr. TAMM. I would just like to cover some of the high spots. I think it might be more productive if I answered some of the questions which you might extend. I think I know some of the answers.

I do represent the professional association of law enforcement administrators of this country. The IACP consists of over 7,000 police

administrators, located primarily in this country and in Canada and includes representatives of 60 of the free world countries, but our membership is concentrated in this country.

We are interested in the fact that the Federal Government has shown a decided interest in assisting law enforcement, and we hope that it will be possible to stimulate some practical and some substantial support from the Federal Government.

We are doing things in police work in the same manner in which my grandfather did them 50 years ago. We are patrolling beats. We have had some improvement in communications. We have had some improvement in means of transportation but we have not made progress from the research and development standpoint.

We think that there is a wide area in which much progress can be made. There is no other segment of the country or its society which is receiving more attention or more criticism than are the police at the present time.

I am not going to be able to tell you anything new or startling. I am just running through this very briefly and then I will be very happy to answer any questions.

I was Assistant Director in charge of the FBI Laboratory for many years and I am a confirmed advocate of the marriage of science to law enforcement. I can assure you that the FBI Laboratory has contributed tremendously to law enforcement and literally thousands upon thousands of criminal cases have been brought to successful culmination because of the existence of this Laboratory.

At the same time, literally scores of innocent individuals have been exonerated of wrongdoing through the application of science by the FBI Laboratory.

In reference to a statement by Congressman Roush and anything further that I may say, let me temper my comments by stating the fact that anything that I say that is not praiseworthy of the FBI Laboratory or any of the FBI functions will be interpreted as criticism. I believe this sincerely. I would be amiss if I didn't say so. FBI Laboratory is not a research laboratory. The tremendous volume of current cases which come to the Laboratory for analysis from the scientific standpoint in order that the cases may be presented in court prohibit the exercising of research facilities or the use of the FBI Laboratory for the intensive type of research that is needed in law enforcement, except in those instances in which the research has developed directly from actually examining of evidence. This is a very simple fact. There are just thousands upon thousands of cases that come in for analysis and for presentation in court. I think that the FBI Laboratory has shown leadership in this type of work.

It, incidentally, is supplemented by State laboratories around the country in many of the States. The major cities have their own laboratories. These are laboratories that are devoted exclusively to the analysis of evidence in current cases pending in court and the research is limited because of the personnel and the funds available.

Mr. DADDARIO. Is that how it should be? You say you support the National Institute of Law Enforcement later on in this statement, but should we, in fact, allow this to continue as it is. Recognizing that these limitations do occur, should there be some scientific and research

capabilities within the Justice Department so that this work which it is doing could then be done better, or would it be done better?

Mr. TAMM. I think it would be done better, and I do support the concept of this National Institute of Justice.

Two years ago, in the magazine published by the IACP which I edit, I wrote an editorial pointing out the need for the concept which you have, an institute very similar to the National Science Foundation, separated from and supported by Federal funds, but also giving the opportunity to industry to assist in this problem or to foundation grants so that worthwhile research could be conducted in a very, very necessary field.

From the practical standpoint of what has gone on as far as the law enforcement and criminal assistant agencies, I feel that the first step in this direction would be the National Institute of Justice, and if it is a part of the Department of Justice, it should be a separate part of the Department of Justice, but it could come under the supervision of the Attorney General. This must be done because we have to have some research capability in law enforcement. Otherwise, we are not going to meet this rising crime problem.

Mr. DADDARIO. We are talking about an either/or situation, and I wonder if some experience this committee has had in this area might help. When this subcommittee reviewed the work being done by the National Science Foundation, there was a proposal that it ought to be the only agency in Government really to do basic research.

As we examined that, we came to the conclusion that this should not be so, that it should retain that unique function, but that the mission-oriented agencies, and I would certainly put the Justice Department in this area, ought to have a basic research competence of their own in order to develop the quality necessary to do a better job. It seems to me that analogy applies here. If we were to apply that capability and then develop some other type of institute, we might accomplish much more than if we separate these functions as has been suggested.

Mr. TAMM. I would agree with you. I feel that there are a couple of basic needs here. For instance, industry has done a tremendous amount of development work that could be applied to law enforcement, but law enforcement has no way of getting access to this. I have talked to a great many people on this subject, and there is a very practical problem that exists as far as industry is concerned; that is the market is limited, and they just aren't about to spend a great deal of money and make a one-shot sale of radios to a police department. They ask how many do you want. If you give every one of them a means of radio communication when the man leaves the force and there is a turnover in law enforcement, will you buy a new radio or will you give the new man a used one.

Mr. ROUSH. Mr. Chairman?

Mr. DADDARIO. Mr. Roush.

Mr. ROUSH. Mr. Tamm, I have a great appreciation for the FBI. I served as a prosecuting attorney for 4 years, and I have used their laboratories. I have used them with great confidence. The point I was trying to make was that when we talk about the national effort in crime control, I believe we are trapped by the thought that the FBI

is capable of doing everything and that the FBI is doing everything. This inhibits our efforts in this regard.

They are not doing everything, and they are not, within the limits of their jurisdiction, capable of doing everything. I am glad to see that we are finally getting away from this idea and are looking elsewhere for the research and development of new equipment, techniques, and methods.

We are also, I believe, coming to the point where we are ready to jump into this area of criminal behavior, the use of the social sciences, in our effort to control and prevent crime. The rehabilitation of the criminal is a very, very important area.

The FBI has taken the leadership in many areas, but I might disagree that they have exercised as much leadership as they could have in bringing us into new endeavors which would make a major contribution to crime control and prevention.

Mr. TAMM. I spent 26 years in the FBI. I was in charge of the laboratory, I was in charge of training; at one time I was in charge of the identification divisions. I served as assistant director in charge of three divisions.

I feel very strongly and have always felt that law enforcement is a local program. It shouldn't be subjected to Federal domination. I could say just send money and I feel I could do the best job of law enforcement you ever saw, and I feel this strongly.

I am going to agree with you completely that there has been too great a reliance in this area on law enforcement. This is a local problem and local law enforcement officers are beginning to realize this.

We have seen a tremendous change in the last 6 years. Law enforcement should be capable or be assisted in being self-sufficient in its own community. Law enforcement must relate itself to its own community. We have to recognize the social changes through which this country is going. In this regard, we can only do it locally. We need assistance from the Federal Government because of the nature of the tax structures of the cities.

I just returned from a meeting with what we call our major cities group. It consists of the 26 cities with a population of over 500,000. We meet twice a year. We had 21 of the major cities in this country represented.

We have tremendous problems because of the changes that are going on in the tax structure of the urban community as to whether there is money enough to meet this local problem. We feel that one of the solutions is the assistance of the Federal Government in providing needed funds, but with certain direction from the police departments themselves. We have relied too much on the FBI laboratories. We have relied too much on the FBI training. This is a problem we have to meet now and I agree with you completely.

Mr. DADDARIO. In the interest of saving time, I think I should file a general disclaimer for the committee and the witnesses. If there is any criticism of the FBI and the fact that it is not doing everything, we need not every time we make a recommendation or a statement apologize as a result.

Do you have further questions?

Mr. ROUSH. I only wanted to say it is not just a matter of limitation of funds, but also a limitation of talent.

Mr. TAMM. Very definitely, sir.

The association that I represent at the present time is actively engaged in trying to raise the level of educational background of the law enforcement people of this country. We have been doing this primarily through a Ford Foundation grant that was given to us to stimulate the interest in colleges and universities in police administration throughout the country.

When we started out with this particular grant from the Ford Foundation 4 years ago, there were 60 colleges and universities in this country, including junior colleges, that offered degree programs leading to a degree in police administration. Through the efforts we have obtained with this grant, there are now some 200 schools, colleges, universities, and junior colleges that are giving courses within easy reach of law enforcement where the law enforcement officers can attain a college degree.

Next, within the 50 States we have been advocating a minimum educational period and a minimum training period for law enforcement officers to be adopted by State legislatures throughout the country to see if we can't raise the standard of law enforcement.

I do not tell you that education is the whole answer to this problem. I say that education can contribute a great deal to solving some of the problems of law enforcement.

There are 23 States that have a minimum requirement of law enforcement officers of at least a high school degree and a minimum amount of training before you put this officer out on the street to perform his duties.

We strongly recommend in a period of 7 years from now that the educational requirement for police officers be a junior college degree, and 10 to 15 years from now a college degree.

This is not beyond the realm of possibility. We must bring to the law enforcement agency more expertise and I think the law enforcement agency is making a decided effort to do this.

Training facilities are extremely important. We have to make more facilities available to educate and train police officers and the better we get them trained the more quickly we are going to conquer crime.

Mr. DADDARIO. You say that things ought to be done on a local level, and you use Los Angeles as an example. What it is doing or not doing is not known to the New York Police Department. What makes that so? Why isn't there better coordination since there are now so many associations? Why is there the communications barrier?

Mr. TAMM. We are trying to do this now. Actually, no one knows how much research has been done in this country by individual police departments.

As a part of our Ford Foundation grant, we had \$25,000 to organize a central clearinghouse for information of this type. The \$25,000 over a 4-year period doesn't give a great deal of funds to collect and disseminate the material and did not provide an evaluation capability.

Research has been accomplished in many fields of police work—such as the very simple problem of one-man patrol versus two-man patrol in a patrol car. There are police associations and police agencies that very staunchly oppose the utilization of one-man patrol because it is considered dangerous. We don't know if it is dangerous or not dangerous.

The Chicago Police Department experimented extensively in this particular area and I think ended up with one-man patrol car.

There is all this information around the country and we are trying to bring it together.

We are limited by funds. My association is supported primarily by membership dues. We probably take in \$125,000 a year in membership dues which is not very much money for which we publish a magazine and an annual report but primarily we are supported by grants and by the fact that we have the only staff of its kind in the country.

We are a nonprofit organization and Internal Revenue takes that rather seriously so our funds are limited to what we get, but there is a need for research. It is a question of financing. The material is there.

Mr. DADDARIO. The limitation here is funding rather than anything else. If you were to take that as a beginning point, what would you need in money and numbers of people?

Mr. TAMM. This is one of the reasons I am interested in the National Institute of Justice. I think it could perform this function.

Mr. DADDARIO. The Institute goes far beyond that. You can get to the ultimate point by having something you could accomplish immediately at less cost. Could you isolate it?

Mr. TAMM. Yes. I am actively trying to raise money from industry right now to finance a project of this type at a million dollars a year.

Mr. DADDARIO. If that information were made available, you would then have a good idea of where to go from there.

Mr. TAMM. Where to start and how good it is.

Mr. DADDARIO. Is that your fundamental reason for supporting the National Institute—the idea that it would allow that to be accomplished?

Mr. TAMM. It would allow this to be accomplished; yes, sir.

Mr. DADDARIO. Your recommendation, then, is that this be a first step?

Mr. TAMM. Yes, very definitely.

Mr. DADDARIO. How would you put it together from the standpoint of making it effective?

Mr. TAMM. I originally approached this on the basis of our own association and the fact we do represent and we are in constant contact with over 4,000 chiefs of police in this country. We communicate with them by magazine, we communicate with them by a series of meetings conducted around the country, we develop some material for them. We are now developing a crime prevention program which is privately financed, and we have the means and we have the means of communication and we have never had any of our members deny us access to any information which they had.

My primary job is strictly one of financing a project such as this. I have knocked on the doors of as many industrial concerns as there are in this country, and I have not been able to interest any in the problem of law enforcement up until last year. Now the problem that is facing the police today, the civil disorders, has made industry conscious.

Mr. DADDARIO. Are there men who belong to police departments in some of our cities who you would use as the personnel in order to bring this information together?

Mr. TAMM. Very definitely, but I also have a staff of my own. We have the only staff of its kind in the country. I have a staff of men representing all types of law enforcement, local, State, county, Federal. We are doing research in the field of highway safety. We are doing research in the field of juvenile delinquency and the police role in this regard.

We are doing extensive research in community relations. We do reorganization management surveys of police departments. Every man on the staff has at least one college degree and a minimum of 10 years law enforcement experience, so we have created a basic staff for this type of work.

Mr. DADDARIO. The point of local law enforcement is a very valid one, and you have gone to industry to get some help.

Mr. TAMM. Yes, sir.

Mr. DADDARIO. Have you ever considered the possibility of getting some of the men whom you know to be highly qualified and have the cities support them for a year or 2 years activity participating in this kind of a venture?

Mr. TAMM. We have, but there is another factor that enters into this from a practical standpoint. The men that we want in this particular regard are in the upper echelons of local law enforcement agencies. There is a very practical question of them being away a year or 2 years from their own assignment because during that period of time the position of chief or superintendent of police may become available and they would not be there to take advantage of it.

Mr. DADDARIO. This is one of the problems we have in government. But we ought to be able to motivate a career opportunity.

Mr. TAMM. My experience has been to get young college trained police officers who have started up the ladder, have had a period of 6 to 12 years in law enforcement.

When they get beyond 12 or 14 years in a law enforcement agency and get involved in a civil service pension, you have trouble attracting them because they hesitate to change their living conditions and move. Most of the police officers are located in the communities in which they were born. This creates a problem, too, but I think we are making progress.

The whole law enforcement problem is so tremendous now it is necessary that we realize that we are going to have to do something about it. We are going to have to do something about the image of law enforcement in the community and give the law enforcement agencies the tools to perform the job.

Mr. DADDARIO. As we have discussed this this morning, you put a price tag on it of a million dollars a year.

Mr. TAMM. As a starter.

Mr. DADDARIO. But a start which could lead us properly down this road so that when additional sums are available we would pretty much be able to indicate why these expenditures should be made.

Mr. TAMM. That is right.

This is a tremendous amount, but it is badly needed. I think somebody is going to have to decide where we are going and what we need.

Mr. DADDARIO. Mr. Waggoner?

Mr. WAGGONER. You know I share your approach to local law enforcement; but I wonder, in the eyes of the public, what really

constitutes local law enforcement. Your approach to the research institute is from the point of view of the IACP. Some people consider not just the local police departments which are municipal in nature to be local law enforcement, but also the county unit of law enforcement as well to be local, and, as you are aware, the Safe Streets Act gives certain authority to the States in this regard.

How would we meld local law enforcement to include the IACP, the county sheriff's departments, or the National Sheriffs' Association, and the State police, which exist all over the country, in a way that you could distribute uniformly without a prejudiced or discolored point of view whatever an institute would produce that could conceivably be beneficial? For example, would the IACP have access to all the findings of such an institute, the National Sheriffs' Association have access, and the State police have access, and then let them coordinate at their own level those findings which they could utilize to advantage? Would that be proper?

Mr. TAMM. Yes, sir. We represent the State police organizations. There are 49 State police organizations out of the 50 States. Hawaii doesn't have a State police organization. The heads of most of the county police organizations are members of IACP. We have some sheriffs as members. The National Sheriffs' Association as you know is very much in existence. They are neighbors of ours. We work extremely close with them.

There is going to have to be some formula as far as we can determine to decide how we do or how this money is going to go within a particular State. It would be possible to have grants directly to them, but that the States themselves must have a plan to, in order to distribute money. Law enforcement operations differ from State to State so the State itself is going to have to set up a plan and an organization as to how they are going to handle these funds. This is proper. The State is going to have to recognize that there are major cities. The State must have a plan and I would say that since this involves Federal funds the plan must be approved by the Federal Government.

We again are engaged in some locally financed programs. For instance, we just signed a contract with the State of Florida to do a statewide survey as to the relationship of State and—in Florida they have a statewide enforcement bureau—the other law enforcement agencies.

We did a survey in Dade County which involves 30 municipalities to see if it wouldn't be practical to evolve a metropolitan system which I think will save money.

Mr. WAGGONER. Governor Kirk is going to try again?

Mr. TAMM. Actually, I don't know if Governor Kirk is responsible for this. The newly created law enforcement bureau is the one we have the contract with.

Mr. WAGGONER. The point I am making is we are going to benefit from whatever we do. We can't allow this thing to be a matter of a local pride and jealousy that puts the different associations in conflict even though they are attempting to accomplish the same thing. This is similar to the problem that different union crafts find themselves in from time to time when they become jealous of their own prerogatives.

Mr. TAMM. I can't say that law enforcement has reached this ultimate degree. We do work very closely with the National Sheriffs' Association. We have members of our associations who are sheriffs, some of the largest sheriffs' offices in the country.

We do have the problems that we do represent the police administrators. Their wishes are not always consistent with the association that represents the echelons of law enforcement, but we are moving closer and closer together.

Mr. ROUSH. One of the good practical programs of the National Aeronautics and Space Administration is the technology utilization program. I have intimate knowledge of the working of the aerospace research center at Indiana University. Industry tells them their needs and interests, and they in turn gather the information which is the innovations of their laboratories. They are able to supply to an industry a specific technical brief which is of interest to that industry, and I wonder if your organization or the FBI uses this service which NASA provides for private industry?

Mr. TAMM. I don't know about the FBI. We have been in very close contact with NASA for the last year in discussions of the material that they have available. We had them, at our last annual conference, provide us with material and printed literature that they think might be of assistance to the police.

They have been most gracious in the way they have reacted and we are maintaining extremely close contact with them because they have available certain things that law enforcement can use, such as the location of police officers on beats, and keeping track of an automobile. These days when we can track a missile in outer space we ought to be able to keep track of a man who is only two blocks from the police station.

This is, I think, going to be very productive and we have been in very close contact with them.

Mr. ROUSH. Thank you.

Mr. DADDARIO. We thank you for coming here this morning and being so helpful, I apologize for not being able to question you further, because we do believe that will be more helpful. We will be in touch with you with a series of questions, and see if we can work this out for the record.

(Mr. Tamm's prepared statement follows:)

PREPARED STATEMENT OF QUINN TAMM, EXECUTIVE DIRECTOR, INTERNATIONAL ASSOCIATION OF CHIEFS OF POLICE

Mr. Chairman and gentleman of the Sub-Committee, I am very pleased to have the opportunity to once again appear before a distinguished Congressional body interested in providing assistance to the law enforcement agencies of this country. Nothing is more gratifying to the 7,000 police executives who make up our Association than the fact that the United States Congress is showing so much concern for the betterment of our police forces and the methods for accomplishing the police mission.

It is redundant, of course, for me to say that no area of the public safety has been more neglected than the police insofar as research and development science and technology are concerned. I would be remiss however, if I did not once again re-emphasize this fact. As you know, the police number only about 400,000 in this country, but there is no other segment of its size in our society which is receiving more attention and criticism than are the police. Bearing in mind that the police forces constitute only some 400,000 individuals in our population

of 200,000,000, I believe this is an enviable or unenviable position, depending upon one's viewpoint.

We should be envied if the attention begets constructive assistance; we shall regard our position as unenviable if the results continue to be nothing but unhelpful, generalized criticism.

I am not certain that I can impart anything new or startling to your deliberations. I have read the task force report entitled, Science and Technology prepared under the auspices of the President's Commission on Law Enforcement and the Administration of Justice, and find it to be an excellent study and delineation of needs and concepts.

As you may know, I was Assistant Director in charge of the FBI Laboratory for many years and I am a confirmed advocate of the marriage of science of law enforcement. I can assure you that the FBI Laboratory has contributed tremendously to law enforcement and literally thousands upon thousands of criminal cases have been brought to successful culmination because of the existence of this laboratory. At the same time, literally scores of innocent individuals have been exonerated of wrong-doing through the application of science by the FBI Laboratory. I can think of no example more compelling for the marshalling of the resources of other existing Federal laboratories for assistance to the police.

At the same time, I am a staunch supporter of the National Institute of Law Enforcement and Criminal Justice sponsored by Representative James H. Scheuer, House of Representatives, and Senator Edward M. Kennedy in the Senate. The Institute envisioned by these gentlemen and those who support the Bill is, I believe, the proper framework for bringing together the expertise existing in the Federal government. I am not certain of the Bill's status at the current time since the latest information I have is that its acceptance or rejection by the United States Congress must depend upon its fate in the Judiciary Committee of the Senate. I fervently hope, however, that this Bill, either by itself or as a part of the Law Enforcement and Criminal Justice Assistance Act will become a reality.

I feel that there lies submerged in the great massive complexity of our Federal framework a great deal of scientific and technological knowledge which can be applied to law enforcement if there were some way to bring this knowledge to the surface and to the attention of the police executives who could make it work. The Science and Technology Task Force Report made reference to such an institute as I am advocating and said, "The program would create inter-disciplinary teams of mathematicians, computer scientists, electronic engineers, physicists, biologists, and other natural scientists, and would require psychologists, sociologists, economists, and lawyers on these teams." Let me say parenthetically, that I should also like to see knowledgeable police executives made a part of these teams. As you gentlemen know only too well, the various professions I have cited have little meaningful dialogue under any corporate banner, but I am certain that should they be brought together in one institute, law enforcement would benefit immeasurably. I am certain that there must exist devices, weapons, communications instrumentation, and other hardware which, because it was not applicable to Viet Nam has been shelved and is gathering dust when it could very well be adapted to more efficient and more humane law enforcement. An institute such as has been proposed would bring to the fore a knowledge and instrumentation which can be of assistance to the police. Please do not ask me for specific examples; I am merely commenting upon what I believe to be a possibility.

As any number of authorities and reports have pointed out, we can with radio signals, order an automation to dig a small trench on the moon. At the same time, however, we cannot alter the actions or direction of a flesh and blood policeman through radio contact who may be only two miles from his radio dispatcher unless, of course, the patrolman is still in his vehicle. We can photograph a six-inch rock on the moon under the most adverse conditions, but we cannot photographically detect a night-time intruder in one of our stores. There must be some means and some funds available for the safe-guarding of our citizens' lives and properties when we can perform such awesomely magnificent feats in outer space.

I am encouraged that some thinking is going into this, however. I might point out to you that the American Express Company, for instance, is planning a \$10,000 a year grant for use by police agencies in research and development projects. As I say, this is highly encouraging.

With respect to some of the specific areas of your interest, I am not sufficiently equipped nor knowledgeable enough about existing Federal laboratories to comment fully. As far as police thinking is concerned, however, I can provide you with some viewpoints.

At IACP headquarters we have a Research and Development Division and the Director of this Division in the last several months has been in touch with a number of the better known Federal agencies whose technical expertise might be applied to police work. This is a rather new venture for us, however, and we have only begun to scratch the surface.

To reiterate, we do need and desire the unusual analytical and other technical capabilities of Federal laboratories to supplement the resources of existing crime laboratories. For instance, the Atomic Energy Commission could provide us with extremely valuable help through their knowledge of radiation, x-rays, and nuclear bombardment. It is most important for the police to determine the age of inks, documents, human remains and any number of other physical properties. We need the means to discover contraband on someone's person or in vehicles plying our highways. The government has done a tremendous amount of work in the fields of fabrics, clothing and protective gear which might be applied to police uniforms. This, I believe, has been handled by the Army and Air Force. The Bureau of Standards could be of great assistance in evaluating and testing police equipment such as vehicles and their components. Certainly, any number of Federal agencies have devised equipment and vehicle automotive techniques which could assist police in getting longer life from their vehicles.

A police officer is burdened with all kinds of heavy equipment as he walks his beat. We need an analysis of this equipment to make his burden lighter. Instead of adapting civilian vehicles to police work, we need someone to devise a better car or patrol vehicle which would be particularly helpful to police. We need a means of electronically bringing to a halt motor vehicles being driven at dangerously high rates of speed. These are some thoughts that occurred to us when we received this invitation to testify, and I am certain that your deliberations have covered other areas of need.

I do believe that we could well use the information centers which some Federal laboratories have established. I believe there is a great need, as I said before, to bring out for the benefit of the police data which must exist in the Federal government. For instance, I was told privately sometime ago that the Army has been testing the various tear gases being used by police. There is a great deal of concern among police and the public generally as to the possible lasting harmful effects of such products as Chemical Mace. We receive inquiries on this constantly, but we have neither the means nor the funds to analyze this substance, and therefore, we are unable to allay the fears of police and the public alike. If the Army has information of this type we should like to know what it is since the tear gases are being used throughout the country. I say this is an example of what could benefit the police if such information centers were set up.

As I have indicated, I believe it is not only feasible but desirable that the capabilities of existing Federal laboratories be used when they coincide with the research needed by police departments. Close working relations could be created among the Federal laboratories and police departments by using the Research and Development Division of the IACP as the conduit. We represent the great majority of the police executives in this country and IACP is the only organization of its kind in this country. Being non-profit, educational and professional in character, we would be eligible to fill this role.

From what I have said already, it is clear that Federal laboratories could do much to foster the setting of standards for police equipment and technical methods and procedures since police agencies in this country are necessarily independent under our form of government. It has been the practice that they experiment and adapt equipment and techniques independently. This, of course, is uneconomical and unrealistic. One of our main problems is disseminating data about equipment usage and techniques which may have been developed in a single department. The proper approach, of course, would be for a police agency to be selected for a pilot project for the determination of standards and then have this information disseminated properly. Once again I would recommend the IACP as the appropriate pipeline for this activity.

I believe that once an appropriate institute is established for the marriage of Federal science and police work funds should be made available to all appropriate government laboratories for training specialists in scientific and technical aspects of police work in order that they might have more knowledgeable research application of existing science to the police establishment.

Industry, of course, has a great stake in minimizing crime in this country. The cost of crime, as you know, is some twenty-two billion dollars a year and industry must share a part of this burden both in losses and insurance costs. The problem here, however, is that millions of dollars must sometimes be spent by industry in researching a particular product and devising a prototype. Unfortunately, however, the police market and budget are not sufficient to take advantage of what is devised. Without a suitable market industry very rightly has little interest in devoting a great deal of research to the needs of police. For example, Congressman Scheuer arranged an exhibit last year of sophisticated equipment which might be applicable to police work. I saw at the exhibition a device capable of detecting narcotics by their peculiar odor. This detection could be accomplished at some distance; in other words, the device could detect narcotics in the attic of a building even though the investigator was not even on the grounds. I do not recall the price tag on this instrument but it was far beyond what any police agency could afford and as a matter of fact, probably the cost would even prohibit use of the device by the Federal Bureau of Narcotics. There must be funds which could bridge this gap and I suppose the only solution would be Federal subsidy of private industry research followed by Federal support for police purchase of the instrumentation developed.

Gentlemen, I believe that what you are trying to accomplish is extremely important and is something which should be followed to a logical conclusion. No one needs more help today than the police officer and the innocent citizen he protects. We are on the verge of being engulfed by criminality. There is no greater domestic need than to bring about a reversal of this trend.

QUESTIONS SUBMITTED TO MR. QUINN TAMM BY THE SUBCOMMITTEE ON SCIENCE, RESEARCH AND DEVELOPMENT

1. In his testimony Dr. Blumstein stated:

I think the equipment needed in operating police departments is almost all on the shelf somewhere. It is a matter of choosing from what is available and tying it together in the right way. Although there are some exceptions to that, basically the equipment can be made available. The research that is needed is research into the operations of this system, into social causes of crime, into the impact on crime of the various things done in the name of controlling it . . . We know how to make the radios. It is a matter of coagulating the market, organizing the demand, and providing the wherewithal to get the radios introduced.

(a) Would you agree with that statement? If not, what do you see as the basic needs?

(b) If you do not agree, why, in your opinion, are law enforcement agencies not using the available technology?

(c) What can be done about it?

(d) Why, in your opinion, hasn't industry filled the void as it would with normal consumer demands?

1. Dr. Blumstein's statement as quoted substantiates my testimony made before your committee on April 4, 1968 in which I said, "I am certain that there must exist devices, weapons, communications instrumentation, and other hardware which, because it was not applicable to Viet Nam has been shelved and is gathering dust when it could very well be adapted to more efficient and more humane law enforcement." However, we must not allow ourselves to be lulled into a feeling of false security. Continued research and advancement is necessary. I support the program advocated in the science and technology task force report of the President's Crime Commission which called for an interdisciplinary team of professionals that would be brought together in one institute such as the National Institute of Law Enforcement and Criminal Justice, which would provide us with new methodology in our fight against the rising crime rate. Law enforcement agencies are not using the available technology because the instruments that have been developed are not being produced in such quantities as to make the use of these instruments economically feasible for smaller departments. I am sure that there are many underlying reasons which have steered industry away from filling this void. One very compelling reason is the relatively small market for products that will be used exclusively by law enforcement agencies.

2. In your testimony you refer to the IACP advocating that minimum educational and training requirements be adopted by the State legislatures throughout the country.

(a) What minimum educational and training requirements does the IACP recommend?

(b) *Why do you consider this necessary?*

(c) *What are the 23 States that have adopted minimum requirements?*

2. The minimum educational and training standards recommended by the IACP are listed on Enclosure #1. Enclosure #2 is a copy of our *Model Police Standards Council Program* which details our suggested program. In brief, we consider these standards are the minimum possible that will permit the forces of law enforcement to cope with the increasing complex social problems of this modern age. A detailed explanation of our position is outlined beginning on page 12 of the August 1967 issue of our POLICE CHIEF magazine, Enclosure #3.* Detailed data on the states having police training legislation are listed on Enclosure #4.

MINIMUM EMPLOYMENT STANDARDS

Citizen of United States

21 years of age

Background Investigation

Fingerprint Record Check (no felony conviction)

Medical and Mental Examination

Oral Interview

High School Graduate or Equivalent

MINIMUM TRAINING STANDARDS

Type	Hours	To be completed following appointment
Recruit.....	240	12 months.
Supervisory.....	80	Do.
Middle management.....	100	Do.
Executive.....	100	Optional.
Advanced officers' course.....	40	Every 4 years.

*Enclosures 2 and 3 may be found in the committee files.

STATUS OF LAW ENFORCEMENT TRAINING LEGISLATION IN UNITED STATES AS OF FEBRUARY 1968

State	Number of members	Hours of instruction—basic course	Funded through—	Mandatory or voluntary	Provides—	Name of governing body
Arkansas: Ch. 526, Arkansas Statute (passed 1965)	3	Fixed by commission	Government improvement fund	V	Food, lodging, and expenses during school.	Arkansas Law Enforcement Training Academy.
California: Sec. 13500, Penal Code (passed 1959)	9	200 (averaging about 400 hours in active practice)	Peace officers training fund (from fines)	V	Mandatory for reimbursement 50 percent of salary and living expenses during school.	Commission on peace officer standards and training, Department of Justice.
Colorado: Ch. 263 (passed 1965)	9	Fixed by council at 224 hours (also special course of 1 week in fingerprinting and administration.	General fund	V	Each agency or trainee pays \$50 toward cost of basic course \$15 for special course.	Colorado Law Enforcement Training Academy, advisory council (Academy operates under the supervision of the Colorado State patrol.)
Connecticut: Connecticut Statutes ch. 104, sec. 7-294 (passed 1965).	12	Fixed by council at 160 hours.	do	M	Each agency pays own expenses.	Municipal police training council.
Florida (passed 1967)	12	Fixed by police standards council at 200 hours.	Direct appropriation	M	Council may reimburse employing agency for salary and expenses while in school.	Police standards council.
Illinois (passed 1965)	16	Fixed by board at 160 hours.	Local governmental law enforcement fund.	V	To local governments that choose to participate \$500, or ½ actual expenses.	Local governmental law enforcement officers' training board.
Indiana (passed 1967)	14	Fixed by board at 160 hours.	Law enforcement training fund; \$2 from each criminal court cost.	M	Fund pays full cost of training.	Law enforcement training board (also advisory council, 4 members).
Iowa: Ch. 80.10, Iowa Statute (passed 1967).	-----	Up to 6 weeks.	Local agencies	M	Academy to be constructed at Camp Dodge, Iowa.	Iowa Law Enforcement Academy Council.
Maryland: Sec. 70-A, art. 41, Annotated Code of Maryland (passed 1966).	10	Fixed by commission at 160 hours.	do	M	-----	Police training commission (in executive department).
Massachusetts (passed 1964)	11	240 hours; fixed by council	State general fund	M	Appointing authority pays wages and reasonable expenses.	Municipal police training council.
Michigan: S. B. 30 (passed 1965)	11	130 hours	10 percent from general fund to LEO training fund (assessment on criminal lines).	V	Mandatory for reimbursement to these governmental bodies that choose to apply, 50 percent salary, 50 percent expenses (overnight).	Michigan Law Enforcement Officers' Training Council.

Minnesota: Ch. 626-461, Minnesota Statute (passed 1959).	15	Fixed by superintendent, \$90-160, 160-200 (in 1958-59).	State legislation and municipal governments, 7 agencies provide training.	V	State pays tuition, city or county pays per diem and regular salary.	Police officer training advisory board (under superintendent, bureau of criminal apprehension).
Mississippi: Sec. 3086-01 et seq. (passed 1964).		Fixed by academy at 3 weeks.	Law Enforcement Officers Training Academy fund.	V	Commission of public safety may maintain a training academy.	Mississippi Law Enforcement Officers' Training Academy.
Montana: Ch. 52, sec. 75, Code of Montana (passed 1959).	9	Academy open 3 weeks during year.	Local agencies.	V	Local agencies pay salaries and expenses during training.	Montana Law Enforcement Academy Advisory Board.
Nevada: Ch. 216, Nevada revised statutes (passed 1965).	5	72 hours set by commission.	State department of education and title I, Higher Education Act of 1965.	M	Commission has adopted standards and required training to be obtained.	Peace officers standards and training commission.
New Jersey: 52:178-66 New Jersey Statutes (passed 1961 (V); passed 1965 (m)).	9	190 (actual classes exceed this) 240 hours, effective Mar. 1, 1968.	State general fund, \$260,000 requested for 1968-69.	M	Departments pay salaries during training.	Police training (in department of law and public safety).
New York: Sec. 480-484 executive law, New York State, art. 19f, New York Statutes (passed 1959).	8	240 hours including 30 hours supervised field training.	State general fund.	M ¹	Payment of training expenses not provided in act.	Municipal police training council (in office for local government), municipalities pay for ammunition. Professionals get about \$20 per session.
North Dakota: Ch. 12-61, North Dakota Code (passed 1967).	9	Fixed by commission at 160 hours effective 1968.	State general fund, \$5,000 per year.	M	Officer must be certified in order to carry a firearm.	North Dakota Combined Law Enforcement Council.
Ohio: Sec. 109-71 Ohio Statutes (passed 1966).	9	120; set by council.	Not provided in act.	M	Payment of training expenses not provided for in act.	Peace officers training council (in attorney general's office).
Oklahoma: (passed 1966).	5	120 hours.	Legislative appropriation.	M	Council may provide for tuition or scholarships aid.	Council on law enforcement education and training.
Oregon: Oregon revised statutes 1-620, passed 1961 (V), passed 1967 (m).	9	Fixed by board at 120 hours.	Police standards and training account in general fund.	M ²	Board may require certification of existing officers.	Board on police standards and training.
Rhode Island: Ch. 42, sec. 1-25, Public Laws of Rhode Island (passed —).	None		State appropriation.	V	Local agencies pay salaries. No tuition. State pays training.	Municipal police school (under superintendent of State police at University of Rhode Island).
Tennessee: Ch. 6, sec. 38-801 Tennessee Statutes (passed 1963).				V	Institute charges agencies for cost of training expenses.	Tennessee Police Training Institute.
Texas: Senate bill 236 (passed 1965).	12	140 hours.	General fund \$67,356. in	V	Cities pay cost of training.	Commission on law enforcement officer standards.
South Dakota: State government ch. 161, sec. 2 (passed 1966).	7	80 hours and 2 days firearms and 10 hours first-aid.	General fund.	V	Advisory commission to assist division of criminal investigation.	Training advisory commission.

¹ As to cities over 1,000.

² Cities over 1,000,000 excluded.

3. Insurance companies support research and standard setting in an effort to lessen the losses due to fire. Why, in your opinion, hasn't this occurred in the crime field, either with support by insurance companies or industrial trade associations?

3. IACP does receive financial support for its work by insurance interests such as the Insurance Institute for Highway Safety and Prudential Life Insurance Company, industrial trade associations such as the American Trucking Associations and the Automotive Safety Foundation, and various industrial corporations. We were supported in our work in the personnel standards area by a Ford Foundation grant. In relationship to the overall requirement for law enforcement, however, this total support has been modest, and concentrated in IACP.

4. *Approximately how many police departments are there in the United States? Does the IACP have any breakdown on the size of these departments (those under 25 men, those under 50 men, etc.) and the average budget for each size?*

4. It is estimated that there are some 40,000 police departments in the United States, 25,000 of which are in communities of less than 1,000 population. The *Municipal Yearbook*, Library of Congress Catalog Card #34-29121, published by the International City Managers Association, contains a survey which gives data for police departments in cities over 10,000 population. Data on 1,022 police departments are given, including information on the size of the department and the budget for each department. (The data are not summarized.)

5. *Could you describe the work the IACP is doing with NASA's Office of Technology Utilization?*

(a) *Please submit a list of the 43 areas submitted to NASA where technology could benefit law enforcement requirements.*

(b) *How were these 43 needs identified by the IACP?*

(c) *What areas is NASA investigating, and with what result?*

(d) *What does the IACP plan to do with the information it receives from NASA?*

5. IACP staff personnel has had a series of meetings with persons from NASA's Office of Technology Utilization including Mr. George J. Howick its Director. The purpose of these meetings was to identify those areas of technological advancement which may be of importance and use to the law enforcement community. We were asked to provide NASA with a list of areas for examination. Literature searches of the NASA information resources were conducted on the development of extended range personal radio communications and light-weight thermal clothing to eliminate the need for heavy cumbersome clothing. As a result of these searches, two documents were forwarded to us for our review. After reviewing these documents, we will contact manufacturers for the purpose of determining the feasibility of producing a sufficient amount of these items to benefit the law enforcement community. A list of the 43 areas identified is attached as Enclosure #5.

(Enclosure 5)

MEMORANDUM

Date: December 8, 1967.

From: Roy McLaren.

Subject: NASA Program Suggestions.

To: Ron Smith.

Topics proposed for further study are as follows:

1. Real time display of status and location of patrol cars and other units in the field with automated control programs to permit guided random patrol, possibly eliminating beat constrictions.

2. Automatic scanning of license plates on vehicles passing particular points, such as major bridge on a controlled access roadway, much as railroad cars are now scanned. The scanning device's output would be searched by computer; any "hits" would be immediately furnished a control point.

3. Development of extended range personal radio communications, so that each police officer, whether in car or on foot could:

a. be contacted individually

b. be contacted as a group

c. have 3-way voice capability (that is, station to officer, officer to station, and officer to officer).

d. direct original messages to discrete addresses

4. Crime and traffic forecasting system similar to techniques used in marketing.

5. Personnel testing techniques which would more concisely indicate promotional potential.

6. Use of infra-sound at 8 cycles per second as a non-lethal weapon and riot control device.
7. Miniaturized radar to detect persons in fields, woods, buildings and/or houses, coupled with an automatic housing spotlight.
8. Device to automatically record (in printed form) officer assignments and all miscellaneous activities.
9. Miniaturized recorder permitting automatic transmission of reports to central point for typing, with personal radio-data channel.
10. Device to temporarily incapacitate a person without permanent injury.
11. Device to render automobile, scooter, motorcycle and/or helicopter completely silent.
12. Low light viewing devices in a price range which could be afforded and in a configuration which could be handled by police officers. (See No. 7.)
13. Techniques for use in the examination of physical evidence which exploit neutron activation analysis.
14. System for automated fingerprint identification.
15. Police microwave systems which are designed to do a police communications job with economy foremost in mind.
16. Secure communications at a suitable privacy level for law enforcement.
17. Further exploration of spread spectrum, random access techniques for police communications.
18. Development of *high speed* facsimile equipment having fingerprint transmission definition for use between headquarters and substations.
19. Examination of digital overlay techniques to provide the movement of data, etc., over existing radio channels.
20. Miniature transmitters—which can be monitored by a remote station for surveillance (RDF) purposes.
21. Remote visual security scanners (self-contained) for business and other high hazard areas. Such scanners should be sensitive to light and heat, yet not be activated by small animals. For example, scanners would be self-activating and would transmit a picture of an alley behind a series of medical offices to a remote monitor at police headquarters. Patrol personnel could be dispatched and guided by such an instrument. Such scanners could also be mounted on patrol vehicles for use during hours of darkness, thus persons and suspicious vehicles in dark shadows would be quickly located. Such scanners could be installed on rooftops of a group of stores, buildings, or warehouse areas to prevent rooftop burglaries.
22. A computerized library of criminalistic formulas which would be placed in several world-wide locations. Information relative to specific tests and/or procedures would be immediately available. (Data retrieval-information exchange.)
23. A chemical which can be discharged with direction by a police officer that will incapacitate without the undesirable discomforts of liquid tear gas, and which will not require penetration of the skin. (Related to No. 10.)
24. Blood coagulants that can be locally applied to stop arterial bleeding.
25. Small collapsible, lightweight ladders that can be carried in the trunks of police vehicles, which would enable police access to rooftops of buildings.
26. Small lightweight flashlights with powerful adjustable beams variable from pinpoint to flood. (See also No. 12.)
27. Waterproofing materials, yet porous, to impregnate police uniforms to eliminate the need for heavy cumbersome raincoats and boots.
28. Lightweight thermal clothing to eliminate need for heavy cumbersome cold weather clothing.
29. Computerized police assignment plans that will designate the most practical quadrant or line cover for any given location in a community. While taking a robbery report over the telephone the dispatcher would simply punch in the address of the incident and an assignment cover would be produced in a second.
30. Portable lightweight metal detectors for scanning suspects at a distance on the street for possible concealed weapons.
31. Inexpensive hidden miniature cameras capable of taking sharp photos with available light. These could be placed in strategic locations inside stores and connected with a silent alarm. When officers arrived at the scene of a robbery—if the responsible(s) had already left—there would be developed photographs of the suspects waiting for review and transmission.
32. A chemical that could be administered by police officers to reduce shock of severely injured or burned persons to reduce the possibility of death.
33. Development of odor identification techniques so that an individual can be identified through odors lingering at a crime scene. (See No. 38.)

34. Highway separators and crash rails of a resilient material or some other substance to replace present crash rails and fencing.

35. Development of TV "instant" reply of crime and traffic scenes so patrol officers, evidence technicians can take pictures used by investigators and laboratory personnel. (See No. 31.)

36. Back-pack propulsion units for patrol service.

37. Better radar which can calculate the speed of vehicles driving toward police vehicle or crossing in front of a moving police vehicle.

38. Improve senses through physical or chemical processes.

a. Vision: better night vision by using infra-red goggles or lenses or taking chemical such as bilberries.

b. Hearing: improved and selective hearing discerning various noises such as sonar detectors, identification of certain noises which activate warning devices.

c. Smell: improve ability to smell various conditions, burning wood, metal cutting torch, the presence of a person in a building being searched, or even the identity of individuals. (See No. 33.)

39. Vehicle incapacitator: ability to direct a beam at a specific vehicle, causing the engine to stop running.

40. Ability to scan city and identify specific vehicles, their location, ownership, etc. Keep this data for short duration so when a crime is reported, the time and place can be checked to see what vehicles were in the area.

41. A colorless "tagging" material which leaves a subliminal "odor" trail and which may be sprayed upon a fleeing suspect or vehicle. This should remain for a period of two or three days and should permit subliminal odor tracing by instrumentation. By this manner officers could avoid using deadly force in attempting to apprehend fleeing subjects.

42. The development of a cartridge similar to a bullet which may be fired by the officer at a subject. This cartridge would have the effect of causing instant paralysis of the subject. This paralysis should last but a few minutes. (Related to Item 10.)

43. Development of a world-wide data system comparable to N.C.I.C., using such advanced techniques as satellite communications and optional scanning of fingerprints and photographs in support of immigration processing and international police operations.

6. *Based upon your experience with running a clearing house on law enforcement research, how useful is this concept as you are presently performing it? What advantages and disadvantages do you see in tying such a function to a Federal agency that already is performing a clearing house function for scientific and technical information?*

6. We are now witnessing the most wide-spread "information explosion" in our nation's history. The law enforcement profession is feeling the pains of this recent proliferation of research information, and we have found that it is most beneficial to have a central depository and place of dissemination for reference material relative to police science, criminalistics, law enforcement, and police administration. The advantage of this type of specialized clearinghouse is obvious. The researcher only has to inquire of one source for information regarding law enforcement. I see no advantage in tying this information source into the Federal Clearinghouse for Scientific and Technical Information. It does not seem to me that the Clearinghouse can be as responsive to the needs of law enforcement as a specialized law enforcement center.

7. *As we understand the functions of the FBI's laboratory, it is primarily a service laboratory devoted to the analysis of evidence and to whatever research and development is needed for its services. To what extent would it be desirable for this laboratory to seek a leadership position in the forensic and police sciences?*

7. As I have stated, the FBI laboratory has contributed tremendously to law enforcement and literally thousands upon thousands of criminal cases have been brought to successful culmination because of the existence of this laboratory. At the same time, many individuals have been exonerated of wrong-doings through the application of science by the FBI laboratory. I think this service should be expanded.

8. *Roughly speaking, what do you estimate it would cost per year to reverse the increasing crime rate, or at least bring it into harmony with the population rate? In what broad fields would you apportion these funds (training, operations, research, etc.) and why?*

8. It is estimated that our annual crime costs are in excess of \$20 billion, and only some \$2.4 billion of that cost is for police services. At the same time, the Department of Commerce tells us we, as a nation, spent \$28.7 billion on recreation in 1966, and we are averaging over \$18 billion per year on research and development, little or none of it for law enforcement. I believe it impossible to give you a definitive estimate on costs per year to reverse the crime rate. I do feel, however, that the funds authorized by Title I of the "Omnibus Crime Control and Safe Streets Act of 1967" should provide initial resources towards this end.

9. *It has been proposed that the directors of Federal laboratories have funds available to pursue research relevant to national problems (such as crime) up to the point where proposals could then be submitted to the agency having the primary mission responsibility. What do you see as the advantages and disadvantages of such a concept?*

(a) *How would Federal laboratory personnel be aware of the specific needs of law enforcement agencies?*

9. I would suggest that it would be quite useful to have funds available for the directors of federal laboratories to pursue research relevant to the reduction of crime. Federal agencies which are geared and structured towards research matters would not have the problems of staffing, and other incidental matters that would be involved in beginning new research either by police departments or private institutions. I would suggest that the IACP should be the organization through which the specific needs of law enforcement agencies can be identified.

Mr. DADDARIO. Even though we are in a rush, I wonder if you could come forward, Mr. English, and in the short time remaining, give us the highlights of your statement.

STATEMENT OF JOSEPH M. ENGLISH, DIRECTOR OF THE FORENSIC SCIENCES LABORATORY, INSTITUTE OF CRIMINAL LAW AND PROCEDURE, GEORGETOWN UNIVERSITY

Mr. ENGLISH. Thank you, Mr. Chairman.

It is certainly an honor and a privilege to participate in your discussions concerning Federal Government laboratories which have scientific and technical skills applicable to the forensic sciences, which are the disciplines of the crime laboratory. The crime laboratory disciplines include document analysis, firearms and tool-mark identification, bloodstain identification, identification of stains due to other body fluids, hair and fiber analysis, analyses of paints, glass fragments, soils, dust and other particulate evidence, extraction and analysis of drugs and poisons found in biological specimens, analysis of inks and dyes, and others.

Unlike many who have spoken here before me, whose organizations have long since established enviable records of accomplishment, the National Bureau of Standards, for instance, which observes its 67th birthday this month, the President's Scientific Advisory Committee, the National Aeronautics and Space Administration, and the others, I represent an installation which is not yet a year and a half old. That you of this subcommittee of the Congress should have sought us out is gratifying.

If I may, I would like to explain what the Forensic Sciences Laboratory is. The laboratory came into existence on October 19, 1966, as a result of the combined effort of the Ford Foundation and Georgetown University. This effort produced the Institute of Criminal Law and Procedure, of which the Forensic Sciences Laboratory is a part.

The laboratory is based in the Law and Medical Centers of Georgetown University and is involved with much of the remainder of the university complex.

The laboratory has undertaken three missions. These are concerned with (1) identifying that research product in the hard sciences and in technology which has application to the unsolved problems of the forensic sciences, (2) dissemination of this knowledge as well as of the best current procedures through training and education as well as publication, and (3) providing of service in cases which relate to research interest and in which injustice may otherwise be likely to occur.

The identification and application of new knowledge in medical, biochemical, toxicological, nuclear, and space science research which has not or has inadequately found its way into the crime laboratory appear to be the aspects of the laboratory's work which is of principal interest to this subcommittee in its present investigation. I shall, therefore, concentrate on these.

Many such scientific advances do exist, advances which are not being used by crime laboratory experts. Advances frequently are not used by police laboratories for a number of reasons:

1. The people doing the research have not been trying to solve police problems, hence extension of scientific investigation oriented to the solving of problems of identification as to source is not undertaken.

2. The police are not aware of new knowledge in the sciences which may be of help to them and are not trained to use it.

3. Researchers in the hard sciences are not aware of the needs of the crime laboratory or lack familiarity with the current state of the art in the forensic sciences; for example, an intimate acquaintance with the procedures of handwriting identification may help a computer software specialist introduce a new element of precision to this field. Lacking this familiarity, there may be a tendency toward overly complex solutions to this and comparable problems.

4. The community as a whole has not devoted much conscious attention to the needs of the crime laboratory disciplines.

On this last-mentioned point, it would not surprise me to find that no one of the directors of the federally run research and development operations really knows of the needs of the forensic sciences.

To illustrate, the National Register of Scientific and Technical Personnel does not identify forensic scientists as such. A list of over 50 currently active scientific specialists in the forensic sciences was searched against the National Register. Of the more than 50 names, including many outstanding men in this field, only seven were found to appear in the Register under any category.

Obviously, there is little awareness that the field exists at all on the part of that segment of the scientific community which maintains rapport with the Federal Government's efforts in the sciences. The same is true among the private foundations, where there is no tradition of support for the forensic sciences.

It would appear that in exploring the research and development potential for the forensic sciences of existing Federal laboratories,

care must be observed to avoid considering solutions before first becoming fully appraised of the nature and extent of the problem.

You ask what my experience has been in obtaining collaboration and assistance from Government laboratories which have scientific and technical skills applicable to forensic analysis.

Since, initially, the efforts of the laboratory were concentrated on the exploration of the capabilities of Georgetown University and those of private and local government facilities and talent, it has been only relatively recently that investigation of the Federal Government's scientific capabilities has been undertaken.

Those contacts which have been effected with Federal agencies have been very fruitful. The National Aeronautics and Space Administration has been engaged in highly advanced studies in instrument analyses for moon and planetary surface investigations which have special importance for the analysis of particulate evidence on the mother planet.

NASA-Goddard Space Flight Center scientists of the Laboratory for Theoretical Studies there also have been doing some very significant work in the area of experimental design development and evaluation and the development of mathematical procedures to correct for machine and transmission induced degradation of analytical data. Also, their work in X-ray fluorescence and other analytical procedures have been very interesting. Further, work at NASA-Goddard in telemetry of instrument readout and its significance in terms of the needs of police investigating officers at the crime scene show exciting possibilities to farseeing people in police work.

However, NASA-Goddard cannot spend from its budget any funds to develop these obvious potential breakthroughs in crime control. Georgetown can afford it with its Ford funds to supply only a tiny portion of the total funds needed to develop the promise of this work into actual hardware and know-how for police.

Explorations by the Forensic Sciences Laboratory at the Harry Diamond Ordnance Laboratory, the Armed Forces Institute of Pathology, and other Federal scientific facilities as well as many private laboratory facilities have resulted in much assistance and encouragement during the discussions which have taken place.

However, discussion does not produce hardware. Nor does it educate and train police laboratory experts in its use.

In my investigations so far, I have yet to find any Federal laboratory facility, and I must interject at this point that I have just begun this phase, I have yet to come upon a facility which had funds it could commit to the work necessary to develop the promise of work already done so that it would be useful as a police aid or a police crime laboratory aid. Unfettered funds in significant amounts at the disposal of the directors of Federal laboratory facilities may help matters. But I am not at all certain that they will in view of the mission orientation which is so evident in the Federal Government establishments as reflected in the testimony of others who have preceded me here, and in view of the almost total lack of awareness throughout the American community, public and private sectors alike, that there is such a thing as scientific crime detection and control as a legitimate area for research effort and support.

A policy statement may well help insofar as the application of Federal laboratory capabilities to the forensic sciences is concerned. I certainly believe one is long overdue. I believe also that positive encouragement on the part of Government to stimulate Federal laboratory directors to commit funds in this direction is long overdue.

Obviously there are details and implications which must be studied before such a statement can be issued and implemented. The study of these details and of the implications should be undertaken forthwith. Such a study should take into consideration all potential interrelationships—Government and local, Government and university, Government and police, police and university, and others and should examine into management and other organizational aspects of insuring maximum benefits to the Nation from research efforts expended.

The desirability of a Federal laboratory's establishing within its existing information system a clearinghouse or information center on research and development relating to crime control and the improved administration of justice depends upon a number of considerations. Certainly a clearinghouse for this type of information is badly needed. So is training in the use of the needed information badly needed. The agency eventually charged with this responsibility will have to perform a function similar to those of the Education Research Information Center in the U.S. Office of Education, the Communicable Diseases Center, the Armed Forces Technical Information Agency, and Medlars. The operations of these organizations which have had salutary influences on educational, technological, and medical research and the application of the product of research efforts in education, technology, and medicine should provide important guidance for the establishment of such a center.

Whether there is an existing agency capable of taking on this function, I am not prepared to say at this time, but let us find out and let us get going. Crime, like time and tide, is not standing still.

Mr. DADDARIO. Thank you very much, Mr. English.

You pointed out that there are in certain of our national laboratories significant information which, if utilized, could be of tremendous help. Questions of jurisdiction and funding have been discussed in these hearings, and if this information could be made known we should be able to take advantage of it.

Mr. ENGLISH. That is right.

Mr. DADDARIO. We felt that this was so. It has been indicated in a few places that it is, and you give us additional information about it. Your testimony is very significant because obviously if information is obtained, even though it is a byproduct of a mission-oriented laboratory, we ought to be able to handle it and to take advantage of it. This is one of the objectives of this committee.

I apologize that we have to leave because you have some very important information, and I hope that we might get in touch with you with some further questions for the record.

Mr. ENGLISH. Certainly; yes sir.

Mr. DADDARIO. We would like to probe into this further because it is extremely helpful.

QUESTIONS SUBMITTED TO MR. JOSEPH M. ENGLISH BY THE SUB-COMMITTEE ON SCIENCE, RESEARCH AND DEVELOPMENT

1. It has been proposed that the directors of Federal laboratories have funds available to pursue research relevant to national problems (such as crime) up to the point where proposals could then be submitted to the agency having the primary mission responsibility. What do you see as the advantages and disadvantages of such a concept?

(a) How would Federal laboratory personnel be aware of the specific needs of law enforcement agencies?

1. The providing of uncommitted funds which would be available to directors of Federal laboratories to pursue research relevant to National problems, such as crime, up to the point where proposals could be submitted to the agency having primary responsibility would appear to offer a number of advantages. It should speed the transfer to the forensic sciences of new knowledge and technology from the many disciplines represented in these laboratories. Disadvantages are not apparent at this point in time. However, problems are predictable. These for the most part would be problems of management.

(a) Federal laboratory personnel could be made aware of the specific needs of the Forensic Sciences in several ways. One possible way would be to institute a Joint Congressional Science and Technology Utilization group. Such a group should keep Federal laboratory personnel aware of the needs of law enforcement agencies and in turn should keep law enforcement agencies acquainted with new developments in the sciences. An example of a Federal agency which has already demonstrated a concern that their research product serve the broader National needs is the Technology Utilization Division of NASA. NASA utilization teams have been organized for specific areas of possible application of NASA-developed technology. To insure optimum screening of the total Government research community, a liaison team designed for this purpose would appear to be essential. The team, I believe, should be based in the Legislative branch. The necessary funding of specific undertakings, I believe, should be managed by this group with the aid of an advisory panel drawn from among the outstanding people in the Forensic Sciences as well as from among those in pertinent scientific disciplines and the Law Enforcement profession. To attempt to operate without such a utilization team presents serious problems. First, at this point in time, there does not appear to be a realistic base for budgeting the amounts which should be awarded to each of the many participating agencies. Second, making this the concern of all research facilities means that we make it the prime concern of none. On the other hand, the existence of funds which a Federal research agency might court and the leverage provided by the utilization group's Congressional base would tend to form a powerful combination which, in my opinion, would bring results far more quickly and efficiently in dealing with agencies of the Executive Branch than another Executive agency created for this purpose is likely to be able to accomplish.

The function of such a Congressional group would be distinct from that of the Law Enforcement Assistance Administration (LEAA) and the Institute of Criminal Justice (ICJ), whose responsibilities are far broader, involve distribution of information and support to police throughout the Nation. The LEAA and the ICJ would be keenly interested consumers of the output resulting from the Congressional group's activities within the Government research community.

2. In your testimony you indicate that certain work in government laboratories could contribute to the forensic sciences but this would require that the laboratory directors have funds in significant amounts at their disposal to pursue this work. Would you cite specific examples of the work you are referring to and how much money you estimate would be required to carry the work forward?

2. Examples of work in Government research laboratories which could contribute to the Forensic Sciences include the following areas of scientific investigation which have been supported by the Atomic Energy Commission, the Department of Defense, NASA and others.

Work with radio isotopes and nuclear generators for use in chemical analysis, such as: alphas excitation X-ray fluorescence systems, portable neutron generators and californium as a source of thermal neutrons which may bring neutron activation analysis within reach of more police department crime laboratories.

Advanced detector systems employing advanced solid state detectors and light weight, highly reliable, low power multi-channel analyzers, as well as the miniaturized ion sputtering source mass spectrograph as additional tools for analysis of physical, including small particle evidence.

Advanced computer methods including on-line real time data analysis, pattern recognition, data handling—acquisition, compression and transmission systems; techniques developed for the transmission and denoising of transmitted television images as a means of speeding the transmission and utilization of evidentiary data and many possible in-laboratory applications such as advanced scanning and digitizing as a means of extracting data from handwriting and hand printing.

Advanced technology in electron probe microanalysis for the analysis of extremely small areas, which instrumentation should be within reach of larger crime laboratories.

The starlight scope image intensification system for assistance in observing illegal activity taking place under cover of darkness. These devices reportedly were in use in Viet Nam more than two years ago and may constitute a type of the hardware on the shelf which Dr. Blumstein referred to.

Advanced medical research and technology in blood analysis for parameters of genetic and environmental origin.

Work being done in the development of methods of interpretation and management of information as a basis for decision making under stress as a means of reducing the subjectivity of the process of evaluating evidentiary findings as well as a possible tool in riot management.

For the benefits of work in the above areas to be effectively introduced into the main stream of the Forensic Sciences, several things are necessary.

These are:

(1) Extension of development work oriented to the special needs of the Forensic Sciences,

(2) Better rapport between the Forensic Sciences and ongoing research in related fields, and

(3) Greatly increased public awareness of the needs and their importance.

To extend the development work and increase the inter-discipline dialogue, especially the first, obviously funds are needed.

A Congressional group, such as described, could if properly staffed, produce dramatic results with a budget of \$150 thousand for the first year of operation, including within that total \$50 thousand general administrative costs and \$100 thousand in unfettered funds for developmental research. The second year budget would more nearly approximate the normal operating budget; which would approximate \$500 thousand annually, of which about \$100 thousand would cover general administrative costs and \$400 thousand would be available in unfettered funds for developmental research.

Funding for the design and production of hardware based on new knowledge from this source would logically fall within the purview of the LEAA.

3. As we understand the functions of the FBI's laboratory, it is primarily a service laboratory devoted to the analysis of evidence and to whatever research and development is needed for its services. To what extent would it be desirable for this laboratory to seek a leadership position in the forensic and police sciences?

3. The FBI Laboratory already holds a position of leadership among the Nation's crime laboratories and from this vantage point has contributed and is contributing substantial benefits to Law Enforcement. As to whether the FBI Laboratory does or should undertake to assume responsibility for the work of other crime laboratories involves a complex of considerations, such as those bearing on delegated mission, those pertaining to recent legislation, the extent of Federal objectives, etc. Any contemplated change should be carefully examined in this light.

4. What work is being performed by Georgetown's Forensic Sciences Laboratory and what is planned for the future?

(a) How does this differ from the work being performed at the FBI Laboratory?

4. The Forensic Sciences Laboratory of Georgetown University's Institute of Criminal Law and Procedure is engaged, within the limits of its own resources, in applying and investigating the application of the analytical techniques used in medical research and in basic research in the physical sciences to the extraction of parameters from handwritten ballpen ink lines which parameters are or may be useful in determining possible sources of the ink and in developing information relative to its possible maximum age. The Laboratory is building a bank of the data it is acquiring.

The technology which has been developed in the Laboratory has been made available to the Nation's forensic science laboratories, the dye industry, the ballpen ink industry and others. The Laboratory has provided assistance in this

field when requested and when the request appeared to have merit. Such requests have come from crime laboratory experts, the medical and legal communities and the ballpen industry. In addition, a great deal of interest has been manifested by the dye industry.

The Laboratory has encouraged and supported research and the publishing of scientific papers and panel discussions at this year's meetings of the American Academy of Forensic Sciences; The American Chemical Society, Middle-Atlantic Region; the Second National Symposium on Law Enforcement Science and Technology and will present a paper before this year's meeting of the International Association for Identification.

These papers and panel discussions treat the advances made in the Laboratory in handwriting identification, in non-destructive analysis of ballpen ink as well as the possible utilization of modern computer technology, alpha excited X-ray fluorescence and other space science developments in article physics and image clarification in the Forensic Sciences.

The Laboratory is assembling a national register of Forensic Science talent. Active investigation is under way to identify areas of medical research which hold promise for relieving some of the more critical needs of the Forensic Sciences. These include the problems of making more specific and more reliable determinations of source of certain categories of physical evidence than is now possible, such as: bloodstains, hairs and handwriting.

Highly qualified medical researchers have been identified and their interest stimulated in these directions. These individuals constitute a resources uniquely qualified to attack the problems referred to and are prepared to capitalize upon and extend an impressive body of medical research developed technology as soon as funds are available.

(a) The Forensic Sciences Laboratory differs from the FBI Laboratory in that the Forensic Sciences Laboratory's principal purpose is to provide and develop an academic base for the Forensic Sciences.

PROPOSED FORENSIC SCIENCES CENTER

THE PROBLEM

There are serious and growing needs in the administration of justice which relate to the courts' increasing dependence upon the expertise of the Nation's crime laboratories. This dependence has been intensified as a consequence of the law's increasing recognition of the inherent limitations of confessions and needs within the crime laboratory milieu. These factors, detailed in the professional studies listed in the footnotes * below may be summarized as follows:

1. Significant numbers of laboratory experts lack adequate education and training. Particularly lacking are means and programs for continuing education and updating in their fields.

2. Certification requirements for expert witnesses are nonexistent in most forensic science disciplines.

3. Discoveries in other disciplines, such as the biological and medical sciences, industrial technology, engineering, space sciences, nuclear science and others, have found their way into the crime laboratory only to a very limited extent. For example, none of the vast new knowledge of blood factors learned since 1902 has been applied to the problems, of identification of dried blood strains. What is known concerning the organic composition of hair has not been applied to the identification of source of hair evidence.

4. Many working in crime laboratories cannot keep up to date on newer methods. Standardization of testing methods and dissemination of these methods are either nonexistent or inadequate for the profession as a whole.

* 1 President's Commission on Law Enforcement and Administration of Justice, *Report—The Challenge of Crime in a Free Society* (1967).

2 Task Force on Science and Technology, President's Commission on Law Enforcement and Administration of Justice, *Task Force Report: Science and Technology* (1967).

3 Methods Committee, American Academy of Forensic Sciences, *Study No. 7—Bloodstains* (1965); *Report on Hair Examinations* (1963); *Study on Inflammables* (1954).

4 American Academy of Forensic Sciences, *Confidential Report to Document Examiners* (1966).

5 Criminalistics Section, American Academy of Forensic Sciences, *Report on Drugs and Examinations* (1961); *Results of Study No. 3—Firearms* (1961).

5. Libraries of analytical data are badly needed. These data banks would greatly assist in the analysis, evaluation of analytical results and their interpretation as to specificity of source of evidentiary material.

6. There is no tradition of support for crime laboratory facilities in many communities. This lack of a tradition of support for the crime laboratory and its disciplines—the Forensic Sciences—likewise extends into the private sector.

PROPOSED ATTACK ON THE PROBLEM

Unlike other disciplines and other important areas of public affairs, the forensic sciences have not enjoyed the presence of a "critical mass" which could actively engage itself in a sustained program to overcome inadequacies and meet needs. Unlike the other major professions, the forensic sciences are dependent upon an extremely tenuous relationship with the academic community.

What also has been lacking is a special service mechanism which could accommodate all those initiatives which must be applied to solve the problem. In the absence of such an agency, the forensic sciences have not been able to gather their resources and bring them to bear to provide solutions.

The Forensic Sciences Laboratory of Georgetown University has devoted a year to study of the problem, of various options for solution, and of the design of recommended programs to produce immediate and sustained improvements through the most efficient utilization of resources.

To take the positive steps necessary to solution, it is proposed herein to launch a center for the forensic sciences as an integral part of the University complex. The proposed center would provide a university base for the forensic sciences and also serve as a model for similar activities at other universities throughout the nation.

Programs to which the new center would address itself are as follows:

Continuing Education.—Post secondary course areas would be offered with special emphasis on the needs of presently practicing laboratory experts as follows:

- a. Forensic Toxicology
- b. Forensic Serology
- c. Forensic Pathology
- d. Forensic Crystallography
- e. Hair and Fiber Analysis
- f. Forensic Ballistics

g. Several specialized areas of Document Analysis, such as ink analysis by spectrophotofluorometry, advanced study in handwriting identification, the graphic arts, typography.

h. Several specialized areas of Instrument Analysis, such as: Neutron Activation Analysis, Ion Sputtering Source Mass Spectroscopy, X-ray Fluorescence Spectroscopy, Emission Spectroscopy, Infrared-visible-ultraviolet Spectrophotometry, Gas Chromatography, Thin Layer Chromatography, Electron Spin Resonance and others.

i. Experimental design techniques and statistical evaluation methods and their application to laboratory procedures.

Certification for Expert Witnesses.—Certification standards for expert witnesses in 10 delineated areas of practice will be developed.

Studies to Apply New Knowledge.—Investigation by the Georgetown University Forensic Sciences Laboratory into priority needs and the consensus of the profession pinpoint the following areas as critically in need of the benefits of advances which are known in related basic science fields. Fortunately, these problem areas are particularly amenable to solution by application of the unique resources of personnel and facilities found to exist in the University complex and the community, and these resources can be applied to the studies at once:

Hair Identification by Organic Composition.—Three categories of organic composition of human hair will be studied: (a) Characteristic fat or "lipid" composition; (b) Pigmentation pattern or "melanin" composition; (c) Drug content of melanin pigments.

Dried Blood Identification by Adaptation of Wet Blood Characteristics.—Despite extensive advances in wet blood research, forensic specialists in blood-stain identification are as yet unable to extend beyond the basic ABO grouping to take advantage of these advances. Immediate studies by individuals especially equipped to do so at the University and elsewhere can be undertaken in the following areas:

- (a) Extension of ABO and variations in hemoglobin content, enzymatic content of the red cell, white cell shapes, serum proteins;
- (b) Factors on gamma globulin molecules; and
- (c) Factors on white blood cells (tissue antigens).

Handwriting Mensuration System.—The application of modern technology in order to permit a more detailed and objective examination of handwriting for such things as identity, and physiological and psychological pathogenesis of the writer can be undertaken immediately.

Ballpoint Ink Dating.—The dating of ballpen writing is important because of the high incidence of embezzlement, fraud, forgery, and other crimes involving writing. There are no means for dating ballpen writings. The G. U. Forensic Sciences Laboratory enjoys a leading position in this area as a consequence of its work in ink analysis by thin layer chromatography and spectrophotofluorometry. Dating studies would be a natural outgrowth of the previous work and can be undertaken immediately.

Monographs.—To provide means for the gathering, coordinating, and disseminating of information to promote a higher mean level of expertise among widely dispersed laboratories and experts by communicating advances, new methodologies and new and improved techniques and procedures, working handbooks will be prepared and disseminated in the following areas:

Compilation of drug levels in fatal and nonfatal poisonings (reported levels found by workers in the field);

Identification of Narcotics from Biological Specimens, such as: blood, urine and tissues (methodology);

Hair and fiber identification;

Analysis of dried bloodstains (best present procedures);

Current developments in Firearms Identification;

Microscopic Characteristics of commonly encountered minerals and other substances in incendiary cases, burglaries, etc.

Public Information and Education.—Except for the leading role of the FBI, local communities and the public at large do not have sophisticated appreciation of the vital needs of the crime laboratory in the administration of justice. The proposed center would serve as a focal point for news media, in the support of an informed public awareness of the crime laboratory.

The public concerned includes the general citizenry and special constituencies such as: judges, prosecution and defense attorneys, legislators, students, and others.

5. *Insurance companies support research and standard setting in an effort to lessen the losses due to fire. Why, in your opinion, hasn't this occurred in the crime field, either with support by insurance companies or industrial trade associations?*

5. The ravages of fire and disease have long been recognized as resulting from controllable conditions. Whereas, the ravages of crime have been largely hidden from view, with the result that it has only been in recent years that there has been any widespread public awareness that serious problems do exist in this field.

6. *In his testimony Dr. Blumstein stated:*

I think the equipment needed in operating police departments is almost all on the shelf somewhere. It is a matter of choosing from what is available and tying it together in the right way. Although there are some exceptions to that, basically the equipment can be made available. . . The research that is needed is research into the operations of this system, into social causes of crime, into the impact on crime of the various things done in the name of controlling it. . . We know how to make the radios. It is a matter of coagulating the market, organizing the demand, and providing the wherewithal to get the radios introduced.

(a) *Would you agree with that statement? If not, what do you see as the basic needs?*

(b) *If you do not agree, why, in your opinion, are law enforcement agencies not using the available technology?*

(c) *What can be done about it?*

(d) *Why, in your opinion, hasn't industry filled the void as it would with normal consumer demands?*

6. (a) Concerning Dr. Blumstein's comments, it seems to me that he is talking about police enforcement equipment, such as, radios. Moreover, his observations concerning research seem to be directed solely toward research into police operations and conditions conducive to crime.

What seems to have been grossly ignored is the crime laboratory area—detection and identification. This is where updated technology is critically important.

(b) Much technology needs to be extended and specifically engineered for crime laboratory use. Much of it is in fields with which police experts have limited familiarity and, further, extensive training is needed in order that crime laboratory personnel be able to obtain the maximum benefits from the technology and new knowledge which will be increasingly available to them if they are prepared for it.

(c) Important education and training programs must be undertaken to attract more people of high competence into the field. Salaries will have to become competitive with those in other areas which employ scientific talent. The possibility of draft deferment for young men contemplating careers in the field should receive serious consideration. Programs to update present crime laboratory personnel must be undertaken. Qualification standards for experts should be developed as should standards for laboratory procedures for testing and evaluating results of tests in: bloodstain analysis; extraction and identification of poisons including narcotics and other drugs from biological specimens; drug level determinations; hair and fiber identification; firearms and tool mark identification; properties of common substances including residues of combustibles and the optical properties of organic and inorganic materials in general.

(d) Why industry hasn't filled the void as it would be expected to with normal consumer demands obviously is conjectural. For one thing, the public has a key role here. By and large, the public has not been aware of the technological needs of the crime laboratory. This may account for the absence of demand and the low response on the part of industry to develop and market improved laboratory procedures. When one considers that there are only 40 crime laboratories of varying degrees of capability among the 151 American cities with populations of 100 thousand or more, the industry's reluctance to invest in developing products for such a limited market becomes somewhat understandable.

The fact that the citizenry of the remaining 111 cities with no local crime laboratory facilities tolerates such a situation and the fact that the citizens of a number of the 40 cities whose police have only rudimentary local laboratory facilities permit the condition to continue is an interesting commentary on the effectiveness of our mass media, which have emphasized the strengths of the crime laboratory until even sophisticates labor under a vague notion that all the problems have been solved.

Mr. DADDARIO. This committee will adjourn to the call of the Chair.

(Whereupon, at 12:13 p.m., the committee was adjourned to the call of the Chair.)

APPENDIX A

(BELL REPORT)

REPORT TO THE PRESIDENT ON GOVERNMENT CONTRACTING FOR RESEARCH AND DEVELOPMENT, APRIL 30, 1962

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D.C., April 30, 1962.

DEAR MR. PRESIDENT: As requested by your letter of July 31, 1961, we have reviewed the experience of the Government in using contracts with private institutions and enterprises to obtain research and development work needed for public purposes.

The attached report presents our findings and conclusions. Without attempting to summarize the complete report, we include in this letter a few of our most significant conclusions, as follows:

1. Federally-financed research and development work has been increasing at a phenomenal rate—from 100 million dollars per year in the late 1930's to over 10 billion dollars per year at present, with the bulk of the increase coming since 1950. Over 80 percent of such work is conducted today through non-Federal institutions rather than through direct Federal operations. The growth and size of this work, and the heavy reliance on non-Federal organizations to carry it out, have had a striking impact on the Nation's universities and its industries, and have given rise to the establishment of new kinds of professional and technical organizations. At present the system for conducting Federal research and development work can best be described as a highly complex partnership among various kinds of public and private agencies, related in large part by contractual agencies.

While many improvements are needed in the conduct of research and development work, and in the contracting systems used, it is our fundamental conclusion that it is in the national interest for the Government to continue to rely heavily on contracts with non-Federal institutions to accomplish scientific and technical work needed for public purposes. A partnership among public and private agencies is the best way in our society to enlist the Nation's resources and achieve the most rapid progress.

2. The basic purposes to be served by Federal research and development programs are public purposes, considered by the President and the Congress to be of sufficient national importance to warrant the expenditure of public funds. The management and control of such

programs must be firmly in the hands of full-time Government officials clearly responsible to the President and the Congress. With programs of the size and complexity now common, this requires that the Government have on its staff exceptionally strong and able executives, scientists, and engineers, fully qualified to weigh the views and advice of technical specialists, to make policy decisions concerning the types of work to be undertaken, when, by whom, and at what cost, to supervise the execution of work undertaken, and to evaluate the results.

At the present time we consider that one of the most serious obstacles to the recruitment and retention of first-class scientists, administrators, and engineers in the Government service is the serious disparity between governmental and private compensation for comparable work. We cannot stress too strongly the importance of rectifying this situation, through Congressional enactment of civilian pay reform legislation as you have recommended.

3. Given proper arrangements to maintain management control in the hands of Government officials, federally-financed research and development work can be accomplished through several different means: direct governmental operations of laboratories and other installations; operation of Government-owned facilities by contractors; grants and contracts with universities; contracts with not-for-profit corporations or with profit corporations. Choices among these means should be made on the basis of relative efficiency and effectiveness in accomplishing the desired work, with due regard to the need to maintain and enlarge the long-term strength of the Nation's scientific resources, both public and private.

In addition, the rapid expansion of the use of Government contracts, in a field where twenty-five years ago they were relatively rare, has brought to the fore a number of different types of possible conflicts of interests, and these should be avoided in assigning research and development work. Clear-cut standards exist with respect to some of these potential conflict-of-interest situations—as is the case with respect to persons in private life acting as advisers and consultants to Government, which was covered in your memorandum of February 9, 1962. Some other standards are now widely accepted—for example, the undesirability of permitting a firm which holds a contract for technical advisory services to seek a contract to develop or to supply any major item with respect to which the firm has advised the Government. Still other standards are needed, and we recommend that you request the head of each department and agency which does a significant amount of contracting for research and development to develop, in consultation with the Attorney General, clear-cut codes of conduct, to provide standards and criteria to guide the public officials and private persons and organizations engaged in research and development activities.

4. We have identified a number of ways in which the contracting system can and should be improved, including:

- providing more incentives for reducing costs and improving performance;
- Improving our ability to evaluate the quality of research and development work;
- giving more attention to feasibility studies and the development of specifications prior to inviting private proposals for

major systems development, thus reducing "brochuresmanship" with its heavy waste of scarce talent.

We have carefully considered the question whether standards should be applied to salaries and related benefits paid by research and development contractors doing work for the Government. We believe it is desirable to do so in those cases in which the system of letting contracts does not result in cost control through competition. We believe the basic standard to be applied should be essentially the same as the standard you recently recommended to the Congress with respect to Federal employees—namely, comparability with salaries and related benefits paid to persons doing similar work in the private economy. Insofar as a comparability standard cannot be applied—as would be the case with respect to the very top jobs in an organization, for example—we would make it the personal responsibility of the head of the contracting agency to make sure that reasonable limits are applied.

5. Finally, we consider that in recent years there has been a serious trend toward eroding the competence of the Government's research and development establishments—in part owing to the keen competition for scarce talent which has come from Government contractors. We believe it to be highly important to improve this situation—not by setting artificial or arbitrary limits on Government contractors but by sharply improving the working environment within the Government, in order to attract and hold first-class scientists and technicians. In our judgment, the most important improvements that are needed within Government are:

- to ensure that governmental research and development establishments are assigned significant and challenging work;
- to simplify management controls, eliminate unnecessary echelons of review and supervision, and give to laboratory directors more authority to command resources and make administrative decisions; and
- to raise salaries, particularly in the higher grades, in order to provide greater comparability with salaries available in private activities.

Action is under way along the first two lines—some of it begun as the result of our review. Only the Congress can act on the third aspect of the problem, and we strongly hope it will do so promptly.

* * * * *

In preparing this report, we have benefited from comments and suggestions by the Attorney General, the Secretaries of Agriculture, Commerce, Labor, and Health, Education and Welfare, and the Ad-

ministrator, Federal Aviation Agency, and they concur in general with our findings and conclusions.

ROBERT S. McNAMARA,
Secretary of Defense.

JAMES E. WEBB,
Administrator, National Aeronautics and Space Administration.

JOHN W. MACY, JR.
Chairman, Civil Service Commission.

DR. GLENN T. SEABORG,
Chairman, Atomic Energy Commission.

DR. ALAN T. WATERMAN,
Director, National Science Foundation.

JEROME B. WIESNER,
Special Assistant to the President for Science and Technology.

DAVID E. BELL,
Director, Bureau of the Budget.

FOREWORD

This report has been prepared in response to the President's letter of July 31, 1961, to the Director of the Bureau of the Budget, asking for a review of the use of Government contracts with private institutions and enterprises to obtain scientific and technical work needed for public purposes.

Such contracts have been used extensively since the end of World War II to provide for the operation and management of research and development facilities and programs, for analytical studies and advisory services, and for technical supervision of complex systems, as well as for the conduct of research and development projects.

As the President noted in his letter, there is a consensus that the use of contracts is appropriate in many cases. At the same time, a number of important issues have been raised, including the appropriate extent of reliance on contractors, the comparative salaries paid by contractors and the Government, the effect of extensive contracting on the Government's own research and development capabilities, and the extent to which contracts may have been used to avoid limitations which exist on direct Federal operations.

Accordingly, the President asked that the review focus on:

- criteria that should be used in determining whether to perform a function through a contractor or through direct Federal operations;
- actions needed to increase the Government's ability to review contractor operations and to perform scientific and technical work; and
- policies which should be followed by the Government in obtaining maximum efficiency from contractor operations and in reviewing contractor performance and costs (including standards for salaries, fees, and other items).

The President requested the following officials to participate in the study: The Secretary of Defense, the Chairman of the Atomic Energy Commission, the Chairman of the Civil Service Commission, the Administrator of the National Aeronautics and Space Administration, and the Special Assistant to the President for Science and

Technology. The Director of the National Science Foundation was also invited to participate.

In making the review requested by the President, a great deal of material was available from hearings and reports of the Senate and House Committees on Appropriations, Armed Services, Judiciary, and Government Operations, the House Committees on Post Office and Civil Service and on Science and Astronautics, the second Hoover Commission, and various governmental and private studies. In addition, information was obtained:

- by questionnaires to which ten Federal agencies and seventy-one Government field installations, universities, and contract establishments responded; and
- by interviews conducted at twenty-eight Government field installations and non-Federal establishments, and with a number of agency headquarters officials.

These data were obtained and analyzed with respect to major policy implications by an indepartmental staff group which included representatives of each of the officials whom the President asked to participate in the review.

This report presents a summary analysis and recommendations growing out of this review. It is organized in four parts:

1. Statement of major issues
2. Considerations in deciding whether to contract out research and development work
3. Proposals for improving policies and practices applying to research and development contracting
4. Proposals for improving the Government's ability to carry out research and development work directly.

In addition, there are attached to the report the following annexes intended to present additional supporting information:¹

1. Letter from the President to the Director of the Budget of July 31, 1961
2. Summary information concerning respondents to Bureau of the Budget questionnaire and organizations interviewed
3. Special analysis on Federal research and development programs, reprinted from the Federal Budget for fiscal year 1963
4. Summary information concerning the distribution of national research and development funds, activities, and personnel
5. Summary of information obtained regarding salaries and related benefits and turnover of personnel
6. Annotated bibliography on Federal contracting-out of research and development.

PART 1

STATEMENT OF MAJOR ISSUES

Policy questions relating to Government contracting for research and development* must be considered in the perspective of the phe-

¹ Annexes 2 through 6 referred to are omitted from this reprint.

*Note on terminology: The term "research and development" is used in this report in the sense in which it is used in the Federal Budget—that is, it means the conduct of activities intended to obtain new knowledge or to apply existing knowledge to new uses. The Department of Defense uses the term "research, development, test, and evaluation," which is a somewhat fuller but more cumbersome term for the same concept. In this report the shorter term is used for convenience. For a summary of all Federal activities of this type, see Annex 3, "Federal Research and Development Programs," reprinted from *The Budget of the United States Government for Fiscal Year 1963*.

nomenal growth, diversity, and change in Federal activities in this field.

Federal research and development activities and their impact

Prior to World War II, the total Federal research and development program is estimated to have cost annually about 100 million dollars. In fiscal year 1950, total Federal research and development expenditures were about 1.1 billion dollars. In the fiscal year 1963, the total is expected to reach 12.4 billion dollars.

The fundamental reason for this growth in expenditures has been the importance of scientific and technical work to the achievement of major public purposes. Since World War II the national defense effort has rested more and more on the search for new technology. Our military posture has come to depend less on production capacity in being and more on the race for shorter lead times in the development and deployment of new weapons systems and of counter-measures against similar systems in the hands of potential enemies. The Defense Department alone is expected to spend 7.1 billion dollars on research and development in fiscal 1963, and the Atomic Energy Commission another 1.4 billion dollars.

Aside from the national defense, science and technology are of increasing significance to many other Federal programs. The Nation's effort in non-military space exploration—which is virtually entirely a research and development effort—is growing extremely rapidly; the National Aeronautics and Space Administration is expected to spend 2.4 billion dollars in fiscal 1963, and additional sums, related to the national space program will be spent by the Department of Commerce and other agencies. Moreover, scientific and technological efforts are of major significance in agriculture, health, natural resources, and many other Federal programs.

The end of this period of rapid growth is not yet in sight. Public purposes will continue to require larger and larger scientific and technological efforts for as far ahead as we can see.

The increase in Federal expenditures for research and development has had an enormous impact on the Nation's scientific and technical resources. It is not too much to say that the major initiative and responsibility for promoting and financing research and development have in many important areas been shifted from private enterprise (including academic as well as business institutions) to the Federal Government. Prior to World War II, the great bulk of the Nation's research achievements occurred with little support from Federal funds—although there were notable exceptions, such as in the field of agriculture. Today it is estimated by the National Science Foundation that the Federal Budget finances about 65 per cent of the total national expenditure for research and development. Moreover, the Federal share is rising.

Federal financing, however, does not necessarily imply Federal operation. As the Federal research and development effort has risen, there has been a steady reduction in the proportion conducted through direct Federal operations. Today about 80 per cent of Federal expenditures for research and development are made through non-Federal institutions. Furthermore, while a major finding of this report is that the Government's capabilities for direct operations in research and development need to be substantially strengthened, there is no doubt

that the Government must continue to rely on the private sector for the major share of the scientific and technical work which it requires.

The effects of the extraordinary increase in Federal expenditures for research and development, and the increasing reliance on the private sector to perform such work, have been very far reaching.

The impact on private industry has been striking. In the past the Government utilized profit-making industry mainly for production engineering and the manufacture of final products—not for research and development. Industries with which it dealt in securing the bulk of its equipment were primarily the traditional large manufacturers for the civilian economy—such as the automotive, machinery, ship-building, steel, and oil industries—which relied on the Government for only a portion, usually a minority, of their sales and revenues. In the current scientific age, the older industries have declined in prominence in the advanced equipment area and newer research and development-oriented industries have come to the fore—such as those dealing in aircraft, rockets, electronics, and atomic energy.

There are significant differences between these newer industries and others. While the older industries were organized along mass-production principles, and used large numbers of production workers, the newer ones show roughly a one-to-one ratio between production workers and scientist-engineers. Moreover, the proportion of production workers is steadily declining. Between 1954 and 1959, production workers in the aircraft industry declined 17 per cent while engineers and scientists increased 96 per cent. Also, while the average ratio of research and development expenditures to sales in all industry is about 3 per cent, the advanced weapons industry averages about 20 per cent and the aerospace industry averages about 31 per cent.

But the most striking difference is the reliance of the newer industries almost entirely on Government sales for their business. In 1958, a reasonably representative year, in an older industry, the automotive industry, military sales ranged from 5 per cent for General Motors to 15 per cent for Chrysler. In the same year in the aircraft industry, military sales ranged from a low of 67 per cent for Beech Aircraft to a high of 99.2 per cent for The Martin Company.

The present situation, therefore, is one in which a large group of economically significant and technologically advanced industries depend for their existence and growth not on the open competitive market of traditional economic theory, but on sales only to the United States Government. And, moreover, companies in these industries have the strongest incentives to seek contracts for research and development work which will give them both the know-how and the preferred position to seek later follow-on production contracts.

The rapid increase in Federal research and development expenditures has had striking effects on other institutions in our society apart from private industry.

There has been a major impact on the universities. The Nation has always depended largely on the universities for carrying out fundamental research. As such work has become more important to Government and more expensive, an increasing share—particularly in the physical and life sciences and engineering—has been supported by Federal funds. The total impact on a university can be sizeable. Well over half of the research budgets of such universities as Harvard,

Brown, Columbia, Massachusetts Institute of Technology, Stanford, California Institute of Technology, University of Illinois, New York University, and Princeton, for illustration, is supported by Federal funds.

New institutional arrangements have been established in many cases, related to but organized separately from the universities, in order to respond to the needs of the Federal Government. Thus, the Lincoln Laboratory of the Massachusetts Institute of Technology was established by contract with the Air Force to supply research and development services and to establish systems concepts for the continental air defense, and similarly the Jet Propulsion Laboratory was established at the California Institute of Technology to conduct research on rocket propulsion for the Department of the Army and later to supply space craft design and systems engineering services to the National Aeronautics and Space Administration. In addition, other research institutions—such as the Stanford Research Institute—which were established to conduct research on contract for private or public customers, now do a major share of their business with the Federal Government.

In addition to altering the traditional patterns of organization of private industry and the universities, the rise in Federal research and development expenditures has resulted in the creation of entirely new kinds of organizations.

One kind of organization is typified by the RAND Corporation, established immediately after World War II, to provide operations research and other analytical services by contract to the Air Force. A number of similar organizations have been established since, more or less modeled on RAND, to provide similar services to other governmental agencies.

A second new kind of organization is the private corporation, generally not-for-profit but sometimes profit, created to furnish the Government with "systems engineering and technical direction" and other professional services. The Aerospace Corporation, the MITRE Corporation, the Systems Development Corporation, and the Planning Research Corporation are illustrations.

A third new organizational arrangement was pioneered by the Office of Scientific Research and Development during World War II and used by the Atomic Energy Commission, which took over the wartime atomic energy laboratories and added others—all consisting of facilities and equipment owned by the Government but operated under contract by private organizations, either industrial companies or universities.

Apart from their impact on the institutions of our society, Federal needs in research and development are placing critical demands on the national pool of scientific and engineering talent. The National Science Foundation points out that the country's supply of scientists and engineers is increasing at the fairly stable rate of 6 per cent annually, while the number engaged in research and development activities is growing at about 10 per cent each year. Accordingly, the task of developing our manpower resources in sufficient quality and quantity to keep pace with the expanding research and development effort is a matter of great urgency. The competition for scientists and engineers is becoming keener all the time and requires urgent attention to the

expansion of education and training, and to the efficient use of the scientific and technical personnel we have now.

Questions and issues considered in this report

The dynamic character of the Nation's research and development efforts, as summarized in the preceding paragraphs, has given rise to a number of criticisms and points of concern. For example, concern has been expressed that the Government's ability to perform essential management functions has diminished because of an increasing dependence on contractors to determine policies of a technical nature and to exercise the type of management functions which Government itself should perform. Some have criticised the new not-for-profit contractors, performing systems engineering and technical direction work for the Government, on the grounds that they are intruding on traditional functions performed by competitive industry. Some concern has been expressed that universities are undertaking research and development programs of a nature and size which may interfere with their traditional educational functions. The cost-reimbursement type of contracts the Government uses, particularly with respect to research and development work on weapons and space systems, have been criticized as providing insufficient incentives to keep costs down and insure effective performance. Criticism has been leveled against relying so heavily on contractors to perform research and development work as simply a device for circumventing civil service rules and regulations.

Finally, the developments of recent years have inevitably blurred the traditional dividing lines between the public and private sectors of our Nation. A number of profound questions affecting the structure of our society are raised by our inability to apply the classical distinctions between what is public and what is private. For example, should a corporation created to provide services to Government and receiving 100 per cent of its financial support from Government be considered a "public" or a "private" agency? In what sense is a business corporation doing nearly 100 per cent of its business with the Government engaged in "free enterprise"?

In light of these criticisms and concerns, an appraisal of the experience in using contracts to accomplish the Government's research and development purposes is evidently timely. We have not, however, in the course of the present review attempted to treat the fundamental philosophical issues indicated in the preceding paragraph. We accept as desirable the present high degree of interdependence and collaboration between Government and private institutions. We believe the present intermingling of the public and private sectors is in the national interest because it affords the largest opportunity for initiative and the competition of ideas from all elements of the technical community. Consequently, it is our judgment that the present complex partnership between Government and private institutions should continue.

On these assumptions, the present report is intended to deal with the practical question: what should the Government do to make the partnership work better in the public interest and with maximum effectiveness and economy?

We deal principally with three aspects of this main question.

There is first the question, what aspects of the research and development effort should be contracted out? This question falls into two

parts. One part relates to those crucial powers to manage and control governmental activities which must be retained in the hands of public officials directly answerable to the President and Congress. Are we in danger of contracting out such powers to private organizations? If so, what should be done about it?

The other part of this question relates to activities which do not have to be carried out by Government officials, but on which there is an option: they may be accomplished either by direct Government operations or by contract with non-Federal institutions. What are the criteria that should guide this choice? And if a private institution is chosen, what are the criteria for choice as among universities, not-for-profit corporations, profit corporations, or other possible contractors?

The second question we deal with is what standards and criteria should govern contract terms in cases where research and development is contracted out. For example, to what extent is competition effective in ensuring efficient performance at low cost, and when—if at all—must special rules be established to control fees, salaries paid, and other elements of contractor cost?

The third question we deal with is how we can maintain strong research and development institutions as direct Government operations. How can we prevent the best of the Government's research scientists, engineers, and administrators from being drained off to private institutions as a result of higher private salaries and superior private working environments, and how can we attract an adequate number of the most talented new college graduates to a career in Government service?

These questions are treated in the sections which follow.

PART 2

CONSIDERATIONS IN DECIDING WHETHER TO CONTRACT OUT RESEARCH AND DEVELOPMENT WORK

Generalizations about criteria for contracting out research and development work must be reached with caution, in view of the wide variety of different circumstances which must be covered.

A great many Government agencies are involved. The Department of Defense, the National Aeronautics and Space Administration, and the Atomic Energy Commission provide the bulk of Federal financing but a dozen or more agencies also play significant roles.

Most Federal research and development work is closely related to the specific purpose of the agency concerned—to the creation of new weapons systems for the Department of Defense, for example, or the exploration of new types of atomic power reactors for the Atomic Energy Commission. But a significant portion of the research financed by the Federal Government is aimed at more general targets: to enlarge the national supply of highly trained scientists, for example, as is the case with some programs of the National Science Foundation. And even the most "mission-oriented" agencies have often found it desirable to make available for basic research to advance the fundamental state of knowledge in fields that are relevant to their missions. Both the Department of Defense and the AEC, for example, make substantial funds available for fundamental research, not related to any specific item of equipment or other end product.

A great many different kinds of activity are involved, which have been classified by some under five headings:

- (1) fundamental research
- (2) supporting research or exploratory development
- (3) feasibility studies, operations analysis, and technical advice
- (4) development and engineering of products, processes, or systems
- (5) tests and evaluation activities.

The lines between many of the activities listed are necessarily uncertain. Nevertheless, it is clear that "research and development" is a phrase that covers a considerable number of different kinds of activity.

Finally, there have been distinct historical developments affecting the different Government agencies. Some agencies, for example, have a tradition of relying primarily on direct Government operations of laboratories—others have precisely the opposite tradition of relying primarily on contracting for the operation of such installations.

Against this background of diversity in several dimensions we have asked what criteria should be used in deciding whether or not to contract out any given research and development task? In outline, our judgment on this question runs as follows:

There are certain functions which should under no circumstances be contracted out. The management and control of the Federal research and development effort must be firmly in the hands of full-time Government officials clearly responsible to the President and the Congress.

Subject to this principle, many kinds of arrangements—including both direct Federal operations and the various patterns of contracting now in use—can and should be used to mobilize the talent and facilities needed to carry out the Federal research and development effort. Not all arrangements however are equally suitable for all purposes and under all circumstances, and discriminating choices must be made among them by the Government agencies having research and development responsibilities. These choices should be based primarily on two considerations:

- (1) Getting the job done effectively and efficiently, with due regard to the long-term strength of the Nation's scientific and technical resources, and
- (2) Avoiding assignments of work which would create inherent conflicts of interest.

Each of these judgments is elaborated below:

Strengthening the ability of the Government to manage and control research and development programs

We regard it as axiomatic that policy decisions respecting the Government's research and development programs—decisions concerning the types of work to be undertaken, when, by whom, and at what cost—must be made by full-time Government officials clearly responsible to the President and to the Congress. Furthermore, such officials must be in a position to supervise the execution of work undertaken, and to evaluate the results. These are basic functions of management which cannot be transferred to any contractor if we are to have proper accountability for the performance of public functions and for the use of public funds.

To say this does not imply that detailed administration of each research and development task must be kept in the hands of top public

officials. Indeed, quite the contrary is true, and an appropriate delegation of responsibility—either to subordinate public officials or by contract to private persons or organizations—for the detailed administration of research and development work is essential to its efficient execution.

It is not always easy to draw the line distinguishing essential management and control responsibilities which should not be delegated to private contractors (or, indeed, to governmental research organizations such as laboratories) from those which can and should be so assigned. Recognizing this difficulty, it nevertheless seems to be the case that in recent years there have been instances—particularly in the Department of Defense—where we have come dangerously close to permitting contract employees to exercise functions which belong with top Government management officials. Insofar as this has been true, we believe it is being rectified. Government agencies are now keenly aware of this problem and have taken steps to retain functions essential to the performance of their responsibility under the law.

It is not enough, of course, to recognize that governmental managers must retain top management functions and not contract them out. In order to perform those functions effectively, they must be themselves competent to make the required management decisions and, in addition, have access to all necessary technical advice. Three conclusions follow:

First, where management decisions are based substantially on technical judgments, qualified executives, who can properly utilize the advice of technical consultants, from both inside and outside the Government, are needed to perform them. There must be sufficient technical competence within the Government so that outside technical advice does not become *de facto* technical decision-making. In many instances the executives making the decisions can and should have strong scientific backgrounds. In others, it is possible to have non-scientists so long as they are capable of understanding the technical issues involved and have otherwise appropriate administrative experience.

By and large, we believe it is necessary for the agencies concerned to give increased stress to the need to bring into governmental service as administrators men with scientific or engineering understanding, and during the development of Government career executives, to give many of them the opportunity, through appropriate training and experience, to strengthen their appreciation and understanding of scientific and technical matters. Correspondingly, scientists and engineers should be encouraged and guided to obtain, through appropriate training and experience, a broader understanding of management and public policy matters. The average governmental administrator in the years to come will be dealing with issues having larger and larger scientific and technical content, and his training and experience, both before he enters Government service and after he has joined, should reflect this fact.

At the present time, we are strongly persuaded that one of the most serious obstacles to acquiring and maintaining the managerial competence which the Government needs for its research and development programs is the discrepancy between governmental and private compensation for comparable work. This obstacle has been growing in-

creasingly serious in recent years as increases in Federal pay have been concentrated primarily at the lower end of the pay scale—resulting in the anomalous situation that many officials of Government responsible for administering major elements of Federal research and development programs are paid substantially smaller salaries than personnel of universities, of business corporations, or of not-for-profit organizations who carry out subordinate aspects of those research and development programs. We cannot stress too strongly the importance of rectifying this situation, and hope the Congress will take at this session the action which the President has recommended to reform Federal civilian pay scales.

Second, it is necessary for even the best qualified governmental managers to obtain technical advice from specialists. Such technical advice can be obtained from men within the Government or those outside. When it is obtained from persons outside of Government, special problems of potential conflict of interest are raised which were dealt with in the President's recent memorandum entitled "Preventing Conflicts of Interest on the Part of Advisers and Consultants to the Government."

We believe it highly important for the Government to be able to turn to technical advice from its own establishment as well as from outside sources. One major source of this technical knowledge is the Government-operated laboratory or research installation and, as is made clear later in this report, we believe major improvements are needed at the present time in the management and staffing of these installations. A strong base of technical knowledge should be continually maintained within the Government service and available for advice to top management.

Third, we need to be particularly sensitive to the cumulative effects of contracting out Government work. A series of actions to contract out important activities, each wholly justified when considered on its own merits, may when taken together begin to erode the Government's ability to manage its research and development programs. These must be a high degree of awareness of this danger on the part of all governmental officials concerned. Particular attention must be given to strengthening the Government's ability to provide effective technical supervision in the letting and carrying out of contracts, and to developing more adequate measures for performance evaluation.

Determining the assignment of research and development work

As indicated above, we consider it necessary and desirable to use a variety of arrangements to obtain the scientific and technical services needed to accomplish public purposes. Such arrangements include: direct governmental operations through laboratories or other installations; operation of Government-owned facilities by contractors; grants and contracts with universities and entities associated with universities; contracts with not-for-profit corporations wholly or largely devoted to performing work for Government; and contracts with private business corporations. We also feel that innovation is still needed in these matters, and each agency should be encouraged to seek new and better arrangements to accomplish its purposes. Choices among available arrangements should be based primarily on two factors:

- relative effectiveness and efficiency, and
- avoidance of conflicts of interest.

Relative effectiveness and efficiency

In selecting recipients, whether public or private, for research and development assignments, the basic rule (apart from the conflict-of-interest problem) should be to assign the job where it can be done most effectively and efficiently, with due regard to the strengthening of institutional resources as well as to the immediate execution of projects. This criterion does not, in our judgment, lead to a conclusion that certain kinds of work should be assigned *only* to certain kinds of institutions. Too much depends on individual competence, historical evolution, and other special circumstances to permit any such simple rule to hold. However, it seems clear that some types of facilities have natural advantages which should be made use of. Thus:

Direct Federal operations, such as the governmental laboratory, enjoy a close and continuing relationship to the agency they serve which permits maximum responsiveness to the needs of that agency and a maximum sense of sharing the mission of the agency. Such operations accordingly have a natural advantage in conducting research, feasibility studies, developmental and analytical work, user tests and evaluations which directly support the management functions of the agency. Furthermore, an agency-operated research and development installation may provide a useful source of technical management personnel for its sponsor.

At the present time we consider that the laboratories and other facilities available to Government are operating under certain important handicaps which should be removed if these facilities are to support properly the Federal research and development effort. These matters are discussed at some length in part 4 of this report.

Colleges and universities have a long tradition in basic research. The process of graduate education and basic research have long been closely associated, and reinforce each other in many ways. This unique intellectual environment has proven to be highly conducive to successful undirected and creative research by highly skilled specialists. Such research is not amenable to management control by adherence to firm schedules, well-defined objectives, or pre-determined methods of work. In the colleges and universities graduate education and basic research constitute an effective means of introducing future research workers to their fields in direct association with experienced people in those fields, and in an atmosphere of active research work. Applied research appropriate to the universities is that which broadly advances the state of the art.

University-associated research centers are well suited to basic or applied research for which the facilities are so large and expensive that the research acquires the character of a major program best carried out in an entity apart from the regular academic organization. Research in such centers often benefits from the active participation of university scientists. At the same time the sponsoring university (and sometimes other, cooperating universities) benefits from increased opportunities for research by its facilities and graduate students.

Not-for profit organizations (other than universities and contractor-operator Government facilities), if strongly led, can provide a degree of independence, both from Government and from the commercial mar-

ket, which may make them particularly useful as a source of objective analytical advice and technical services. These organizations have on occasion provided an important means for establishing a competent research organization for a particular task more rapidly than could have been possible within the less flexible administrative requirements of the Government.

Contractor-operated Government facilities appear to be effective, in some instances, in securing competent scientific and technical personnel to perform research and development work where very complex and costly facilities are required and the Government desires to maintain control of those facilities. Under such arrangements, it has been possible for the Government to retain most of the controls inherent in direct Federal operations, while at the same time gaining many of the advantages of flexibility with respect to staffing, organizations, and management, which are inherent in university and industrial operations.

Operations in the profit sector of the economy have special advantages when large and complex arrays of resources needed for advanced development and pre-production work must be marshalled quickly. If the contracting system is such as to provide appropriate incentives, operations for profit can have advantages in spurring efficiency, reducing costs, and speeding accomplishments. (It is plain that not all operations in this sector have resulted in low costs or rapid and efficient performance; we regard this as a major problem for the contracting system and discuss it further in part 3 of this report.) Contractors in the profit sector may have the advantage of drawing on resources developed to satisfy commercial as well as governmental customers which adds to the flexibility of procurement, and may permit resources to be phased in and out of Government work on demand.

The preceding paragraphs have stressed the advantages of these different types of organization. There are disadvantages relating to each type which must also be taken into account. Universities, for example, are not ordinarily qualified—nor would they wish—to undertake major systems engineering contracts.

We repeat that the advantages—and disadvantages—noted above do not mean that these different types of arrangements should be given areas of monopoly on different kinds of work. There are, by common agreement, considerable advantages derived from the present diversity of operations. It permits great flexibility in establishing and directing different kinds of facilities and units, and in meeting the need for managing different kinds of jobs. Comparison of operations among these various types of organizations helps provide yardsticks for evaluating performance.

Moreover, this diversity helps provide many sources of ideas and of the critica analysis of ideas, on which scientific and technical progress depend. Indeed, we believe that some research (in contrast to development) should be undertaken by most types of organizations. Basic and applied research activities related to the mission of the organization help to provide a better intellectual environment in which to carry out development work. They also assist greatly in recruiting high quality research staff.

In addition to the desirability of making use of the natural areas of advantage within this diversity of arrangements, there is one addi-

tional point we would stress. Activities closely related to governmental managerial decisions (such as those in support of contractor selection), or to activities inherently governmental (such as regulatory functions, or technical activities directly bound up with military operations), are likely to call for a direct Federal capability and to be less successfully handled by contract.

Conflicts of interest

There are at least three aspects of the conflict-of-interest problem which arise in connection with governmental research and development work.

First, there are problems relating to private individuals who serve simultaneously as governmental consultants and as officers, directors, or employees of private organizations with which the Government has a contractual relationship. Many of these individuals are among the Nation's most capable people in the research and development field, and can be of very great assistance to Government agencies.

The problems arising in their case with respect to potential conflicts of interest have been dealt with in the President's memorandum of February 9, referred to earlier in this report. The essential standard set out in that memorandum was that no individual serving as an adviser or consultant should render advice on an issue whose outcome would have a direct and predictable effect on the interests of the private organization which he serves. To this end the President asked that arrangements be made whereby each adviser and consultant would disclose the full extent of his private interests, and the responsible Government officials would undertake to make sure that conflict-of-interest situations are avoided.

Second, there is a significant tendency to have on the boards of trustees and directors of the major universities, not-for-profit and profit establishments engaged in Federal research and development work, representatives of other institutions involved in such work. Such interlocking directorships may serve to reinforce and strengthen the overall management of private organizations which are heavily financed by the Government. Certainly it is in the public interest that organizations on whom so much reliance is placed for accomplishing public purposes should be controlled by the most responsible, mature, and knowledgeable men available in the Nation. However, we see the clear possibility of conflict-of-interest situations developing through such common directorships that might be harmful to the public interest. Members of governing boards of private business enterprises, universities, or other organizations which advise the Government with respect to research and development activities are often simultaneously members of governing boards of organizations which receive or may receive contracts or grants from the Government for research, development, or production work. Unless these board members also serve as consultants to the Government, present conflict-of-interest laws do not apply. The spirit, if not the letter, of the standards of conduct for Government advisers set forth in the President's memorandum, in our judgment, can and should provide guidance to boards and their members with respect to the interrelationships among universities, not-for-profit organizations, and business corporations where Government business is involved. Some boards of trustees and directors have already taken action along these lines.

Beyond this, however, there is a third type of problem which requires consideration: this might be described as potential conflicts of interest relating to organizations rather than to individuals. It arises in several forms—not all of which by any means are yet fully understood. Indeed, in this area of potential conflicts of interest relating to individuals and organizations in the research and development field, we are in an early stage of developing accepted standards of conduct—unlike other fields, such as the law or medicine, where there are long-established standards of conduct.

One form of organizational conflict of interest relates to the distinction between organizations providing professional services (e.g., technical advice) and those providing manufactured products. A conflict of interest could arise, for example, if a private corporation received a contract to provide technical advice and guidance with respect to a weapons system for which that same private corporation later sought a development or production contract, or for which it sought to develop or supply a key subsystem or component. It is clear that such conflict-of-interest situations can arise whether or not the profit motive is present. The managers of the not-for-profit institutions have necessarily a strong interest in the continuation and success of such institutions, and it is part of good management of Federal research and development programs to avoid placing any contractor—whether profit or nonprofit—in a position where a conflict of interest could clearly exist.

Another kind of issue is raised by the question whether an organization which has been established to provide services to a Government agency should be permitted to seek contracts with other Government agencies—or with non-Government customers. The question has arisen particularly with respect to not-for-profit organizations established to provide professional services.

This is not a clear consensus on this question among Government officials and officers of the organizations in question. We have considered the question far enough to have the following tentative views:

In the case of organizations in the area of operations and policy research (such, for example, as the Rand Corporation), the principal advantages they have to offer are the detached quality and objectivity of their work. Here, too close control by any Government agency may tend to limit objectivity. Organizations of this kind should not be discouraged from dealing with a variety of clients, both in and out of Government.

On the other hand, a number of the organizations which have been established to provide systems engineering and technical direction (such, for example, as Aerospace Corporation) are at least for the time being of value principally as they act as agents of a single client. In time, as programs change and new requirements arise, it may be possible and desirable for such organizations also to achieve a fully independent financial basis, resting on multiple clients, but this would seem more likely to be a later rather than an earlier development.

Enough has been said to indicate that this general area of conflict of interest with respect to research and development work is turning up new kinds of questions and all the answers have not yet been found. We believe it important to continue to work toward setting forth standards of conduct, as was done by the President in his February memorandum.

We recommend that the President instruct each department and agency head, in consultation with the Attorney General, to proceed to develop as much of a code of conduct for individuals and organizations in the research and development field as circumstances now permit.

Finally, we would note that beyond any formal standards, we cannot escape the necessity of relying on the sensitive conscience of officials in the Government and in private organizations to make sure that appropriate standards are continually maintained.

PART 3

PROPOSALS FOR IMPROVING POLICIES AND PRACTICES APPLYING TO RESEARCH AND DEVELOPMENT CONTRACTING

During the course of this review, a number of suggestions arose which we believe to indicate desirable improvements in the Government's policies and practices applying to research and development contracting.

Improving the Government's Competence as a "Sophisticated Buyer"

In order for the contracting system to work effectively, the first requirement is for the Government to be a sophisticated buyer—that is, to know what it wants and how to get it. Mention has already been made of the requirements this places on governmental management officials. At this point four additional suggestions are made.

1. In the case of many large systems development projects, it has been the practice to invite private corporations to submit proposals to undertake research and development work—relating to a new missile system, for example, or a new aircraft system. Such proposals are often invited before usable and realistic specifications of the system have been worked out in sufficient detail. As a consequence, highly elaborate, independent, and expensive studies are often undertaken by the would-be contractors in the course of submitting their proposals. This is a very costly method of obtaining competitive proposals, and it unnecessarily consumes large amounts of the best creative talent this country possesses, both on the preparation of the proposals and their evaluation. Delivery time pressures may necessitate inviting proposals before specifications are completed, but we believe this practice can and should be substantially curtailed.

This would mean in many instances, improving the Government's ability to accomplish feasibility studies, or letting special contracts for that purpose, before inviting proposals. In either event, it would require the acceptance of a greater degree of responsibility by Government managers for making preliminary decisions prior to inviting private proposals. We believe the gains from such a change would be substantial in the avoidance of unnecessary and wasteful use of scarce scientific and technical personnel as well as heavy costs to the private contractors concerned—costs which in most cases are passed on to the Government.

2. We believe there is a great deal of work to be done to improve the Government's ability to supervise and to evaluate the conduct of research and development efforts—whether undertaken through public or private facilities. We do not have nearly enough understanding as yet of how to know whether we are getting a good product for our

money, whether research and development work is being competently managed, or how to select the more competent from the less competent as between research and development establishments.

When inadequate technical criteria exist, there is a tendency to substitute conformity with administrative and fiscal procedures for evaluation of substantive performance. What is required is more exchange of information between agencies on their practices in contractor evaluation and on their experience with these practices. A continuing forum should be provided for such exchange. It is possible also that some central and fairly formal means of reporting methods and experience and recording them permanently should be established. We recommend that the Director of the new Office of Science and Technology, when established, be asked to study the possibility of establishing such a forum and the best means for providing information regarding evaluation practices.

3. With the tremendous proliferation of research and development operations and associated facilities in recent years, it has become difficult for the Government officials who arrange for such work to be done to be aware of all the facilities and manpower that are available. To maintain a complete and continuous roster of manpower, equipment and organizations, sensitive to month-by-month changes, would undoubtedly be too costly in terms of its value.

Nevertheless, we believe that an organized attempt should be made to improve the current inventory of information on the scientific and technical resources of the country. We recommend that the National Science Foundation consider ways and means of improving the availability of such information for use by all concerned in public and private activities.

4. In addition, the expansion of the Nation's research and development effort has multiplied the difficulties of communication among researchers engaged on related projects at separate facilities, both public and private. It is clear that additional steps should be taken to further efforts to improve the system for the exchange of information in the field of science and technology.

At present a Panel on Scientific Information of the President's Science Advisory Committee is at work on this subject. We expect that its report will be followed by full-scale planning for the establishment of a more effective technical information exchange system, to support the needs of the operating scientists and the engineer.

Improving arrangements with the private sector types of contracts

The principal type of contract for research and development work which is made with private industry is the cost-plus-fixed-fee contract. Such contracts have been used in this area because of the inherent difficulty of establishing precise objectives for the work to be done and of making costs estimates ahead of time.

At the same time, this type of contract has well-known disadvantages. It provides little or no incentive for private managers to reduce costs or otherwise increase efficiency. Indeed, the cost-plus-fixed-fee contract, in combination with strong pressures from governmental managers to accomplish work on a rapid time schedule, probably provides incentives for raising rather than for reducing costs. If a corporation is judged in terms of whether it accomplishes a result by a given deadline rather than by whether it accomplishes that result at minimum

cost, it will naturally pay less attention to costs and more attention to speed of accomplishment. On the other hand, where there is no given deadline, the cost-plus-fixed-fee contract may serve to prolong the research and development work and induce the contractor to delay completion.

Consequently, we believe it to be desirable to replace cost-plus-fixed-fee contracting with fixed price contracting wherever that is feasible—as it should be in the procurement of some late-stage development, test work, and services. Where it is judged that cost reimbursement must be retained as the contracting principle, it should be possible in many instances to include an incentive arrangement under which the fee would not be fixed, but would vary according to a predetermined standard which would relate larger fees to lower costs, superior performance, and shorter delivery times. There is ample evidence to prove that if adequate incentives are given by rewards for outstanding performance, both time and money can be saved. Where the nature of the task permits, it may be desirable to include in the contract penalty provisions for inadequate performance.

Finally, if neither fixed-price nor incentive-type contracts are possible, it is still necessary for Government managers to insist on consideration being given to lower cost, as well as better products and shorter delivery times—and to include previous performance as one element in evaluating different contractors and the desirability of awarding them subsequent contracts.

Contract administration

The written contract itself, however well done, is only one aspect of the situation. The administration of a contract requires as much care and effort as the preparation of the contract itself. This is particularly important with respect to changes in system characteristics, for these changes often become the mechanism for justifying cost overruns. Other factors of importance in contract administration are fixing authority and responsibility in both Government and industry, excessive reporting requirements, and an all-too-frequent lack of pre-arranged milestones for auditing purposes.

Reimbursable costs

Concern has been expressed because of significant differences among the various agencies in policies regarding which costs are eligible for reimbursement—notably with respect to some of the indirect costs. These differences are now being reviewed by the Bureau of the Budget with the cooperation of the Department of Defense, the National Aeronautics and Space Administration, the Atomic Energy Commission, and the General Services Administration.

Arrangements with universities

With respect to universities, Government agencies share responsibility for seeing that research and development financed at universities does not weaken these institutions or distort their functions which are so vital to the national interest.

Government agencies use both grants and contracts in financing research at universities, but in our judgment the grant has proved to be a simpler and more desirable device for Federal financing of fundamental research, where it is in the interest of the Government

not to exercise close control over the objectives and direction of research. Since all relevant Government agencies are now empowered to use grants instead of contracts in supporting basic research, the wider use of this authority should be encouraged.

Apart from this matter, three others seem worthy of comment.

One arises from the extensive use of contracts (or grants) for specific and precisely identified projects. Often there is a tendency to believe that in providing support for a single specific project the chance of finding a solution to a problem is being maximized. In reality, however, less specific support often would permit more effective research in broad areas of science, or in interdisciplinary fields, and provide greater freedom in drawing in more scientists to participate in the work that is undertaken. Universities, too, often find project support cumbersome and awkward. A particular professor may be working on several projects financed by several Government agencies and must make arbitrary decisions in allocating expenses to a particular project. It thus appears both possible and desirable to move in the direction of using grants to support broader programs, or to support the more general activities of an institution, rather than to tie each allocation of funds to a specific project. A number of Government agencies have been moving in this direction and it would be desirable to expand the use of such forms of support as experience warrants.

At the same time, it would not, in our judgment, be appropriate to place major reliance on the institutional grant, since the major purpose of making grants in most cases is to assure that the university personnel and facilities concerned will be devoted to pursuing specific courses of inquiry.

A second problem associated with the support of research at universities is whether the Government should pay all costs, including indirect expenses or "overhead," associated with work financed by the Government. We believe this matter involves two related but distinct questions, which should be separated in considering the appropriate policy to be followed.

1. We believe there is no question that, in those cases in which it is desirable for the Government to pay the entire cost of work done at a university, the Government should pay for allowable indirect as well as direct costs. To do otherwise would be discriminatory against universities in comparison with other kinds of institutions. For purposes of financial and accounting simplicity, in those cases where grants are used, and it is desirable for the Government to pay all allowable costs, it may be possible to work out a uniform or average percentage figure which could be regarded as covering indirect costs.

2. We believe there are many cases in which it is neither necessary nor desirable for the Government to pay all the costs of the work to be done. In many fields of research, a university may gain a great deal from having the research in question done on its campus, with the participation of its faculty and students, and may be able and willing to share in the costs, either through its regular funds or through raising additional funds from foundations, alumni, or by other means. The extent and degree of cost-sharing can and should vary among different agencies and programs, and we are not prepared at this time to suggest any uniform standards—except the negative one that it

would be plainly illogical to require that the university uniformly provide its share through the payment of all or a part of the indirect costs. Only in the exceptional case would this turn out to be the best basis for determining the appropriate sharing of costs.

A third problem relates to the means for furnishing major capital assets for research at universities (such as a major building or a major piece of equipment such as a linear accelerator, synchrotron, or large computer). In most cases, it will be preferable to finance such facilities by a separate grant (or contract), which will ensure that careful attention is given to the long-term value of the asset and to the establishment of appropriate arrangements for managing and maintaining it.

Arrangements with respect to not-for-profit organizations other than universities

It has been the practice in contracting for research and development work with such organizations to cover all allowable costs and, in addition, to provide what is commonly called a "fee." The reason for paying a "fee" to not-for-profit organizations is quite different from the reason for paying a fee to profit-making contractors and therefore the term "fee" is misleading. The profit-making contractor is engaged in business for profit. His profit and the return to his shareholders or investors can only come from the fee. In the case of the not-for-profit organizations, there are no shareholders, but there are two sound reasons to justify payment of a "development" or "general support" allowance to such organizations.

One is that such allowances provide some degree of operational stability and flexibility to organizations which otherwise would be very tightly bound to the precise limitations of cost financing of specific tasks; the allowances can be used to even out variations in the income of the organization resulting from variations in the level of contract work. A second justification is that most not-for-profit organizations must conduct some independent, self-initiated research if they are to obtain and hold highly competent scientists and engineers. Such staff members, it is argued, will only be attracted if they can share, to some extent, in independently directed research efforts.

We consider that both of these arguments have merit and, in consequence, support the continuation of these payments. Both arguments represent incentives to maintain the cohesiveness and the quality of the organization, which is in the interest of the Government. They should underlie the thinking of the Government representatives who negotiate contracts with not-for-profit organizations. But the amount of the "fee" or allowance in each instance must still be determined by bargaining between Government and contractor, in accordance with the independent relationship that is essential to successful contracting.

An important question relating to not-for-profit organizations other than universities, concerns facilities and equipment. In our judgment, the normal rule should be that where facilities and equipment are required to perform research and development work desired by the Government, the Government should either provide the facilities and equipment, or cover their cost as part of the contract. This is the rule relating to profit organizations and would hold in general for not-for-profit organizations—but there are two special problems with respect to the latter.

First, we believe it is generally not desirable to furnish funds through "fees" for the purpose of enabling a contractor to acquire major capital assets. On the other hand, the Government should not attempt to dictate what a contractor does with his "fee", provided it has been established on a sound and equitable basis, and if a contractor chooses to use part of his "fee" to acquire facilities for use in his self-initiated research, we would see no objection.

Second, we would think it equitable, where the Government has provided facilities, funds to obtain facilities, substantial working capital, or other resources to a contractor, it should, upon dissolution of the organization, be entitled to a first claim upon such resources. This would seem to be a matter which should be governed, insofar as possible, by the terms of the contract—or in the case of any newly established organizations, should be provided in the provisions of its charter.

Salaries and related benefits

In addition to the question of fees and allowances, there has been a great deal of concern over the salaries and related benefits received by persons employed on federally financed research and development work in private institutions, particularly persons employed in not-for-profit establishments doing work exclusively for the Government. Controls have been suggested or urged by congressional committees and others to make sure that there is no excessive expenditure of public funds and to minimize the undesirable competitive effect on the Federal career service.

We agree that where the contracting system does not provide built-in controls (for example, through competitive bidding), attention should be paid to the reasonableness of contractors' salaries and related benefits, and contractors should be reimbursed only for reasonable compensation costs.

The key question is how to decide what is reasonable and appropriate compensation. We believe the basic standard for reimbursement of salaries and related benefits should be one of comparability to compensation of persons doing similar work in the private economy. The President recently proposed to the Congress that the pay for Federal civilian employees should be based on the concept of reasonable comparability with employees doing similar work in the private economy. We believe this to be a sound principle which can be applied in the present circumstances as well.

Application of this comparability principles may require some special compensation surveys (perhaps made by the Bureau of Labor Statistics), which can and should be arranged for as necessary. Furthermore, there will undoubtedly be cases in which comparable data are difficult to obtain—as, for example, with respect to top management jobs. In such cases the specific approval of the head of the Government contracting agency or his designee should be required.

In view of the inherent complexity and sensitivity of this subject, we suggest that special administrative arrangements should be established in each agency. Contract policies respecting salaries and related benefits in each contracting agency should be controlled by an official reporting directly to the head of the agency (in the Department of Defense, to assure uniformity of treatment, by an official reporting directly to the Secretary of Defense), and salaries above a certain level—say \$25,000—should require the personal approval of that official.

PART 4

PROPOSALS FOR IMPROVING THE GOVERNMENT'S ABILITY TO CARRY OUT
RESEARCH AND DEVELOPMENT ACTIVITIES DIRECTLY

Based on the evidence acquired in the course of this review, we believe there is no doubt that the effects of the substantial increase in contracting out Federal research and development work on the Government's own ability to execute research and development work have been deleterious.

The effects of the sharp rise in contracting out have included the following. First, contractors have often been able to provide a superior working environment for their scientists and engineers—better salaries, better facilities, better administrative support—making contracting operations attractive alternatives to Federal work. Second, it has often seemed that contractors have been given the more significant and more interesting work assignments, leaving Government research and development establishments with routine missions and static programs which do not attract the best talent. Third, additional burdens have often been placed on Government research establishments to assist in evaluating the work of increasing numbers of contractors and to train and educate less skilled contractor personnel—without adding to the total staff and thus detracting from the direct research work which appeals to the most competent personnel. Fourth, scientists in contracting institutions have often had freedom to move “outside of channels” in the Government hierarchy and to participate in program determination and technical advice at the highest levels—freedom frequently not available to the Government's own scientists. Finally, one of the most serious aspects of the contracting out process has been that it has provided an alternative to correcting the deficiencies in the Government's own operations.

In consequence, for some time there has been a serious trend toward the reduction of the competence of Government research and development establishments. Recently a number of significant actions have been started which are intended to reverse this trend. We point particularly to the strong leadership being given within the Defense Department by the Director of Defense Research and Engineering, in striving to raise the capabilities of the Department's laboratories and other research and development facilities.

Nevertheless, we believe the situation is still serious and that major efforts are required.

We consider it a most important objective for the Government to maintain first-class facilities and equipment of its own to carry out research and development work. This observation applies not only to the newer research and development agencies but equally to the older agencies such as Commerce, Interior and Agriculture.

No matter how heavily the Government relies on private contracting, it should never lose a strong internal competence in research and development. By maintaining such competence it can be sure of being able to make the difficult but extraordinarily important program decisions which rest on scientific and technical judgments. Moreover, the Government's research facilities are a significant source of management personnel.

Major steps seem to us to be necessary in the following matters:

1. It is generally recognized that having significant and challenging work to do is the most important element in establishing a successful research and development organization. It is suggested that responsibility should be assigned in each department and agency to the Assistant Secretary for Research and Development or his equivalent to make sure that assignments to governmental research facilities are such as to attract and hold first-class men. Furthermore, arrangements should be made to call on Government laboratory and development center personnel to a larger extent for technical advice and participation in broad program and management decisions—in contrast to the predominant use of outside advisers.

2. The evidence is compelling that managerial arrangements for many Government-operated research and development facilities are cumbersome and awkward. Several improvements are needed in many instances, including

- delegating to research laboratory directors more authority to make program and personnel decisions, to control funds, and otherwise to command the resources which are necessary to carry out the mission of the installation.
- providing the research laboratory director a discretionary allotment of funds, to be available for projects of his choosing, and for the results of which he is to be responsible;
- eliminating where possible excess layers or echelons of supervisory management, and insuring that technical, administrative, and fiscal reviews be conducted concurrently and in coordinated fashion; and
- making laboratory research assignments in the form of a few major items with a reasonable degree of continuity rather than a multiplicity of small narrowly specified tasks; this will put responsibility for detailed definition of the work to be done at the laboratory level where it belongs.

To carry out these improvements will require careful and detailed analysis of the different situations in different agencies. Above all, it will require the energetic direction of top officials in each agency.

Plans have already been developed for joint teams of Civil Service Commission and Department of Defense research and manpower personnel to visit nine Defense laboratories during April and May 1962, in order to analyze precisely what administrative restrictions exist that hamper research effectiveness. In this fashion, those unwarranted limitations that can be eliminated by executive action can be identified as distinguished from those that may require legislative change.

3. Salary limitations, as already mentioned, in our opinion play a major role in preventing the Government from obtaining or retaining highly competent men and women. Largely because of the lack of comparable salaries, the Government is not now and has not for at least the past 10 years been able to attract or retain its share of such critically necessary people as: recently graduated, highly recommended Ph.D.'s in mathematics and physics; recent B.S./M.S. scientific and engineering graduates in the upper 25 percent of their classes at top-ranked universities; good experienced, weapons systems engineers and missile, space, and electronic specialists at intermediate and senior levels; and senior-level laboratory directors, scientific managers, and administrators. This obstacle will be substantially overcome if the Congress ap-

proves the President's recommendation to establish a standard of comparability with private pay levels for higher professional and technical jobs in the Federal service.

4. A special problem in the Defense Department is the relationship between uniformed and civilian personnel. This is a difficult and sensitive problem of which the Department of Defense is well aware. We do not attempt in this report to propose detailed solutions, but we do suggest that certain principles are becoming evident as a result of the experience of recent years.

It seems clear, for example, that the military services will have increasing need for substantial numbers of officers who have extensive scientific and technical training and experience. Such officers bring first-hand knowledge of operational conditions and requirements to research and development installations and, in turn, learn about the state of the art and the feasible applications of technology to military operations. The military officer is needed to communicate the needs of the user, to prepare the operational forces for new equipment, to plan for the use of developing equipment, and later to install it and supervise its use.

All of the above roles suggest that when military personnel are used in research and development activities, they should perform as "technical men" rather than "military men" except when there is a need for their military skills. Military command and direction become important only as one moves from the research end of the spectrum into the area where operational considerations predominate. Both at middle management and policy levels, a well-balanced mixture of military and civilian personnel may be most advantageous in programs designed to meet military needs.

In research, there are many instances in which the existence of military supervision, and the decreased opportunities for advancement because of military occupancy of top jobs, are among the principal reasons why the Defense Department has had difficulty in attracting outstanding civilian scientists and engineers. On the other hand, there are examples within the Department of cases in which enlightened policies of civil-military relationships have drawn on the strengths of each and produced excellent results. In such instances, the military head of the laboratory has usually concentrated on administrative problems and the civilian technical director has had complete control of technical programs.

Military officers should not be substituted for civilians in the direction and management of research and development unless they are technically qualified and their military background is directly needed and applicable.

In the course of the next year, the Department of Defense intends to give consideration to the delineation of those research and development installations in which operational considerations are predominant and those installations in which scientific and technical considerations are predominant. Having done so, the assignment of military officers to head the former type of installation, and civilians (or equally qualified military officers) to head the latter will be encouraged. Furthermore, when military personnel are assigned to work in civilian-directed installations on the basis of their technical abilities, it is in-

tended that they should be free of the usual rotation-of-duty requirements and not have separate lines of reporting.

5. In addition to the recommendations above, we have given consideration to the possible establishment of a new kind of Government research and development establishment, which might be called a Government Institute. Such an Institute would provide a means for reproducing within the Government structure some of the more positive attributes of the nonprofit corporation. Each Institute would be created pursuant to authority granted by the Congress and be subject to the supervision of a Cabinet officer or agency head. It would, however, as a separate corporate entity directly managed by its own Board of Regents, enjoy a considerable degree of independence in the conduct of its internal affairs. An Institute would have authority to operate its own career merit system, as the Tennessee Valley Authority does, would be able to establish a compensation system based on the comparability principle, and would have broad authority to use funds and to acquire and dispose of property.

The objective of establishing such an instrumentality would be to achieve in the administration of certain research and development programs the kind of flexibility which has been obtained by Government corporations while retaining, as was done with the Government corporation, effective public accountability and control.

We regard idea as promising and recommend that the Bureau of the Budget study it further, in cooperation with some of the agencies having major research and development programs. It may well prove to be a useful additional means for carrying out governmental research and development efforts.

6. It would seem, based on the results of this review, that it would be possible and desirable to make more use of existing governmental facilities and avoid the creation of duplicate facilities. This is not as easy a problem as it might seem. It is ordinarily necessary for a laboratory, if it is to provide strong and competent facilities, to have a major mission and a major source of funding. This will limit the extent to which it is possible to make such facilities available for the work of other agencies. Nevertheless, in some cases and to some extent it is clearly possible to do this and a continuing scrutiny is necessary in order to make sure that the facilities which the Government has are used to their fullest extent.

7. Finally, together with the better use of existing facilities, the Government must also make better use of its existing scientific and engineering personnel. This implies not only a careful watch over work assignments, but also a continual upgrading of the capabilities of Federal personnel through education and training. At the present time, technology is changing so rapidly that on-the-job scientists and engineers find themselves out of date after a decade or so out of the university. To remedy this, the Government must strengthen its educational program for its own personnel, to the extent of sending them back to the university for about an academic year every decade. This program, necessary as it is, will only become attractive if the employee is ensured job security on his return from school and if his parent organization is allowed to carry him on its personnel roster.

ANNEX 1

THE WHITE HOUSE,
July 31, 1961.

HONORABLE DAVID E. BELL,
Director, Bureau of the Budget,
Washington, D.C.

DEAR MR. BELL: Since the end of World War II, the Federal Government has been making extensive use of contracts with private institutions and enterprises to provide for the operation and management of research and development facilities and programs, for analytical studies and advisory services, and for technical supervision of weapons systems and other programs administered on a systems basis. Through such contracts the Government has been able to accomplish scientific and technical work essential to urgent public purposes.

In part, the use of such contracts has been made necessary by the Government's entry into new fields, such as atomic energy, missile development and space exploration, and the need for talents and services not previously employed. In part, the use of contracts has also been induced by the recommendations of the second Hoover Commission and other groups that the Government terminate activities which could better be performed for it by private enterprise. Present Federal policies with respect to contracting-out Government activities are outlined generally in Bureau of the Budget Circular No. A-49, "Use of management and operating contracts", and Bureau of the Budget Bulletin No. 60-2, "Commercial-industrial activities of the Government providing products or services for governmental use".

After a decade or more of experience with such contracts, I think it would be desirable to review the effectiveness of this means of accomplishing the Government's purposes. Some of the questions that require review have been posed recently in studies and reports by several committees of Congress. I would like to have you undertake, with the assistance and cooperation of the other Federal officials most concerned, a review of the experience with respect to the types of contracts mentioned above. I am requesting the following officials to participate in the study: the Secretary of Defense, the Chairman of the Atomic Energy Commission, the Chairman of the United States Civil Service Commission, the Administrator of the National Aeronautics and Space Administration, and the Special Assistant to the President for Science and Technology.

The product of the review should be recommendations to guide future executive branch action. While there is a consensus that the use of contracts is essential and appropriate to carry on certain types of Federal operations, it also appears that use of the contract device has been made necessary in part by the limitations which exist with respect to direct Federal operations. I would like to have you explore the circumstances and conditions under which contractor operations provide the most effective means for accomplishing the Government's objectives in the areas under review. I would also like to have full consideration given to the limitations which make direct Federal operations difficult, and to the development of proposals for adjustments and new concepts in direct Federal operations which would provide the Government with greater flexibility in determining

whether the public interest would best be served by the use of contractor or direct Government operations.

The review should focus on the following matters: (1) the effect of the use of contractors on direct Federal operations, the Federal personnel system, and the Government's own capabilities, including the capability to review contractor operations and carry on scientific and technical work in areas where the contract device has not been used, and policies and actions needed to increase the Government's capabilities in these respects; (2) the policies, if any, that the Government should follow in controlling the salaries and fringe benefits of personnel working under a contract, and the appointment, management and dismissal of such personnel; (3) the criteria to be used in determining whether to perform a service or function through a contractor or through direct Federal operations, including any special considerations to be given to the nature of the contractor and his relationship to production contractors; (4) the policies which should apply in selecting contractors, including the organization of institutions for the sole purpose of entering into contracts with the Government; (5) the means for reviewing and supervising contractor operations, and for achieving maximum efficiency in such operations; and (6) the policies which should apply with respect to contractor fees and cost reimbursement practices on items such as overhead, facilities and equipment, and advertising.

The results of the review should be available not later than December 1.

Sincerely,

JOHN F. KENNEDY.

APPENDIX B

EXECUTIVE ORDER No. 10521

March 19, 1954, 19 F. R. 1499

ADMINISTRATION OF SCIENTIFIC RESEARCH BY AGENCIES OF THE FEDERAL GOVERNMENT

Whereas the security and welfare of the United States depend increasingly upon the advancement of knowledge in the sciences; and

Whereas useful applications of science to defense, humanitarian, and other purposes in the Nation require a strong foundation in basic scientific knowledge and trained scientific manpower; and

Whereas the administration of Federal scientific research programs affecting institutions of learning must be consistent with the preservation of the strength, vitality, and independence of higher education in the United States; and

Whereas, in order to conserve fiscal and manpower resources, it is necessary that Federal scientific research programs be administered with all practicable efficiency and economy; and

Whereas the National Science Foundation has been established by law for the purpose, among others, of developing and encouraging the pursuit of an appropriate and effective national policy for the promotion of basic research and education in the sciences:

Now, therefore, by virtue of the authority vested in me as President of the United States, it is hereby ordered as follows:

SECTION 1. The National Science Foundation (hereinafter referred to as the Foundation) shall from time to time recommend to the President policies for the Federal Government which will strengthen the national scientific effort and furnish guidance toward defining the responsibilities of the Federal Government in the conduct and support of scientific research.

SEC. 2. The Foundation shall continue to make comprehensive studies and recommendations regarding the Nation's scientific research effort and its resources for scientific activities, including facilities and scientific personnel, and its foreseeable scientific needs, with particular attention to the extent of the Federal Government's activities and the resulting effects upon trained scientific personnel. In making such studies, the Foundation shall make full use of existing sources of information and research facilities within the Federal Government.

SEC. 3. The Foundation, in concert with each Federal agency concerned, shall review the scientific research programs and activities of the Federal Government in order, among other purposes, to formulate methods for strengthening the administration of such programs and

activities by the responsible agencies, and to study areas of basic research where gaps or undesirable overlapping of support may exist, and shall recommend to the heads of agencies concerning the support given to basic research.

SEC. 4. As now or hereafter authorized or permitted by law, the Foundation shall be increasingly responsible for providing support by the Federal Government for general-purpose basic research through contracts and grants. The conduct and support by other Federal agencies of basic research in arms which are closely related to their missions is recognized as important and desirable, especially in response to current national needs, and shall continue.

SEC. 5. The Foundation, in consultation with educational institutions, the heads of Federal agencies, and the Commissioner of Education of the Department of Health, Education, and Welfare, shall study the effects upon educational institutions of Federal policies and administration of contracts and grants for scientific research and development, and shall recommend policies and procedures which will promote the attainment of general national research objectives and realization of the research needs of Federal agencies while safeguarding the strength and independence of the Nation's institutions of learning.

SEC. 6. The head of each Federal agency engaged in scientific research shall make certain that effective executive, organizational, and fiscal practices exist to ensure (a) that the Foundation is consulted on policies concerning the support of basic research, (b) that approved scientific research programs conducted by the agency are reviewed continuously in order to preserve priorities in research efforts and to adjust programs to meet changing conditions without imposing unnecessary added burdens on budgetary and other resources, (c) that applied research and development shall be undertaken with sufficient consideration of the underlying basic research and such other factors as relative urgency, project costs, and availability of manpower and facilities, and (d) that, subject to considerations of security and applicable law, adequate dissemination shall be made within the Federal Government of reports on the nature and progress of research projects as an aid to the efficiency and economy of the overall Federal scientific research program.

SEC. 7. Federal agencies supporting or engaging in scientific research shall, with the assistance of the Foundation, cooperate in an effort to improve the methods of classification and reporting of scientific research projects and activities, subject to the requirements of security of information.

SEC. 8. To facilitate the efficient use of scientific research equipment and facilities held by Federal agencies:

(a) the head of each such agency engaged in scientific research shall, to the extent practicable, encourage and facilitate the sharing with other Federal agencies of major equipment and facilities;

(b) a Federal agency shall procure new major equipment or facilities for scientific research purposes only after taking suitable steps to ascertain that the need cannot be met adequately from existing inventories or facilities of its own or of other agencies; and

(c) the Interdepartmental Committee on Scientific Research and Development shall take necessary steps to ensure that each Federal

agency engaged directly in scientific research is kept informed of selected major equipment and facilities which could serve the needs of more than one agency. Each Federal agency possessing such equipment and facilities shall maintain appropriate records to assist other agencies in arranging for their joint use or exchange.

SEC. 9. The heads of the respective Federal agencies shall make such reports concerning activities within the purview of this order as may be required by the President.

DWIGHT D. EISENHOWER.

THE WHITE HOUSE, *March 17, 1954.*

APPENDIX C

EXECUTIVE ORDER No. 10807

March 17, 1959, 24 F.R. 1897

FEDERAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Whereas science and technology are essential resources for the security and welfare of the United States; and

Whereas Federal programs in science and technology will advance our security, health, and economic welfare and the quality of education in the United States; and

Whereas closer cooperation among Federal agencies will facilitate the resolution of common problems in science and technology, promote a greater measure of coordination, and otherwise improve the planning and management of Federal programs in these fields:

Now, therefore, by virtue of the authority vested in me as President of the United States, it is hereby ordered as follows:

SECTION 1. Establishment of Council. (a) There is hereby established the Federal Council for Science and Technology (hereinafter referred to as the Council).

(b) The Council shall be composed of the following-designated members: (1) the Special Assistant to the President for Science and Technology, (2) one representative of each of the following-named departments, who shall be designated by the Secretary of the Department concerned and shall be an official of the Department of policy rank: the Departments of Defense, the Interior, Agriculture, Commerce, and Health, Education, and Welfare, (3) the Director of the National Science Foundation, (4) the Administrator of the National Aeronautics and Space Administration, and (5) a representative of the Atomic Energy Commission, who shall be the Chairman of the Commission or another member of the Commission designated by the Chairman. A representative of the Secretary of State designated by the Secretary and a representative of the Director of the Bureau of the Budget designated by the Director may attend meetings of the Council as observers.

(c) The Chairman of the Council (hereinafter referred to as the Chairman) shall be designated by the President from time to time from among the members thereof. The Chairman may make provision for another member of the Council, with the consent of such member, to act temporarily as Chairman.

(d) The Chairman (1) may request the head of any Federal agency not named in section 2(b) of this order to designate a representative to participate in meetings or parts of meetings of the Council concerned

with matters of substantial interest to the agency, and (2) may invite other persons to attend meetings of the Council.

(e) The Council shall meet at the call of the Chairman.

SEC. 2. Functions of Council. (a) The Council shall consider problems and developments in the fields of science and technology and related activities affecting more than one Federal agency or concerning the over-all advancement of the Nation's science and technology, and shall recommend policies and other measures (1) to provide more effective planning and administration of Federal scientific and technological programs, (2) to identify research needs including areas of research requiring additional emphasis, (3) to achieve more effective utilization of the scientific and technological resources and facilities of Federal agencies, including the elimination of unnecessary duplication, and (4) to further international cooperation in science and technology. In developing such policies and measures the Council, after consulting, when considered appropriate by the Chairman, the National Academy of Sciences, the President's Science Advisory Committee, and other organizations, shall consider (i) the effects of Federal research and development policies and programs on non-Federal programs and institutions, (ii) long-range program plans designed to meet the scientific and technological needs of the Federal Government, including manpower and capital requirements, and (iii) the effects of non-Federal programs in science and technology upon Federal research and development policies and programs.

(b) The Council shall consider and recommend measures for the effective implementation of Federal policies concerning the administration and conduct of Federal programs in science and technology.

(c) The Council shall perform such other related duties as shall be assigned, consonant with law, by the President or by the Chairman.

(d) The Chairman shall, from time to time, submit to the President such of the Council's recommendations or reports as require the attention of the President by reason of their importance or character.

SEC. 3. Agency assistance to Council. (a) For the purpose of effectuating this order, each Federal agency represented on the Council shall furnish necessary assistance to the Council in consonance with section 214 of the act of May 3, 1945, 59 Stat. 134 (31 U.S.C. 691). Such assistance may include (1) detailing employees to the Council to perform such functions, consistent with the purposes of this order, as the Chairman may assign to them, and (2) undertaking, upon request of the Chairman, such special studies for the Council as come within the functions herein assigned to the Council.

(b) Upon request of the Chairman, the heads of Federal agencies shall, so far as practicable, provide the Council with information and reports relating to the scientific and technological activities of the respective agencies.

SEC. 4. Standing committees and panels. For the purpose of conducting studies and making reports as directed by the Chairman, standing committees and panels of the Council may be established in consonance with the provisions of section 214 of the act of May 3, 1945, 59 Stat. 134 (31 U.S.C. 691). At least one such standing committee shall be composed of a scientist-administrators representing Federal agencies, shall provide a forum for consideration of common administrative policies and procedures relating to Federal research and development activities

and for formulation of recommendations thereon, and shall perform such other related functions as may be assigned to it by the Chairman of the Council.

SEC. 5. Security procedures. The Chairman shall establish procedures to insure the security of classified information used by or in the custody of the Council or employees under its jurisdiction.

SEC. 6. Other orders; construction of orders. (a) Executive Order No. 9912 of December 24, 1947, entitled "Establishing the Interdepartmental Committee on Scientific Research and Development," is hereby revoked.

(b) Executive Order No. 10521 of March 17, 1954, entitled "Administration of Scientific Research by Agencies of the Federal Government," is hereby amended:

(1) By substituting for section 1 thereof the following:

"SECTION 1. The National Science Foundation (hereinafter referred to as the Foundation) shall from time to time recommend to the President policies for the promotion and support of basic research and education in the sciences, including policies with respect to furnishing guidance toward defining the responsibilities of the Federal Government in the conduct and support of basic scientific research."

(2) By inserting before the words "scientific research programs and activities" in section 3 thereof the word "basic".

(3) (i) By adding the word "and" at the end of paragraph (a) of section 8 thereof, (ii) by deleting the semicolon and the word "and" at the end of paragraph (b) of section 8 and inserting in lieu thereof a period, and (iii) by revoking paragraph (c) of section 8.

(4) By adding at the end of the order a new section 10 reading as follows:

"SEC. 10. The National Science Foundation shall provide leadership in the effective coordination of the scientific information activities of the Federal Government with a view to improving the availability and dissemination of scientific information. Federal agencies shall cooperate with and assist the National Science Foundation in the performance of this function, to the extent permitted by law."

(c) The provisions of Executive Order No. 10521, as hereby amended, shall not limit the functions of the Council under this order. The provisions of this order shall not limit the functions of any Federal agency or officer under Executive Order No. 10521, as hereby amended.

(d) The Council shall be advisory to the President and to the heads of Federal agencies represented on the Council; accordingly, this order shall not be construed as subjecting any agency, officer, or function to control by the Council.

DWIGHT D. EISENHOWER.

THE WHITE HOUSE, *March 13, 1959.*

APPENDIX D

[Circular No. A-64 (Revised)]

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D.C., June 28, 1965.

Subject: Position management systems and employment ceilings.

To the Heads of Executive Departments and establishments:

1. *Purpose.* This Circular (a) establishes criteria for the operation of an effective position management system, and (b) sets forth information on the concepts and procedures to be followed with regard to employment ceilings, their observance, and related reporting to the Bureau of the Budget. Effective July 31, 1965, this revised Circular replaces Circular No. A-64 dated March 31, 1964, as amended by Transmittal Memorandum No. 1 of January 5, 1965.

2. *Policy.* Consistent with the policy of reducing Government costs (see Bureau of the Budget Circular No. A-44, Revised, March 29, 1965), the President expects each agency head to pursue vigorously the efforts of his agency to achieve lower employment levels and increased productivity through tighter management, aggressive manpower utilization programs, simplification of procedures, and stripping work to essentials; and to assure strict observance of the employment ceilings.

3. *Position management.*

a. Each department and agency will develop and maintain a position management system designed to assure that the work is organized and assigned among positions in a manner which will serve mission needs most effectively and economically. As used in this Circular, position management includes the evaluation of the need for positions and required skills and knowledge; and the organization, grouping and assignment of duties and responsibilities among all positions. The position structure should be designed to utilize the most effective work processes, equipment, procedures, methods and techniques.

The position management system should be designed to identify, prevent and eliminate such common faults as unnecessary organizational fragmentation, excessive layering, excessive use of deputies, assistants to, and special assistants, improper design of jobs, outmoded work methods, and improper distribution of manpower resources.

b. A position management system should be developed which is best adapted to the needs of a particular agency or program. Provision normally should be made in each position management system, however, for the following key elements:

(1) *Assignment of responsibility.* Responsibility for work organization and position management should be explicitly assigned to line managers at appropriate levels in the organization.

(2) *Utilization of total staff resources.* In carrying out their responsibilities, line managers should utilize budget, planning, management analysis, personnel, and other special staff in the development and continuing operation of an effective position management system in the organization. It is especially important that the work of the different staff elements be coordinated and mutually supporting.

(3) *Position authorization and employment controls.* A position authorization and employment control procedure should be established to assure that existing and proposed work organization and staffing arrangements meet the requirements of good position management. Such a procedure must have as its basis adequate records, not only to identify the numbers of employees, but to identify positively the types of employment which are covered by the attached statement of definitions.

The procedure must ensure that (a) employment requirements are kept under continuous review, (b) positions authorized are limited to those that can be financed from available funds, (c) year-end employment does not exceed the approved ceiling, and (d) employment is not permitted to reach a point at any time during the year which would require reduction-in-force or other disruptive or uneconomical actions to get within the approved ceiling by year-end.

The requirements for the authorized position structure should be determined principally through the budget process, but also through the use of such tools as work measurement, work standards, productivity analysis, and manpower and workload reporting. An adequate position authorization and employment control system should provide control over total employment as well as over full-time employment in permanent positions.

(4) *Vacancy control.* Before any vacancy is filled, a review should be made to determine whether the duties of the position can be eliminated, assigned to other positions, or modified to permit performance at a lower grade.

(5) *Position reclassification.* Before any position is reclassified, the organizational work pattern should be thoroughly reviewed to ascertain the necessity for assigning responsibilities as high as the grade being proposed. Approval should be withheld unless the review indicates that such action is clearly consistent with the aims of effective and economical accomplishment of the agency mission.

(6) *Approval of organizational changes.* Each proposed change of organization or position structure should be reviewed and approved as appropriate from the standpoint of work design, occupational distribution, grade distribution, manpower requirements, and costs.

(7) *Interagency sharing of personnel resources.* Efforts to achieve effective manpower utilization should include the exploration of possible arrangements with other agencies for the sharing of personnel resources to meet certain nonrecurring needs or to take care of continuing housekeeping or administrative services. This type of arrangement could be advantageous for small offices, in Washington or in the field, but may be also applicable to specialized work in larger offices,

particularly where other agencies are better equipped to perform such services more effectively and economically.

(8) *Reporting.* The position management system should provide complete, accurate, reliable, and timely information on numbers of employees to meet central reporting requirements of the Civil Service Commission and the Bureau of the Budget as well as periodic reports for the use of the agency in reviewing the effectiveness of the system. The reports should provide essential data for effective analysis by the agency head and upon request by the Bureau of the Budget, the Civil Service Commission, and the Congress. While the frequency of central reporting will vary from agency to agency, the system should make it possible to provide management, either periodically or upon request, with the following information:

(a) The number of positions authorized under the position management system, by employment category and grade. (See Attachment A for definitions of employment categories.)

(b) The number of occupied positions, by employment category and grade.

(c) Any new arrangements entered into for the provision of services by contract.

(d) An analysis and explanation of any significant changes in the position structure, together with an analysis of any longer-term trends indicated.

(9) *Special reviews.* When budget reviews, internal management appraisals, quarterly reports, or other available data indicate that an organization may not be achieving effective position management, action should be initiated to identify the reasons and bring about changes in personnel, organization structure, management practices, or work processes to achieve improvement.

c. Assessments of the effectiveness of its position management system should be made by the department or agency itself, and will be made by the Bureau of the Budget as part of its continuing surveillance of agency programs, by the Civil Service Commission in its inspection of position classification, and as a part of the joint reviews of management and manpower utilization conducted by the Bureau of the Budget, the Civil Service Commission, and the agencies under review.

4. *System and nature of employment ceilings.*

a. Maximum allowable employment figures ("employment ceilings") are determined by the President at the time of the annual budget review, both for the end of the fiscal year then in progress and for the end of the succeeding fiscal year.

b. Each year the employment ceilings applicable to the year in progress are intended to be absolute limits as of the end of the fiscal year, consistent with the employment reportable to the Civil Service Commission on the Standard Form 113 series, and in accordance with this Circular.

c. Generally, employment ceilings reflect budget proposals and assumptions with regard to workload, efficiency, proposed new legislation, interagency reimbursable arrangements, and other special financing methods. Employment included for proposed legislation, or for carrying out proposed supplemental appropriations, must be re-

served until the additional funds become available by congressional action. Employment under estimated reimbursable arrangements must also be reserved until such arrangements have been negotiated.

d. Any decision to substitute the use of service contracts for direct employment, or to change the proportionate use of full-time (permanent or temporary), part-time, or intermittent employment must be based on considerations of effectiveness and economy in administering Federal programs, and must not be used as a device to avoid compliance with the ceilings.

5. *Adjustments to employment ceilings.* Under normal circumstances it would be expected that requests for revisions in employment ceilings for the current year in progress would be considered by the Bureau of the Budget during the examination of agency budget submissions for the following year. In the case of unusual or emergency situations, requests for revisions may be submitted at other times.

Revisions to employment ceilings will be considered only when congressional action on the budget request, or on supplemental requests or budget amendments transmitted after the budget, or any development subsequent to the establishment of the ceilings clearly requires a material change in the number of positions.

In the agency's request for an adjustment, it is not sufficient merely to justify the need for additional employment in a particular bureau or unit. The justification should indicate clearly why the increase cannot be absorbed through an internal adjustment in the agency's ceiling distribution, or why the need cannot be postponed to the next fiscal year.

All requests for adjustments in ceilings will be brought to the President's attention through the Bureau of the Budget.

6. *Report of violations.* It is the responsibility of each agency head to insure that the end-of-year employment is kept within the approved ceilings. In exceptional situations where the end-of-year employment exceeds an approved ceiling, the agency head will be responsible for the preparation of a report containing:

a. An explanation of the factors which caused employment to exceed the ceiling;

b. A statement describing the specific weaknesses in the agency's employment control system which permitted the violation to occur and the action taken to prevent recurrence of such violations; and

c. A schedule showing by bureau, the agency's distribution of the established ceiling and the corresponding numbers of employees at the end of the year.

An original and two copies of the report described above will be submitted to the Bureau of the Budget no later than the 20th of the month following the end of the fiscal year.

CHARLES L. SCHULTZE, *Director.*

Attachment.

DEFINITIONS OF EMPLOYMENT CATEGORIES

Note that the three types of employment are the equivalent of those set forth in the *Federal Personnel Manual*, Chapter 292. The employment categories used in the Civil Service Commission Monthly Re

port of Federal Civilian Employment (Standard Form 113-A) are consistent with these definitions.

1. A *full-time* employee is one who is regularly scheduled to work the number of hours and days required by the administrative workweek for his employment group or class. (Most full-time employees have an administrative workweek of 5 days of 8 hours each). Such employees may occupy either of two types of positions.

a. A *permanent position*—one which has been established without time limit, or for a limited period of a year or more, or which, in any event, has been occupied for a year or more (regardless of the intent when it was established).

b. A *temporary position*—one which has been established for a limited period of less than a year and which has not been occupied for more than a year.

2. A *part-time* employee is one who is regularly employed on a pre-scheduled tour of duty which is less than the specified hours or days of work for full-time employees in the same group or class.

3. An *intermittent* employee is one who is employed on an irregular or occasional basis, with hours or days of work not on a prearranged schedule, and with compensation only for the time actually employed or for services actually rendered.

APPENDIX E

[Circular No. A-76 (Revised)]

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D.C., August 30, 1967.

Transmittal Memorandum No. 1.

Subject: Policies for acquiring commercial or industrial products and services for Government use.

To the Heads of Executive Departments and Establishments:

Transmitted herewith is a revision of Bureau of the Budget Circular A-76 dated March 3, 1966. It is issued to clarify some provisions of the earlier Circular and to lessen the burden of work by the agencies in implementing its provisions. A brief summary of the changes is attached.

There is no change in the Government's general policy of relying upon the private enterprise system to supply its needs, except where it is in the national interest for the Government to provide directly the products and services it uses.

We intend to keep the provisions of the Circular under continuing review. We anticipate that further changes will be desirable in light of experience gained from implementing the Circular's provisions, including the required reviews of existing Government commercial or industrial activities to be completed by June 30, 1968. We intend to give special attention to the adequacy of the guidelines contained in the Circular for such matters as comparative cost analyses; the circumstances under which cost differentials in favor of private enterprise are appropriate; and the use of contracts involving support services that require minimal capital investment.

We welcome your suggestions.

PHILLIP S. HUGHES, *Acting Director.*

Attachments.

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D.C., August 30, 1967.

Subject: Policies for acquiring commercial or industrial products and services for Government use.

To the Heads of Executive Departments and Establishments:

1. *Purpose.* This Circular replaces Bureau of the Budget Circular A-76 issued March 3, 1966. It is issued to clarify some provisions of the earlier Circular and to lessen the burden of work by the agencies in implementing its provisions. The basic policies to be applied by executive agencies in determining whether commercial and industrial products and services used by the Government are to be provided by

private suppliers or by the Government itself are the same as those contained in Circular A-76 dated March 3, 1966.

2. *Policy.* The guidelines in this Circular are in furtherance of the Government's general policy of relying on the private enterprise system to supply its needs.

In some instances, however, it is in the national interest for the Government to provide directly the products and services it uses. These circumstances are set forth in paragraph 5 of this Circular.

No executive agency will initiate a "new start" or continue the operation of an existing "Government commercial or industrial activity" except as specifically required by law or as provided in this Circular.

3. *Definitions.* For purposes of this Circular:

a. A "new start" is a newly established Government commercial or industrial activity involving additional capital investment of \$25,000 or more or additional annual costs of production of \$50,000 or more. A reactivation, expansion, modernization or replacement of an activity involving additional capital investment of \$50,000 or more or additional annual costs of production of \$100,000 or more are, for purposes of this Circular, also regarded as "new starts." Consolidation of two or more activities without increasing the overall total amount of products or services provided is not a "new start."

b. A *Government commercial or industrial activity* is one which is operated and managed by an executive agency and which provides for the Government's own use a product or service that is obtainable from a private source. The term does not include a Government-owned contractor-operated activity.

c. A *private commercial source* is a private business concern which provides a commercial or industrial product or service required by agencies and which is located in the United States, its territories and possessions, the District of Columbia, or the Commonwealth of Puerto Rico.

4. *Scope.* This Circular is applicable to commercial and industrial products and services used by executive agencies, except that it:

a. Will not be used as authority to enter into contracts if such authority does not otherwise exist nor will it be used to justify departure from any law or regulation, including regulations of the Civil Service Commission or other appropriate authority, nor will it be used for the purpose of avoiding established salary or personnel limitations.

b. Does not alter the existing requirement that executive agencies will perform for themselves those basic functions of management which they must perform in order to retain essential control over the conduct of their programs. These functions include selection and direction of Government employees, assignment of organizational responsibilities, planning of programs, establishment of performance goals and priorities, and evaluation of performance.

c. Does not apply to managerial advisory services such as those normally provided by an office of general counsel, a management and organization staff, or a systems analysis unit. Advisory assistance in areas such as these may be provided either by Government staff organizations or from private sources as deemed appropriate by executive agencies.

d. Does not apply to products or services which are provided to the public. (But an executive agency which provides a product or service

to the public should apply the provisions of this Circular with respect to any commercial or industrial products or services which it uses.)

e. Does not apply to products or services obtained from other Federal agencies which are authorized or required by law to furnish them.

f. Should not be applied when its application would be inconsistent with the terms of any treaty or international agreement.

5. *Circumstances under which the Government may provide a commercial or industrial product or service for its own use.* A Government commercial or industrial activity may be authorized only under one or more of the following conditions:

a. *Procurement of a product or service from a commercial source would disrupt or materially delay an agency's program.* The fact that a commercial or industrial activity is classified or is related to an agency's basic program is not an adequate reason for starting or continuing a Government activity, but a Government agency may provide a product or service for its own use if a review conducted and documented as provided in paragraph 7 establishes that reliance upon a commercial source will disrupt or materially delay the successful accomplishment of its program.

b. *It is necessary for the Government to conduct a commercial or industrial activity for purposes of combat support or for individual and unit retraining of military personnel or to maintain or strengthen mobilization readiness.*

c. *A satisfactory commercial source is not available and cannot be developed in time to provide a product or service when it is needed.* Agencies' efforts to find satisfactory commercial sources should be supplemented as appropriate by obtaining assistance from the General Services and Small Business Administrations or the Business and Defense Services Administration. Urgency of a requirement is not an adequate reason for starting or continuing a Government commercial or industrial activity unless there is evidence that commercial sources are not able and the Government is able to provide a product or service when needed.

d. *The product or service is available from another Federal agency.* Excess property available from other Federal agencies should be used in preference to new procurement as provided by the Federal Property and Administrative Services Act of 1949, and related regulations.

Property which has not been reported excess also may be provided by other Federal agencies and unused plant and production capacity of other agencies may be utilized. In such instances, the agency supplying a product or service to another agency is responsible for compliance with this Circular. The fact that a product or service is being provided to another agency does not by itself justify a Government commercial or industrial activity.

e. *Procurement of the product or service from a commercial source will result in higher cost to the Government.* A Government commercial activity may be authorized if a comparative cost analysis prepared as provided in this Circular indicates that the Government can provide or is providing a product or service at a cost lower than if the product or service were obtained from commercial sources.

However, disadvantages of starting or continuing Government activities must be carefully weighed. Government ownership and

operation of facilities usually involve removal or withholding of property from tax rolls, reduction of revenues from income and other taxes, and diversion of management attention from the Government's primary program objectives. Losses also may occur due to such factors as obsolescence of plant and equipment and unanticipated reductions in the Government's requirements for a product or service. Government commercial activities should not be started or continued for reasons involving comparative costs unless savings are sufficient to justify the assumption of these and similar risks and uncertainties.

6. *Cost comparisons.* A decision to rely upon a Government activity for reasons involving relative costs must be supported by a comparative cost analysis which will disclose as accurately as possible the difference between the cost which the Government is incurring or will incur under each alternative.

Commercial sources should be relied upon without incurring the delay and expense of conducting cost comparison studies for products or services estimated to cost the Government less than \$50,000 per year. However, if there is reason to believe that inadequate competition or other factors are causing commercial prices to be unreasonable, a cost comparison study will be directed by the agency head or by his designee even if it is estimated that the Government will spend less than \$50,000 per year for the product or service. A Government activity should not be authorized on the basis of such a comparison study, however, unless reasonable efforts to obtain satisfactory prices from existing commercial sources or to develop other commercial sources are unsuccessful.

Cost comparison studies also should be made before deciding to rely upon a commercial source when terms of contracts will cause the Government to finance directly or indirectly more than \$50,000 for cost of facilities and equipment to be constructed to Government specifications. Cost comparison studies should also be made in other cases if there is reason to believe that savings can be realized by the Government providing for its own needs. Such studies will not be made, however, if in-house provision of the product or service, or commercial procurement thereof, is clearly justified in accordance with other provisions of this Circular.

The determination as to whether to purchase or to lease equipment or to construct buildings or acquire their use under lease-construction arrangements involves a determination of the difference in costs under the alternatives, and the principles set forth in this Circular should be applied to the extent relevant in making such determinations.

a. *Costs of obtaining products or services from commercial sources* should include amounts paid directly to suppliers, transportation charges, and expenses of preparing bid invitations, evaluating bids, and negotiating, awarding, and managing contracts. Costs of materials furnished by the Government to contractors, appropriate charges for Government-owned equipment and facilities used by contractors and costs due to incentive or premium provisions in contracts also should be included. If discontinuance of a Government commercial or industrial activity will cause a facility being retained by the Government for mobilization or other reasons to be placed in a standby status, the costs of preparing and maintaining the facility as standby also should be included. Similarly, if such a discontinuance is expected to result

in premature retirement of Government employees which will cause a significant increase in retirement costs to the Government, such increased cost should be added to the cost of procurement from commercial sources. Costs of obtaining products or services from commercial sources should be documented and organized for comparison with costs of obtaining the product or service from a Government activity.

b. For purposes of economy and simplicity in making cost comparison studies, generally agreed costs that would tend to be the same under either alternative need not be measured and included (for example, bid and award costs and operating costs under lease-purchase alternatives).

c. *Costs of obtaining products or services from Government activities* should include all costs which would be incurred if a product or service were provided by the Government and which would not be incurred if the product or service were obtained from a commercial source. The objectives should be to compute, as realistically as possible, the incremental or additional cost that would be incurred by the Government under the alternatives under consideration. In making such determinations it is important that recognition be given to the full amount of additional or incremental direct and indirect cost to be incurred in providing the products or services required. Under this general principle, the following costs should be included, considering the circumstances of each case:

(1) *Personal services and benefits.* Include costs of all elements of compensation and allowance for both military and civilian personnel, including the full cost to the Government of retirement systems, calculated on a normal cost basis, Social Security taxes where applicable, employees' insurance, health, and medical plans, (including services available from Government military or civilian medical facilities), living allowances, uniforms, leave, termination and separation allowances, travel and moving expenses, and claims paid through the Bureau of Employees' Compensation.

(2) *Materials, supplies, and utilities services.* Include costs of supplies and materials used in providing a product or service and costs of transportation, storage, handling, custody, and protection of property, and costs of electric power, gas, water, and communications services.

(3) *Maintenance and repair.* Include costs of maintaining and repairing structures and equipment which are used in providing a product or service.

(4) *Damage or loss of property.* Include costs of uninsured losses due to fire or other hazard, costs of insurance premiums and costs of settling loss and damage claims.

(5) *Federal taxes.* Include income and other Federal tax revenues (except Social Security taxes) received from corporation or other business entities (but not from individual stockholders) if a product or service is obtained through commercial channels. Estimates of corporate income for these purposes should be based upon the earnings experience of the industry, if available, but if such data are not available. *The Quarterly Financial Report of Manufacturing Corporation*, published by the Federal Trade Commission and the Securities and Exchange Commission may be consulted. Assistance of the appropriate Government regulatory agencies may be obtained in estimating taxes for regulated industries.

(6) *Depreciation.* Compute depreciation as a cost for any new or additional facilities or equipment which will be required if a Government activity is started or continued. Depreciation will not be allocated for facilities and equipment acquired by the Government before the cost comparison study is started. However, if reliance upon a commercial source will cause Government-owned equipment or facilities to become available for other Federal use or for disposal as surplus, the cost comparison analysis should include as a cost of the Government activity, an appropriate amount based upon the estimated current market value of such equipment or facilities. The Internal Revenue Service publication, *Depreciation Guidelines and Rules* may be used in computing depreciation. However, rates contained in this publication are maximums to be used only for reference purposes and only when more specific depreciation data are not available. Accelerated depreciation rates permitted in some instances by the Internal Revenue Service will not be used. In computing the depreciation cost of new or additional facilities or equipment to be acquired if a Government activity is started or continued and in determining comparative costs under lease-purchase alternatives, appropriate recognition should be given to estimated residual or salvage values of the facilities or equipment.

(7) *Interest.* Compute interest for any new or additional capital to be invested based upon the average rate of yield for long-term Treasury bonds as shown in the current monthly Treasury Bulletin. The method of computation should provide for reduction in the capital investment to which interest is applied over the useful life of the asset on a straight-line basis.

(8) *Indirect costs.* Include any additional indirect costs incurred resulting from a Government activity for such activities as management and supervision, budgeting, accounting, personnel, legal and other applicable services.

7. *Administering the policy.*

a. *Inventory.* Each agency will compile and maintain an inventory of its commercial or industrial activities having an annual output of products or services costing \$50,000 or more or a capital investment of \$25,000 or more. In addition to such general descriptive information as may be appropriate, the inventory should include for each activity the amount of the Government's capital investment, the amount paid annually for the products or services involved, and the basis upon which the activity is being continued under the provisions of this Circular. The general descriptive information needed for identifying each activity should have been included in the inventory by June 30, 1966. Other information needed to complete the inventory should be added as reviews required in paragraphs 7.b. and c. are completed.

b. *"New starts."*

(1) A "new start" should not be initiated until possibilities of obtaining the product or service from commercial sources have been explored and not until it is approved by the agency head or by an assistant secretary or official of equivalent rank on the basis of factual justification for establishing the activity under the provisions of this Circular.

(2) If statutory authority and funds for construction are required before a "new start" can be initiated, the actions to be taken under

this Circular should be completed before the agency's budget request is submitted to the Bureau of the Budget. Instructions concerning data to be submitted in support of such budget requests will be included in annual revisions of Bureau of the Budget Circular No. A-11.

(3) A "new start" should not be proposed for reasons involving comparative costs unless savings are sufficient to outweigh uncertainties and risks of unanticipated losses involved in Government activities.

The amount of savings required as justification for a "new start" will vary depending on individual circumstances. Substantial savings should be required as justification if a large new or additional capital investment is involved or if there are possibilities of early obsolescence or uncertainties regarding maintenance and production costs, prices and future Government requirements. Justification may be based on smaller anticipated savings if little or no capital investment is involved, if chances for obsolescence are minimal, and if reliable information is available concerning production costs, commercial prices and Government requirements. While no precise standard is prescribed in view of these varying circumstances a "new start" ordinarily should not be approved unless costs of a Government activity will be at least 10 percent less than costs of obtaining the product or service from commercial sources. It is emphasized that 10 percent is not intended to be a fixed figure.

A decision to reject a proposed "new start" for comparative cost reasons should be reconsidered if actual bids or proposals indicate that commercial prices will be higher than were estimated in the cost comparison study.

(4) When a "new start" begins to operate it should be included in an agency's inventory of commercial and industrial activities.

c. Existing Government activities.

(1) A systematic review of existing commercial or industrial activities (including previously approved "new starts" which have been in operation for at least 18 months) should be maintained in each agency under the direction of the agency head or the person designated by him as provided in paragraph 8. The agency head or his designee may exempt designated activities if he decides that such reviews are not warranted in specific instances. Activities not so exempted should be reviewed at least once before June 30, 1968. More frequent reviews of selected activities should be scheduled as deemed advisable. Activities remaining in the inventory after June 30, 1968, should be scheduled for at least one additional followup review during each three-year period but this requirement may be waived by the agency head or his designee if he concludes that such further review is not warranted.

(2) Reviews should be organized in such a manner as to ascertain whether continued operation of Government commercial activities is in accordance with the provisions of this Circular. Reviews should include information concerning availability from commercial sources of products or services involved and feasibility of using commercial sources in lieu of existing Government activities.

(3) An activity should be continued for reasons of comparative costs only if a comparative cost analysis indicates that savings resulting from continuation of the activity are at least sufficient to outweigh the disadvantages of Government commercial and industrial activities.

No specific standard or guideline is prescribed for deciding whether savings are sufficient to justify continuation of an existing Government commercial activity and each activity should be evaluated on the basis of the applicable circumstances.

(4) A report of each review should be prepared. A decision to continue an activity should be approved by an assistant secretary or official of equivalent rank and the basis for the decision should appear in the inventory record for the activity. Activities not so approved should be discontinued. Reasonable adjustments in the timing of such actions may be made, however, in order to alleviate economic dislocations and personal hardships to affected career personnel.

8. *Implementation.* Each agency is responsible for making the provisions of this Circular effective by issuing appropriate implementing instructions and by providing adequate management support and procedures for review and followup to assure that the instructions are placed in effect. A copy of the implementing instructions issued by each agency will be furnished to the Bureau of the Budget.

If overall responsibility for these actions is delegated by the agency head, it should be assigned to a senior official reporting directly to the agency head.

If legislation is needed in order to carry out the purposes of this Circular, agencies should prepare necessary legislative proposals for review in accordance with Bureau of the Budget Circular No. A-19.

9. *Effective date.* This Circular is effective on October 2, 1967.

PHILLIP S. HUGHES, *Acting Director.*

SUMMARY OF CHANGES IN BUREAU OF THE BUDGET CIRCULAR NO. A-76 AS
REVISED AUGUST 1967

Paragraph 3—Definitions

3.a. The definition for a "new start" has been split as between (a) a newly established Government commercial or industrial activity and (b) a reactivation, expansion, modernization, or replacement of an activity. These separate definitions have been provided so that different dollar limitations on capital investment and annual cost of production may be applied. There is no change in the dollar limitations applicable to newly established Government commercial or industrial activities. But the dollar limitations have been doubled for the category of "new starts" that are a reactivation, expansion, modernization, or replacement of an activity. The change is necessary in order to avoid applying the "new start" procedures to routine adjustments for handling existing workload. For example, the replacement of a single machine tool at a shipyard may easily add capital cost of more than \$25,000, or the addition of only 10 employees at relatively low grades would add more than \$50,000 per year to production cost. This type of change occurs several times a year at a large facility and, under the terms of the earlier Circular A-76, each such change would have to be treated as a "new start" with a detailed cost study and a special approval.

3.b. The definition of a Government commercial or industrial activity has been clarified. The earlier Circular, by definition, excluded a

Government-owned-contractor-operated activity but the wording was not entirely clear. The change made clarifies the fact that a Government-owned-contractor-operated activity is not to be regarded as a Government commercial or industrial activity for purposes of the Circular.

Paragraph 4—Scope

4.c. The words "professional staff" that were contained in the earlier Circular have been eliminated. Paragraph *4.c.* is intended to exempt various kinds of staff advisory services which are so intimately related to the processes of top management and control of Government programs that the general provisions of A-76 favoring reliance upon commercial sources should not be applicable. The term "professional staff" was so broad that it could be interpreted to apply to a large variety of services which are commercially available and which are not necessarily related intimately to top management and control of Government programs. The change will clarify the meaning of this subparagraph.

Paragraph 6—Cost comparisons

A change is made in the third unnumbered paragraph to make clear that if there is reason to believe savings can be realized by the Government providing for its own needs, cost comparison studies should be made before deciding to rely upon a commercial source. However, the changed wording also makes it clear that cost studies will not be required if in-house provision of the product or service, or commercial procurement thereof, is clearly justified in accordance with other provisions of the Circular.

A new unnumbered paragraph has been added to provide guidelines for applying provisions of the Circular to purchase *vs* lease of equipment, and to construction of buildings *vs* acquisition under lease-construction arrangements. The paragraph requires a determination of the difference in costs under the alternatives, and application of the principles set forth in the Circular in making judgments in these areas.

6.a. A sentence has been added providing that if discontinuance of a Government commercial or industrial activity will result in premature retirement of Government employees, and will cause a significant increase in retirement costs to the Government, such increased costs should be added to the cost of procurement from commercial sources.

6.b. This is a new subparagraph. It provides that costs which would tend to be the same for both Government and industry need not be measured and included in comparative cost analyses (for example, bid and award costs and operating costs under lease-purchase alternatives). The change is made in the interest of economy and simplicity in making cost comparisons.

6.c. (Paragraph 6.b. in the earlier Circular). A sentence has been added to clarify the fact that the incremental method of costing is to be employed and to emphasize the importance of a realistic recognition of all such additional or incremental costs.

6.c.(1). (Paragraph 6.b.(1) in the earlier Circular). Some additional wording has been added to clarify, in connection with personal services and benefits, that the full cost to the Government of retirement systems should be included.

6.c.(6). (Paragraph 6.b.(6) in the earlier Circular). A sentence has been added to make clear that appropriate recognition should be given to estimated residual or salvage value of facilities or equipment in computing depreciation.

6.c.(7). (Paragraph 6.b.(7) in the earlier Circular). This paragraph has been rewritten to provide that the computation of interest for any new or additional capital to be invested will be based upon the average rate of yield for long-term Treasury bonds as shown in the current monthly Treasury Bulletin. Also, the method of computation suggested would provide for reduction in the capital investment to which interest is applied as the asset is depreciated. The purpose of the change is to clarify the rate and source of interest to be charged and to provide guidance as to the principal to which it is to be applied. The suggested rate is a readily available measure of the current cost of money to the Government and the provision for reducing the balance to which interest is applied is considered reasonable because the interest cost should not go on indefinitely.

6.c.(8). (Paragraph 6.b.(8) in the earlier Circular). A change in wording has been made to clarify that Government costs should include any additional indirect costs incurred for such activities as management and supervision, budgeting, accounting, personnel, legal and other applicable services.

Paragraph 7—Administering the policy

7.b.(3). In the past there has been some misunderstanding about the cost differential in favor of private enterprise due to uncertainties relating to Government production costs, equipment obsolescence, and other factors, including the amount of capital investment involved. A sentence has been added to clarify the fact that the ten per cent cost differential in favor of private enterprise, mentioned in this subparagraph, is not intended to be a fixed figure. The differential may be more or less than ten percent, depending upon the circumstances in each individual case.

Paragraph 8—Implementation

A sentence has been added requiring agencies to furnish the Bureau of the Budget with a copy of their implementing instructions.

APPENDIX F

AEC POLLUTION RESEARCH

CONGRESS OF THE UNITED STATES,
JOINT COMMITTEE ON ATOMIC ENERGY,
November 15, 1966.

MR. CHARLES L. SCHULTZE,
Director, Bureau of the Budget,
Washington, D.C.

DEAR MR. SCHULTZE: I am writing to discuss the overall pollution of our environment, which President Johnson has described as "one of the most pervasive problems of our society." I also wish to offer some suggestions concerning use of existing facilities to help resolve this critical problem affecting our Nation and the entire world.

Month by month the degree of concern over pollution, within the scientific community and the public at large, becomes more intense. Clearly, it is the responsibility of the Federal Government to furnish dynamic leadership in planning and conducting a long-term program to deal with this matter. In this connection, I have reviewed and been impressed by last November's report of the Environmental Pollution Panel of the President's Science Advisory Committee. On several occasions I have publicly called attention to some of the Panel's most significant conclusions.

One of these conclusions is that an urgent need exists to provide additional trained personnel, with adequate facilities, to launch the required broadscale attack on the manifold causes of environmental pollution. While I generally agree with this view, I am concerned that we may lose irretrievable lead-time in establishing new organizations and facilities, which will result in wasteful duplication and fail to achieve the desired results. We can and must make the optimum use of the qualified people and facilities currently available to us.

For more than two decades, the Federal Government has supported a vast program of research and development including the construction of expensive laboratories and other scientific establishments. These plants are furnished with the most advanced equipment. Thousands of scientists and engineers have been trained at Federal expense, and there exist in this country a number of highly skilled organizations which we have built up and supported in order to devote their energies to the attainment of various national research and development objectives. My efforts on the Joint Committee on Atomic Energy and the Government Operations Committee have convinced me of the critical need for making better use of these Federal research establishments in solving the dilemma of environmental pollution, particularly as it relates to urban design. This needs to be done in order to maximize

our scientific and technological progress and to achieve the best allocation of scarce resources.

As a specific example I call your attention to the federally-supported atomic energy research laboratories. Unquestionably, these facilities represent a national asset of incomparable value. The plants themselves are outstanding in their quality and diversity. They are staffed by outstanding people, expert in both the physical and life sciences. The systems type approach which they have applied to problems of the magnitude and complexity of development of nuclear energy for peaceful and military purposes especially qualifies these organizations for coping with the Herculean tasks which must be accomplished in order to safeguard our environment against pollution. Moreover, and very importantly, these organizations have had perhaps the most extensive experience in many of the programs which must be pursued now with great vigor, such as measurements of pollution, studies of its effects, and analysis of waste disposal methods.

I have discussed this matter with Atomic Energy Commission Chairman Glenn Seaborg, and have requested him to consider carefully the capabilities of our atomic energy facilities to contribute to the national effort to abate pollution. I am also bringing this to your personal attention because of your position of responsibility concerning the overall programs of Executive Agencies. I hope you will specifically review this subject with Dr. Seaborg to determine how best to utilize these outstanding laboratories. Your efforts to assure that available resources are used wherever possible are of the utmost importance in promoting an effective, timely and economical Federal approach to this problem. You can be assured of my support in these efforts.

I believe it is of vital importance that the matters I have discussed be given full and early consideration. Accordingly, I would appreciate an opportunity to talk with you about them as soon as our mutual schedules permit.

With kindest regards,

Sincerely,

CHET HOLIFIELD, *Chairman.*

EXECUTIVE OFFICE OF THE PRESIDENT,
BUREAU OF THE BUDGET,
Washington, D.C., January 6, 1967.

HON. CHET HOLIFIELD,
*Chairman, Joint Committee on Atomic Energy,
Congress of the United States,
Washington, D.C.*

DEAR CHET: I write in belated response to your letters of November 14 and 15 concerning the problems of pollution control research and development, with specific reference to the possible use of AEC facilities and to certain aspects of procurement practices among the agencies involved.

We have discussed this matter in a preliminary way with AEC, and we plan to make a more detailed exploration into the possibilities identified in your November 15 letter as soon as the current problems of budget preparation are out of the way.

I certainly share your concern that air and water pollution represents a very serious national problem and that we should give careful thought to the means and methods to be pursued in the years immediately ahead in our efforts to cope with this problem. I, too, hope, that we will be able to get together to talk about these matters. When the budget is out of the way I would like to arrange a time to meet with you.

CHARLES L. SCHULTZE, *Director*.

APPENDIX G

THE "KILLIAN COMMITTEE" REPORT, NATIONAL ACADEMY OF SCIENCES, 1964

In 1964 a Committee on Utilization of Scientific and Engineering Manpower of the National Academy of Sciences made its report, "Toward Better Utilization of Scientific and Engineering Talent: A Program for Action." Chaired by James R. Killian, Jr., of Massachusetts Institute of Technology, the committee undertook the study in response to a recommendation to President Kennedy by Jerome Wiesner, his special assistant for science and technology. Chapter III of this report had to do with utilization of manpower and the Federal Government. The 12 recommendations made and discussed in that chapter bear more or less directly upon the utilization of Government laboratories. The text of chapter III as follows:

REPORT OF THE COMMITTEE ON UTILIZATION OF SCIENTIFIC AND ENGINEERING MANPOWER

TOWARD BETTER UTILIZATION OF SCIENTIFIC AND ENGINEERING TALENT—A PROGRAM FOR ACTION

PREFACE

Suggestions that a study be undertaken to examine the utilization of scientists and engineers in the United States originated in the President's Science Advisory Committee and in the Federal Council for Science and Technology. As early as 1959, both bodies had expressed a need for such a review and had taken first steps toward initiating a study.

In 1961, in response to a recommendation to President Kennedy by Jerome Wiesner, his Special Assistant for Science and Technology, the President approved the undertaking of a study on utilization, together with a review of requirements for the development of scientists and engineers between now and 1970. This latter review, it was agreed, should be undertaken by the President's Science Advisory Committee.

The study of utilization, it was felt, could best be conducted through a non-governmental body and supported from private sources. The National Academy of Sciences was requested to appoint a committee to make such a study, and to secure the necessary funds. The Academy agreed and in 1962 appointed the Committee on Utilization of Scientific and Engineering Manpower; and, in response to a proposal from the Academy, the Ford Foundation made a grant to finance the Committee's work. This report reflects the views of the Committee, based on its two years of study.

The Committee expresses its gratitude for the subvention of the Ford Foundation and for the generous conditions governing its use.

The Committee has been supported by an able staff: Marvin Adelson, Executive Director, on leave from System Development Corporation; for various periods, Vincent P. Rock, on leave from the Institute for Defense Analyses; Arnold Nemore; Ernest Mosbaek; Allen O. Gamble; and John Dickson.

UTILIZATION AND THE FEDERAL GOVERNMENT

The federal government influences the deployment and utilization of scientific and engineering manpower in three principal ways. (1) At the policy level, it

initiates major programs requiring a heavy investment of scientific and engineering talent. (2) In implementing its programs it purchases a major share of the nation's research and development effort, and of its end products. (3) It directly employs many scientists and engineers. In addition, the federal government is the largest supplier of information about scientists and engineers, and about the activities, such as research and development, in which they engage.

As the initiator of major national programs, over the past 15 years the government has determined the deployment of hundreds of thousands of scientists and engineers. Its decision to invest heavily in the development of missiles and of other advanced weapons systems, and more recently its decision to carry through the manned lunar project by 1970, are together largely responsible for the high proportion of scientists and engineers now engaged more or less directly in national security and space efforts.

Through contracts and grants, the government has an indirect but powerful influence on the utilization of a large fraction of the nation's scientific and engineering manpower employed by industry and the universities. This influence is exerted by the government in its definitions of work to be funded, its selection of the institutions where the work will be done and the individuals who will do it, in the conditions it writes into contracts and grants under which work will be performed, and in the skill and intelligence with which the work is supervised by government scientists, engineers, and administrators.

Finally, the government directly employs more than 120 thousand scientists and engineers, of whom one third are engaged in research and development.

The following series of recommendations is intended to help the government improve its performance in each of these roles.

THE GOVERNMENT AS AN INITIATOR OF MAJOR PROGRAMS

1. Before the government reaches a decision to undertake a great technological program (e.g., the lunar landing or the supersonic transport projects), it should make a careful assessment of the impact of the decision on the deployment and utilization of scientists and engineers.

In view of the way in which certain government decisions have radically altered the pattern of deployment of scientists and engineers in recent years, it might be supposed that major decisions had been preceded by careful studies of their probable impact on the market for scientific and engineering manpower, and, more broadly, of their effect on the general direction of scientific and technological effort in the United States. Yet, so far as we can learn, no adequate studies of the impact of these decisions were in fact made before the decisions were taken. Indeed, meaningful studies probably could not have been made, partly because the information on which to base them was not available.

Common sense suggests that there should be a careful calculation of the requirements for scientific and engineering manpower that will flow from each major decision of the federal government. When these requirements are large, the government should make an estimate of what the resulting redeployment of the nation's manpower is likely to cost in money and in scientific and engineering manpower diverted from other objectives.

Such calculations and estimates are difficult to obtain. At the present time, many different units of the federal government are involved in the collection, analysis, and publication of information on scientific and technical personnel. Even though considerable progress has been made toward the coordination of these disparate activities, officials at the top levels of the government still lack the kind of coordinated information they need if they are to assess accurately the impact their decisions are likely to have on the deployment and utilization of scientific and engineering manpower.

2. Responsibility should be assigned to a unit within the Executive Office of the President for (a) stimulating and coordinating planning by federal departments and agencies with respect to scientific and engineering manpower; (b) promoting research, both inside and outside government, that is likely to facilitate such planning and the solution of manpower problems; and (c) taking the lead in developing an integrated program for the continuing collection and analysis of information, relevant for operating and policy purposes, on scientific and engineering manpower. While the Committee does not recommend a specific location for this unit in the Executive Office, it notes the feasibility of placing it in the Office of Science and Technology.

Executive Office leadership and coordination are clearly essential, both to assess the impact of major decisions and to promote continuing improvement in the utilization of scientists and engineers. The Committee does not propose that the collection of information about scientific and engineering manpower be accomplished by a single agency; centralization of this kind, in fact, is to be avoided. It does propose that the data now being collected from various sources be made more compatible. In some areas, additional data must be obtained. In support of this objective, extensive and continuing analysis is needed to ensure that information related to scientific and engineering manpower is both adequate and useful for making major decisions in all sectors, and especially in the federal government.

Another task of Executive leadership should be to strengthen research in the field of scientific and engineering manpower. A considerable increase in expenditures for development of organized information would yield a high return in better utilization of scientists and engineers. Particularly urgent is the need for research that will identify and help to resolve certain critical problems. For example, convertibility and occupational mobility of scientists and engineers critically affect their utilization; yet there is little useful information on this subject.

The machinery and the precise arrangements required for the development of an integrated federal policy on all manpower are not the proper concern of this Committee. Nevertheless, it sees an acute need for a continuing assessment of the total impact of government policies and activities on the development and utilization of manpower in the United States. The Committee is encouraged by the recent establishment by the President of a cabinet-level Committee on Manpower.

THE GOVERNMENT AS PURCHASER

3. Each department and agency charged with major scientific or engineering activities should assign to one of its top officials responsibility for improving the utilization of civilian scientists and engineers, both those the agency employs and those whose work it finances. The duties of that official should include: (a) participating in government-wide scientific and engineering manpower planning activities; (b) bringing to the attention of his colleagues the implications, in terms of scientific and engineering manpower, of proposed new programs; (c) assessing the impact on manpower of cancellation, curtailment, or alteration of major programs; (d) analyzing the influence of various management practices and policies on the effectiveness with which scientific and engineering manpower is utilized; (e) providing for the collection and analysis of the information he needs to meet his other responsibilities. Specifically, the Committee recommends that an official be assigned these responsibilities in the Department of Defense in order to improve the utilization of civilian scientists and engineers working on defense programs both within and without the department.

Decisions made within the departments and agencies of the government are of key importance in determining how effectively a very large proportion of the nation's scientific and engineering manpower outside the government is utilized. At the present time, the direct attention paid to the utilization of scientific and engineering manpower varies widely from agency to agency. The National Aeronautics and Space Administration, for example, as required by statute, has actively sought and organized information on the numbers and kinds of scientific and engineering personnel that are involved in its programs, including those employed by its contractors. The Department of Defense has very little information of this kind. It has, however, actively examined the impact of various management policies and practices on project effectiveness, although not directly on utilization of manpower. Responsibility for efficient use of scientific and engineering manpower tends to be widely diffused within most agencies, and is regarded by most program managers as incidental to other tasks. If this responsibility is to be fulfilled effectively, it must be made the principal concern of designated officials at the highest level of department and agency management.

4. The Department of Defense, the National Aeronautics and Space Administration, the Federal Aviation Agency, the Atomic Energy Commission, and other agencies with major technological programs should continue to place great emphasis on improving the management of major projects by assigning to these projects identifiably top-quality managers with both technical and administrative skills, and giving them authority, responsibility, and resources necessary for successful completion of projects.

We particularly commend measures already taken to give both military and civilian personnel special training in project management; to form project teams that cut across conventional organizational lines; to use formal management techniques for the better coordination of complex programs; and to increase the technical competence of government project-management teams by encouraging them to draw on the resources of industrial contractors, non-profit companies, and universities.

More than half of all scientists and engineers employed by private industry in research and development are working on projects financed and supervised by the federal government. The effectiveness of their efforts depends in very large degree upon the skill with which the government manages these projects. A single unwise decision in the fixing of design objectives may delay by a year the development of a space vehicle or a weapons system, and add a thousand man-years of scientific and engineering effort to its cost. Conversely, an alert and technically competent project-management team can effect enormous savings in time and effort by skillfully coordinating the activities of contractors working on different but related phases of a major space or weapons system.

It appears that the successful development of two particular weapons systems, for which the Committee had case studies prepared, can be traced in part to skillful management for both the government and industry by strong project offices.

Many large government research and development projects have in fact been handled most competently. But we believe that the quality of management could be substantially improved by wider use of techniques such as those recommended above and by recognition and reward of exceptional work. It would be improved further by the passage of legislation raising the salaries of scientists and engineers in the upper civil service grades, from whose ranks the members of project-management teams are in large part recruited. The military services, also, need to give more attention to the development and retention of this kind of engineer-manager in their officer corps.

5. Government agencies responsible for development programs should continue to place great emphasis on accurate estimates of their cost and feasibility, and on the use of multi-phase contracts.

The Committee is impressed by evidence of the government's growing skill in estimating the cost of projected programs, and in determining their technological feasibility before large amounts of money and manpower have been committed. The government is also to be commended for increased use of multi-phase contracting, a system under which several companies, chosen in competition, are awarded contracts calling for preliminary study and task definition. The company that performs best in this early and relatively inexpensive phase is then awarded a development contract. One of the several advantages of multi-phase contracting is that it tends to reduce the number of prospective contractors submitting major proposals for a development program, thus reducing the investment of scientific and engineering talent in the preparation of proposals.

6. In development programs, the use of fixed-price and incentive contracts instead of cost-plus-fixed-fee contracts is to be commended. Great care must be taken by government agencies to establish meaningful and realistic performance criteria.

In general, the Committee favors the increasing use of fixed-price and incentive contracts for development work. It is clear that the payment of higher fees to contractors whose performance is superior is likely to result in over-all improvement in the efficiency with which scarce technical talent is utilized in government-financed research and development programs. There is a danger, however, in overemphasizing objective performance criteria in contracts, in such a way that a company's profits become related to the achievement of goals irrelevant to the central objective for which its services are secured. For example, early operational capability and low cost are usually desirable characteristics for military systems. But if the need is for a highly dependable back-up to a system already in the field, care must be taken lest a premium paid for speed of contractor performance, or an undue penalty for a cost overrun, divert attention and effort from the primary goal of reliability.

7. The Committee commends federal contracting agencies in the fields of defense and space for their increasing ability to act at an early stage to cancel, curtail or materially alter major programs that do not appear to be worth their cost.

Because of the necessarily speculative nature of development, it may often prove impossible to reach a desired goal by continuing to move along a particular line, or to reach it soon enough at an acceptable cost. Significant reductions in waste

of money as well as manpower can be achieved if responsible government organizations are alert to the desirability of terminating or drastically modifying projects, or even entire programs, whenever there is convincing evidence of probable failure. Carefully considered action to terminate or redirect a program under such conditions is more often a sign of strength than a sign of weakness in the government's research and development management, and should be so interpreted by Congress and the public. Such action can be an important means of conserving scarce scientific and engineering manpower.

8. Federal departments and agencies should work with industry to develop plans and programs for minimizing the dislocation and consequent malutilization of scientists and engineers as a result of program cancellation or redirection.

Early cancellation or curtailment of major programs will not, by itself, improve utilization of scientific and engineering personnel unless the personnel inactivated by these decisions can go to work on other productive activities immediately. If they are thrown out of employment by the cancellation, or assigned to busy-work projects, their usefulness is actually reduced, of course, although money may be saved by reduced need for materials and facilities.

As noted at the beginning of this report, scientists and engineers can play a key role in creating new opportunities for the nation. If the burden of defense lightens, they should be involved in the conversion of defense industry to other national objectives or to civilian purposes. If their potential is to be utilized productively, cooperative action will be needed to facilitate the transition. Provisions are required to enable existing defense industrial contractors more readily to utilize their scientists and engineers in diversifying and transforming the enterprise. Incentives to facilitate the formation of new enterprises, based on the capabilities of creative groups wishing to apply technology with which they are familiar to the civilian economy, will also be of value.

It would be in the national interest if, during the periods of transition, attractive opportunities could be provided for individual scientists and engineers to replenish and augment their professional value through education and training, possibly at university centers as well as within the organizations in which they work.

The Committee recognizes that these objectives are difficult to achieve, and hastens to express its view that programs designed to minimize dislocation should not involve coercive methods that would curtail the freedom of individuals or encroach upon the proper prerogatives of responsible free enterprise.

9. Federal support of contractor-initiated technical effort by government industrial contractors should be maintained at a substantial level. Incentives should be developed for encouraging corporate managements to emphasize quality and continuity, and to orient work toward long-run objectives.

Companies engaged in research and development or production under government contract are usually permitted to devote some portion of their total effort to what has been called independent research and development, or, as it has more recently been designated, contractor-initiated technical effort. Its objectives are, as a rule, defined only in general terms, and it is treated as a recognized business cost. Independent research and development has provided scientists and engineers employed by industrial contractors the opportunity to develop advanced concepts that, in many cases, have been of great value to the government. In the current efforts to strengthen government contracting procedures, it would be unfortunate if government funding in this area were to be eliminated or even substantially reduced. While the Committee recognizes the need for limits on government funding for this purpose, it believes that the public interest would be better served by an increase than by a decrease in current allowances.

The government should seek to develop incentives to encourage the most effective use of the manpower supported by the funds it supplies. While detailed government controls over the specific activities of individual contractors are not desirable, a periodic review by responsible and competent technical people would be useful to determine whether the results of independent research and development effort are commensurate with its cost.

THE GOVERNMENT AS EMPLOYER

10. Greater emphasis should be placed on assuring a high level of professional competence in the federal scientific establishment. In support of this objective, the administration proposals for higher salaries at the upper levels of government service should be promptly enacted by the Congress.