

THE KELLY COMMITTEE

The release of this favorable report on the National Bureau of Standards, shortly and fortuitously preceded by the official reinstatement of Dr. Astin as NBS Director, mercifully rings down the curtain on a show that should never have opened. It also provides a crisp analysis of the problems confronting a Federal agency that does not receive adequate funds for support of its authorized programs.

ON OCTOBER 15TH, six months after the Secretary of Commerce called for the formation of the ad hoc Committee for "the evaluation of the functions and operations of the National Bureau of Standards in relation to the national needs", the Committee¹ submitted a comprehensive 109-page report which should stand as a positive and convincing answer to the Bureau's critics. The report makes some important points clear at the outset: in the first place, the Bureau's staff is competent and its work is not only of high caliber but is essential to the nation, thus meriting the fullest support of the Federal Government; secondly, the Bureau, severely handicapped by obsolete and inadequate space and facilities, has not been able to keep pace with the expanding needs of the nation's technology and its basic programs of testing and research are in urgent need of being strengthened; thirdly, in spite of the high standing of the present personnel of the Bureau in the scientific world, the Committee is concerned that NBS is not attracting its proper share of the talented young scientists.

Most of the Committee's major recommendations for strengthening and improving the Bureau are concerned with one aspect or another of these considerations. They are listed in the report in the following manner:

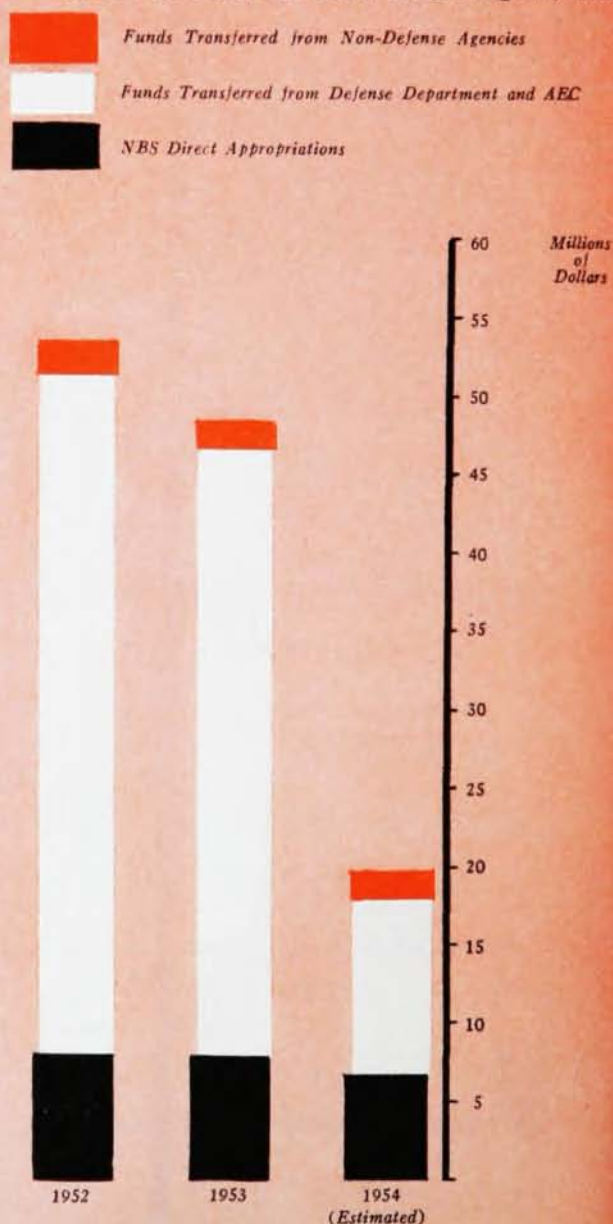
1. Higher level of activity in the basic programs.
2. Modernization of facilities and increased space for basic programs.
3. Improvement of organization at the Associate Director level.
4. Transfer of weaponry projects to the Department of Defense.
5. Continued use of the Bureau by Department of Defense and Atomic Energy Commission for nonweaponry science and technical aid.
6. Continued and increased use of the Bureau by other agencies of Government in indicated areas of science and technology.

¹ The organization and charter of the Committee is as follows: Dr. Mervin J. Kelly, chairman (Bell Telephone Laboratories), appointed by the president of the National Academy of Sciences; Mr. John C. Green, executive secretary (Department of Commerce), appointed by the Secretary of Commerce at the request of the Committee; Dr. Lee A. DuBridge (California Institute of Technology), nominated by the American Institute of Physics; Dr. William L. Everitt (University of Illinois), Institute of Radio Engineers; Dr. James W. Parker (Detroit Edison Company), American Society of Mechanical Engineers; Dr. Kenneth S. Pitzer (University of California), American Chemical Society; Dr. J. Barkley Rosser (Cornell University), Policy Committee for Mathematics; Dr. Guy Suits (General Electric Company), American Institute of Electrical Engineers; Dr. Clyde Williams (Battelle Memorial Institute), American Institute of Mining & Metallurgical Engineers; Dr. Abel Wolman (Johns Hopkins University), American Society of Civil Engineers.

NBS Divisions

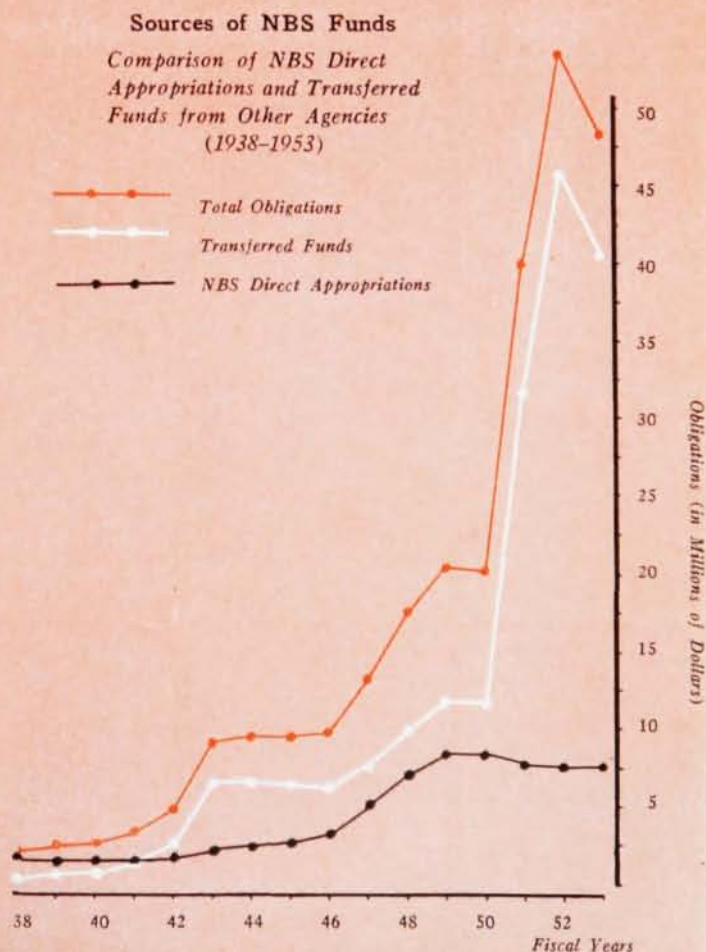
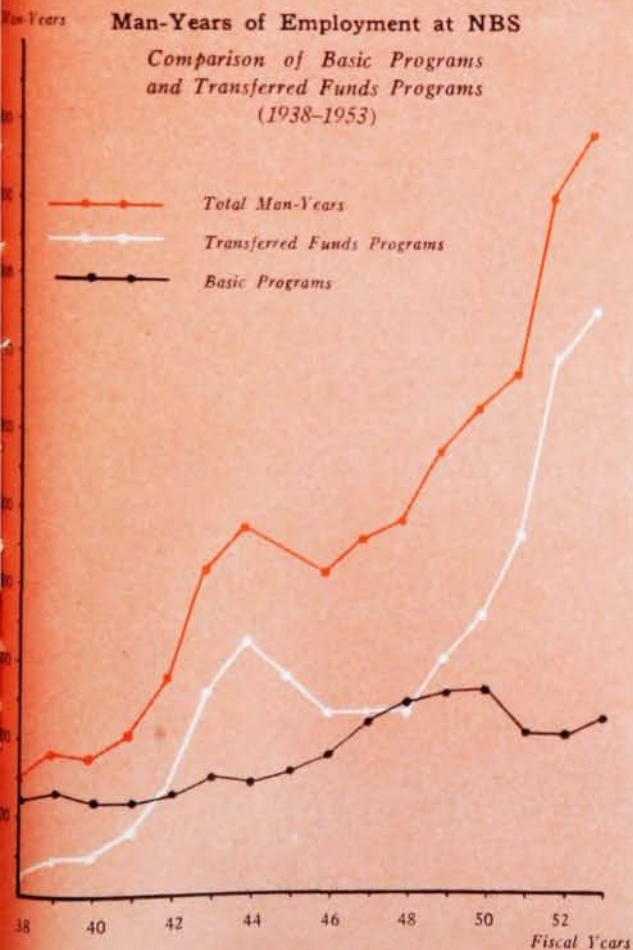
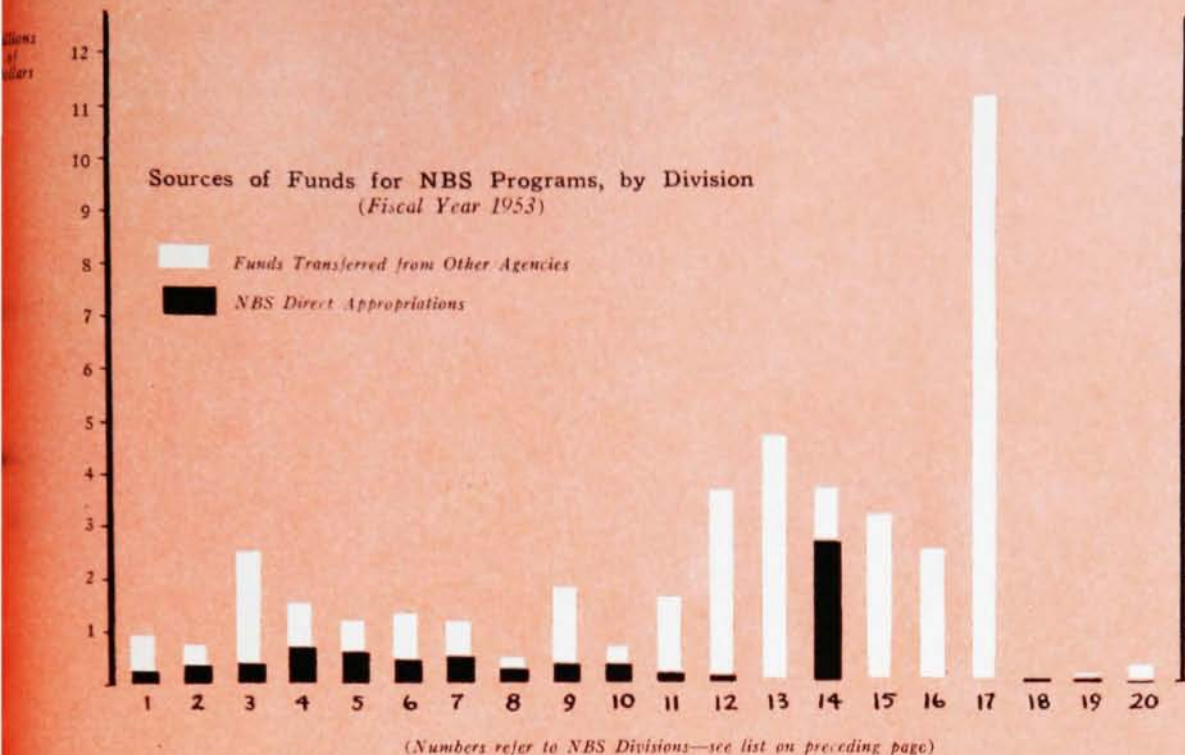
1. Electricity
2. Optics and Metrology
3. Heat and Power
4. Atomic and Radiation Physics
5. Chemistry
6. Mechanics
7. Organic and Fibrous Materials
8. Metallurgy
9. Mineral Products
10. Building Technology
11. Applied Mathematics
12. Electronics
13. Ordnance Development
14. Central Radio Propagation Laboratory
15. Corona Laboratories
16. Electromechanical Ordnance
17. Ordnance Electronics
18. Office of Weights and Measures
19. Office of Basic Instrumentation
20. Other Technical Units

Sources of Funds for Total NBS Program, 1952-54



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7. Decrease in repetitive test operations at the Bureau.
8. Division of primary responsibility for policy and procedure on commercial product tests between the Secretary of Commerce and the Director of the Bureau.
9. Increased support of standard samples program.
10. Advisory groups to the Director selected from membership in eight scientific and technical societies.

NBS and National Welfare

"The functions authorized for the Bureau of Standards," the Committee observes, "are of great importance to national welfare. As our society becomes increasingly industrialized, these functions assume even greater importance and the work of the Bureau in meeting the obligations of its assigned functions becomes more highly scientific, broader in scope and more complex in organization.

"In a society whose welfare is so dependent on applied science and technology as is our own, it is most important that the Government carry out those functions in support of science and technology that are uniquely in its province in the most effective manner possible and that a sufficiently high level of effort be maintained to insure an adequate coverage of the area of responsibility. It has placed broad and important functions in this area with the Bureau.

"The first four of the six functions of the Bureau² are wide in scope and of great importance to our nation's industrial health. The remaining two, while more restricted in scope, are properly placed with the Bureau; for with its organization of experts in science and technology and their special technical facilities, it is fitting that the Bureau provide advisory service on scientific and technical matters to other Government agencies and, where uniquely indicated, to develop special devices to serve their needs.

"It is the Committee's considered judgment that our highly industrialized society requires a Bureau of Standards that is the finest that can be created. To the extent that the Bureau is weak or inadequate, our technologic society is handicapping itself. By the very nature of its functions the Bureau's work must not be 'reasonably good', it must be superior. It is not sufficient to have fairly good standards of measurement; fairly good methods of testing materials, mechanisms, or structures; or reasonably good determination of important physical constants. The standards, the measurements, the test procedures must be the very best, the most accurate, the most reliable that can possibly be achieved at any given time, limited only by the state of the art at the time. It is thus more than a play on

words to say that the 'standards' by which the Bureau is judged must be the very highest and best.

"The scope of coverage of the first four broad functions must be adequate to meet the needs of our advancing technology. Physical constants, the properties of new materials, the development of methods for their testing and their early incorporation in codes and specifications are vitally important to our highly industrialized society. The Bureau's work on the 'new' should as a minimum keep step with the pace of applications of the 'new' by industry. For its full effectiveness it must not lag.

"It is with these views of the functions of the Bureau and of their importance to national welfare that the Committee has approached its assigned task of evaluation."

Place of NBS in Government

"The Committee has received suggestions from a variety of sources that the Committee consider the place of the Bureau of Standards within the organizations of Government. It has been suggested that the Bureau might better perform its authorized functions if transferred elsewhere in the Government from the Department of Commerce and specific suggestions have been given as to places more appropriate to its functions. The Committee has given thoughtful consideration to these suggestions. We are convinced that in the present framework of Government organizations there is no place better suited to the Bureau of Standards than in the Department of Commerce."

Organization of the Bureau

The Committee, in its report, notes that the Bureau is in general well-organized along functional lines, but adds that the organizational pattern at the associate and assistant director level can be improved to increase the effectiveness of technical administration. Changes are recommended which, the Committee holds, will mean that the Director "can then give less time to supervision, which will give him the freedom that he much needs for policy and administrative activities outside the Bureau but within Government and for participation in the scientific and technical activities of the nation for which, under the present organization pattern, there is not sufficient time".

Observing that "the line of separation between activities classified as 'technical' and 'administrative' is well selected" as a means of relieving technical leaders to the maximum extent possible of repetitive routines that are of an administrative nature, the report adds that such a line of division has also "undesirably weakened the effectiveness of the Associate Directors". The Associate Directors for research and for testing "share with the Director the responsibility for the leadership of the technical divisions. They do not have direct 'line' responsibility for specific technical divisions but rather act as programmatic aides to the Director in the areas that correspond to their titles. This plan of organizations ties the Director too closely to division su-

² The functions and activities of the National Bureau of Standards are undertaken in conformance with legislative provisions. The Organic Act (31 Stat. 1449), establishing the Bureau on March 3, 1901, was extensively amended in 1950 (64 Stat. 371, 5 U.S.C. 271-286) and now authorizes six broad functions: (1) the custody, maintenance, and development of national standards of measurement and related measurement problems; (2) the determination of physical constants and properties of materials; (3) the testing and the development of methods for testing materials, mechanisms, and structures; (4) cooperative activities relating to standard practices incorporated in codes and specifications; (5) advisory services to Government agencies on scientific and technical problems; and (6) the development of devices to serve special needs of the Government.

pervision and places an unnecessary limit on the full use of the Associate Directors. The Assistant Director for administration, in addition to his direct line responsibility for the eight administrative divisions, also acts as administrative aide to the Director for the technical divisions. With some clarification and restriction of these responsibilities, especially with respect to the technical divisions, there appears no reason to change the duties of this office."

The Committee recommends that the Associate Directors for research and for testing be given "line responsibility to the maximum extent possible" and urges that an additional Associate Director for research be provided because the "technical scope of the responsibilities of the Assistant Director for research is too broad to be encompassed in the professional background of any one man". Another addition, according to the report, should be a man at the associate-assistant director level to relieve the Director of much of his present load of detailed responsibility in connection with the Bureau's scientific and technical publications, educational programs, and relations with other governments on scientific, technical, and standards matters.

In connection with suggestions to the Committee that consideration be given to a change in the pattern of top leadership of the Bureau, the report says: "The change proposed involves the separation of the scientific and technical administration from the general administration and the relations of the Bureau with the Department of Commerce and the Congress. Under this suggestion the policy and administrative man would head the Bureau and the scientific and technical director would be subordinate to him. The Committee considers this an unworkable proposal. In the academic and industrial areas of the nation the leaders of scientific and technical organizations are substantially all scientists or engineers of high professional competence. They are aided in their nonprofessional management responsibilities by an adequately competent business administrator who is under their supervision. This common pattern has evolved from long years of experience and there are compelling reasons for it. We are confident that it is also the best pattern for the Bureau of Standards."

Personnel

"The Bureau of Standards has high standing among the scientific and engineering people of our country and its superior qualities are recognized in other countries. This results from the high quality of the professional staff, their dedication to the Bureau, and the integrity of their scientific and engineering work.

"While this favorable situation now prevails, it is deteriorating and, unless corrective steps are taken, the Bureau will not be adequately staffed with men of high professional competence and standing in the years to come. Much of the strength described above comes from the professional staff recruited before World War II. The enlarged opportunities for scientists and engineers in our country since that time, the relation of

supply to demand, the siphoning of junior personnel from the basic programs to the military programs, and the contraction in basic programs since 1950 have all made contribution to the inadequacies in the junior professional staff. These are the men that will make up the core of the professional staff of tomorrow. Time marches on and the staff recruited before 1940 will through the years disappear from the Bureau.

"The separation of the weaponry programs from the Bureau will help this situation. However, unless the decrease in support of the basic programs of the Bureau that began with the Korean incident and is continuing through Fiscal 1954 is reversed and to an adequate extent, the Committee views the future professional personnel outlook of the Bureau with grave concern."

Basic Programs

"These programs are concerned primarily with scientific standards of measurement, methods and instruments of measurement, the properties of matter, the determination of physical constants, and the performance of calibration and testing services. To maintain an organization of experts of adequate competence and an environment for this work, the Bureau must carry out carefully selected programs of basic research in the physical sciences and engineering. The major fields in which the Bureau must maintain such basic programs are physics, mathematics, electronics, chemistry, metallurgy, and engineering (this includes electronic, electrical, mechanical, hydraulic, and structural engineering). The basic programs are supported by funds for the Bureau appropriated by the Congress."

The appropriated funds for the basic programs for Fiscal Years 1938-1954 are given in the table below.

"It will be observed that the basic programs, as measured by appropriated funds, increased almost without exception in each year from 1938 through 1950. Be-

The Bureau's Basic Programs

Funds and Personnel, Fiscal Years 1938-1954
(Obligations given in thousands of dollars)

<i>Fiscal Year</i>	<i>Man-Years</i>	<i>Obligations</i>
1938	620	\$1,886
1939	681	1,904
1940	623	2,010
1941	624	2,055
1942	677	2,207
1943	783	2,597
1944	738	2,809
1945	812	3,112
1946	907	3,571
1947	1,120	5,504
1948	1,247	7,406
1949	1,315	8,743
1950	1,330	8,658
1951	1,047	8,112
1952	1,032	7,779
1953	1,136*	7,812

* On roll 3/31/53.

(In Fiscal 1954, the basic appropriation is \$6 000 000. This will permit an estimated employment of 933 man-years.)

cause of the decreasing value of the dollar in the later years, the man-years of work actually decreased. In 1938, 620 man-years were devoted to the basic programs and this had increased to 1330 man-years in 1950. An increase of an even larger amount was justified by the expanding scope of scientific and technical activities essential to the performance of the Bureau's authorized functions. The unprecedented expansion in science and technology, both in scope and depth, during these years made essential the expansion of the basic program effort of the Bureau. The amount of expansion was indeed modest as measured by the needs of the situation.

"Beginning in Fiscal 1951, with the expansion of national defense effort occasioned by the Korean situation and general world tensions, there has been a sharp contraction in the effort of the Bureau on its basic programs. In Fiscal 1952, the man-years of effort had decreased to 1032 from the peak of 1330 in 1950, a shrinkage of some 25 percent. The funds appropriated for Fiscal 1954 will bring about a further decrease in effort, perhaps as much as 20 percent, on the basic programs. This continuing decrease in effort on the basic programs of the Bureau is by far the most serious element affecting its functions and operations in relation to the nation's needs.

"The decrease in effort on the basic programs since 1950 has taken place at a time when the requirements for additional effort have been clearly evident. The Bureau has effected its reduction by restricting the work in areas already established and in failing to initiate work in new areas."

Commenting further on this situation, the report observes that "The extent of coverage in the basic programs is, in general, not adequate to meet present national needs. This is due to lack of personnel, space, and modern technical facilities. During the postwar years, 1945-1950, encouraging progress was made in building the basic program work to a level commensurate with national needs. However, the Committee does not believe that the work level of 1950 had reached the minimum justified by the needs of the nation in science, technology, and industry for the services rendered by the Bureau. The shrinkage in support of basic programs that began in 1950, occasioned by the nation's emphasis on building military strength, made it necessary to decrease the work level by almost twenty percent as measured by man-years of effort by 1953 and the funds provided for Fiscal 1954 will make necessary a further reduction of at least ten percent. The Committee recommends a reversal of this trend and a building back to the work level of 1950 at the earliest possible time. This could be accomplished with efficiency in a two-year interval, if funds were available.

"The Director of the Bureau, his supervisory staff, and the advisory committees to be referred to later should make a realistic and critical study of the minimum additional support, beyond the 1950 level, needed by the Bureau to bring its strength into balance with the nation's needs. The Committee is convinced that a

level well beyond that of 1950 is required but believes the level should be arrived at by a more extended study than that of this Committee.

"The Committee recommends that the basic program effort be increased to the level of 1950 in two successive increments in Fiscal Years 1955 and 1956; also that the Bureau and the proposed advisory committees be prepared, in time for consideration in the 1957 Budget requests, to recommend the amount of further expansion in basic programs that is required to meet the nation's needs."

Transferred Funds Programs

The Bureau is authorized by law to aid other departments of Government in the areas of testing and of standard practices as well as in providing advisory services on scientific and technical matters and in the development of special devices. Such work is carried out by means of funds transferred from the outside agency involved and is not supported by direct appropriations for the Bureau. In 1953, for example, approximately five-sixths of the Bureau's total program was supported by other agencies—mainly the Department of Defense and the Atomic Energy Commission. The dollar volume of the transferred funds work has increased more than twenty-fold in the fifteen-year period 1938-1953, with somewhat more than half of the increase occurring in the years since the Korean incident.

"The aid to agencies other than the Department of Defense and the Atomic Energy Commission," the report observes, "is small in its amount in comparison to the basic programs of the Bureau. Within the Government, the Bureau is uniquely equipped to provide these services and should continue its present practice. The amount is modest and could well be materially increased with value to the Bureau in its effectiveness in its area of primary responsibility." In recent years, the report continues, the dollar volume of this work has been only eleven percent of the dollar volume of the appropriated funds for the Bureau's basic programs.

The work of the Bureau for the AEC (with a dollar volume of \$2.9 million in 1953) is not of a weapons development nature and is closely related to some of the Bureau's basic programs. "The presence of this work in the Bureau contributes to its strength," the Committee declares, adding that it hopes that the Atomic Energy Commission will continue its use of the Bureau according to its present pattern. "A large portion of the work is in two specially constructed buildings at Boulder, Colorado. This work was surveyed by competent members of the Committee with consultants. The work is well-organized, staffed with competent people, and appears to be in very good order. The work at Boulder has been discussed with those immediately concerned in the Atomic Energy Commission and we believe that their appraisal of the work and the desirability of its continuance in the Bureau are the same as that of the Committee."

With special reference to the transferred funds programs carried out for the Department of Defense, how-

ever, the Committee argues that they have impaired NBS effectiveness for its primary functions, making it difficult for the Bureau to build strength for the future. Principal factors contributing to the deleterious effects, according to the Committee, are "The large size of the programs in comparison to that of the basic program area, the highly classified nature of a large sector of the work, the crowding of the laboratories for the basic programs necessitated by the rapid expansion, and the loss of professional and subprofessional employees by transfer from the basic programs to the military work.

"The large size, coupled with the secret nature, of some of the programs has necessitated a large administrative organization within the Bureau whose character has been dictated primarily by the requirements of the military work.

"The large amount of highly classified work has brought about secrecy, limited freedom of movement, and other restrictions and has created an environment that is not best suited to the basic programs.

"The need for rapid expansion of the military work, especially since Korea, has increased the Bureau's personnel at a more rapid rate than space could be provided. To meet this situation, excessive crowding in some of the laboratories of the basic programs has been necessary. This has decreased effectiveness and has adversely affected morale.

"The rapid expansion of the military programs has made opportunity for advancement in the Civil Service grades at a more rapid rate in the military area than in the basic programs area. As the Committee understands it, in conformity with standard Civil Service personnel practices, competent junior personnel, both professional and subprofessional, of the basic programs area have opportunities to take positions of higher Civil Service grade in the military area. This has siphoned away from the basic programs specialists of experience. With the general employment situation, it has not been possible to replace them with equivalent people even when funds were available. This has lowered the efficiency of operations on the basic programs.

"The Committee has viewed this situation with alarm and has critically examined the military programs to find those that could be transferred to the Department of Defense without sacrifice to the progress of the programs and with long-term advantage to the Bureau. The Committee decided that two large areas of ordnance work, development of proximity fuse and guided missiles, mainly segregated in four divisions of the Bureau, could be transferred to the Department of Defense without harm to the programs.³ Their dollar volume in Fiscal 1953 is of the order of \$20 million.

"As strong as are the Committee's views of the need, in the interest of the Bureau's basic functions, for the transfer out of the Bureau of these large weapons development projects, it would not recommend their transfer had it brought about any sacrifice in quality or speed of progress of the military programs. The Committee is convinced that no sacrifice is involved. The Department of Defense operates many large laboratories active in developments that are of the same general nature and of at least as high priority. They are, therefore, experienced in the management of such operations. The Committee was informally assured that all personnel on the work would be taken over by the Defense Department and that the work would continue in its present locations. Changes in personnel or location, if later required, would be done in a manner that would not introduce delay or affect quality.

"Concern has been expressed that the transfer represented a shift of function from Government laboratories to those of industry. No such shift is indicated or expected. In the programs recommended for transfer the Bureau has subcontracted portions of the work to industry in a pattern similar to that followed by the Department of Defense. While the dollar volume of this work is indeed large in comparison to the basic programs of the Bureau, it is small (less than three percent) in comparison to the whole military development program. It is not to be expected that in this small sector of military development the Defense Department would initiate a pattern of division of work between laboratories of Government and industry different from that which has evolved from their experience in operating the entire military development program.

"The statutory Visiting Committee to the Bureau of the Secretary of Commerce recommended to him in 1952 the transfer of the weapons development projects that is now taking place.

"While in England two members of the Committee reviewed the policy on military development work of the British National Physical Laboratory. Their problem is identical with that of our Bureau of Standards. The National Physical Laboratory was heavily committed to military work during the war. Since the close of the war it has limited its participation in military developments to research and evaluation that is suited to its staff and facilities and that adds strength to its basic programs. Its volume is less than that of its basic programs.

"After discussing the effects of transferring the programs with the Director of the Bureau and with the Department of Defense, finding them in concurrence with its views, the Committee recommended the trans-

³ In reporting back to the American Institute of Physics, L. A. DuBridge, the AIP representative on the Kelly Committee, makes the following observations: "You will note that our report advocates the transfer of the weapon development work formerly sponsored by the Ordnance Corps of the U. S. Army, out from under the cognizance of the National Bureau of Standards. I realize that this recommendation is likely to cause some misunderstanding among scientists. Actually, as you know, the recommendation, after being agreed on by the Committee, was conveyed by its Chairman to the Secretary of Commerce and action was taken on this matter several weeks before our final report was ready.

We felt it most desirable to get advance action on this matter even though there was danger of misunderstanding of the reasons behind the action since our complete report was not then available. I trust that the report will now explain our reasons for believing that the National Bureau of Standards would be strengthened as far as its basic programs of testing and research are concerned if it is not burdened with the responsibility for the development of secret military weapons. The large transfers of funds from the Defense Department to the Bureau of Standards served only to hide from the view of the public and the Congress the fact that the Bureau's basic programs were suffering from lack of funds."

fer to the Secretary of Commerce early in July 1953. He accepted the recommendation and initiated procedures with the Department of Defense to implement the transfer.

"These ordnance programs, as well as all other secret projects for the Department of Defense, have been carefully examined by members of the Committee competent in military developments and by expert consultants of their choice. The programs were found to be in very good order. They are staffed with competent scientists and engineers and the relationships with the Department of Defense are excellent. This recommendation for transfer, therefore, is not motivated by the quality and effectiveness of the work but entirely for the reasons given above.

"There may well be other weaponry developments that the Departments of Commerce and Defense will decide to transfer. The remaining ones are not large in total volume and it may be well to complete them in the Bureau. The Committee believes that the transfer of the two large areas recommended will, to a large extent, take care of our concerns about the presence in the Bureau of weaponry developments. However, the Committee believes that specific weapons development projects, in general, should only be carried out in the Bureau in a period of war when the scientific and technical strength of the nation are largely committed to war work.

"There is a relatively large volume of transferred funds work for the Department of Defense that is not directly concerned with weapons that is distributed among the 13 nonordnance technical divisions of the laboratory. In general, the presence of this work in these divisions contributes to the strength of the Bureau for its basic programs and their separation would adversely affect it in its basic functions. It is our judgment that the placement of this work with the Bureau is to the interest of the Department of Defense and the Committee hopes that the Department of Defense will continue its present use of the Bureau in the other than weapons development areas."

Space and Facilities

While the transfer of weaponry programs to the Department of Defense will not immediately aid in the correction of the crowded condition of the laboratories for the Bureau's basic programs, the Committee recommends that in the plans for the Department of Defense operation of ordnance work provision be made for returning to the Bureau some of the space now occupied by weapons developments so that it can be used in the basic programs area.

"The laboratory facilities for basic programs work are inadequate. There have not been funds sufficient for replacement of obsolete facilities and the procurement of new facilities to meet the needs of present-day laboratory work in science and technology. The contrast in the qualities and amount of facilities for military development, which are of high quality, modern and generous in amount, with that of facilities in many areas

of the basic programs is most striking. This situation can only be corrected by the provision of increased funds for implementing the Bureau's basic work. There is urgent need for increased funds in the years immediately ahead. The Committee recommends that the Director of the Bureau, in cooperation with the advisory committees that will be later proposed, make a critical review of the Bureau's laboratory facilities requirements and that funds be requested promptly on completion of the study to bring the Bureau's technical facilities up to levels of quality and quantity that insure effective and efficient laboratory work."

Evaluation of Commercial Products

"The Bureau makes evaluation tests on the commercial products of industry from time to time at the request of other agencies of the Government and has done so, we believe, throughout its history. This is a service that the Bureau must render. It has a competence for product evaluation over a very large area of industrial products. Such competence does not exist to a comparable extent anywhere else within Government. This competence must be made available to other departments.

"While the volume of this work is extremely small in relation to the Bureau's total basic programs, it is the area that most frequently brings the Bureau to the attention of the general public. The current 'Battery Additive' evaluation is typical of others that have sporadically occurred throughout the Bureau's history where its findings have been challenged and wide public attention directed to them.

"The Committee recommends that policy and procedures of a nontechnical nature, particularly with other agencies of Government, for handling commercial product tests be reviewed by the Secretary of Commerce and appropriate members of his staff with the Director of the Bureau of Standards. The Committee recommends that the policy and establishment of the nontechnical procedures on commercial product tests be the responsibility of the Secretary of Commerce. The policy on the technical content of the problem should reside with the Director of the Bureau. We believe that the area of commercial product tests involves policies and actions of a nontechnical nature on which the Director of the Bureau should not be required to make the decisions."

Advisory Committees

"The conversion of new scientific knowledge into industrial products is proceeding at an ever-increasing tempo. In the formation of the programs of the basic area of the Bureau, balanced attention should be given to the new areas of science and technology where standards activities will be required. To aid the Director in forming the new programs and in the consideration of balance on programs in being, the Committee believes that a more intimate tie with the science and technology of the country is desirable. It therefore recommends that the Director of the Bureau, with cooperation from

the eight scientific and technical professional organizations that supplied the members of this Committee, form small advisory groups for the different scientific and technical areas of the Bureau. We believe it desirable for the members of these groups to be appointed by the societies as advisors to the Director. This Committee will discuss with the Director its views concerning the formation of these groups. Should he decide to form them, the Committee will recommend to the societies that they cooperate with the Director in the selection of suitable candidates from their memberships."

Other Comments

In addition to the program areas discussed earlier, the Committee has given special attention to the Bureau's work in testing and specifications, standard samples, radio propagation, and applied mathematics.

The testing area (which includes quality control, calibration, etc.) is described as being "one of the most important end products in the Bureau's basic programs". The Committee registers its concern that a larger amount of repetitive testing is now done at NBS than is necessary with the present state of development of technology in industry. It is recommended that the repetitive test operations be critically examined to determine whether some of the work might be eliminated by substituting Government supervised acceptance tests in the plants of suppliers or by using commercial laboratories.

"Standard samples" of industrial products, such as alloys, rubber compounds, and more recently radioactive elements, are used mainly for calibration of analytical chemistry procedures by industry. The Committee finds this "a proper function for the Bureau and one that within its resources it has performed well". Increased funds are urgently needed for maintenance of the present supply and for the development of new standard samples, according to the Committee, which notes that "There is a charge for the standard samples that is small compared to their worth and this money goes into the Treasury and is not available for Bureau use".

The Committee is "impressed by the effectiveness" of the Bureau's radio propagation work and takes it as "an indication of the values that may well be expected from other areas in which Bureau activities are indicated as required, if the Bureau is to meet the obligations of its authorized functions, when the Bureau is provided with funds necessary to the performance of the work".

With reference to the Bureau's work in applied mathematics, the Committee notes that, while it is limited in scope, it has been most effective in its areas of activity and should be specially commended.

The Committee's full report describes and evaluates the technical operations of the Bureau in considerably more detail than is suggested in the present summary. Each of the Bureau's major divisions (with the exception of the four ordnance divisions transferred to the Defense Department) is reviewed in terms of its rela-

tive contributions to the Bureau's programs. In a remarkably large number of cases the Committee has found the work of individual divisions to be impaired because of inadequate direct appropriations or because the division has been forced to rely on transferred funds for its support.

In the case of the Atomic and Radiation Physics Division, for example, the Committee reports:

"The general impression of the work of this Division is that it is of high caliber and is being carried on by a competent staff. Most of the major areas in this field of physics seem to be covered, though in many fields of work at far too low a level for the needs of the country. This Division, like others at the Bureau, suffers from administrative, fiscal, and other uncertainties which are mentioned in the section of the report devoted to those matters. It is the Committee's belief that the personnel, morale, and quality of effort of all divisions, including this one, can be measurably improved as such uncertainties are corrected.

"This Division of the Bureau should have more success than most in attracting young physicists, for this is an exciting and new field of physics. However, the Bureau has the gravest of difficulties in attracting competent young physicists, not because the program is not good or important but because of these same fiscal and administrative uncertainties and the lack of confidence that a program once initiated in the Bureau can be continued to fruition at a reasonably stable level. To give one example, money was appropriated by Congress five years ago for the Bureau to build a betatron to carry on high-energy electron and x-ray studies. However, after the betatron was completed, no funds were ever appropriated for its operation, though funds were requested year after year in the budget estimates. Thus the Bureau had to choose between letting a valuable piece of equipment go completely unused or of 'robbing' other activities for funds to carry on modest operations. The latter course was followed so the Bureau's already inadequate funds were spread even more thinly.

"There is an equally sad story arising out of activities in the field of atomic and nuclear physics. The Atomic Energy Commission urged the Bureau to undertake this work under a direct appropriation. An agreement was entered into between the two agencies whereby the AEC would omit the programs from their budget request and Standards would initiate. However, Congress refused to make the corresponding transfer of funds with the result that the assumption of those efforts has caused reduction on other operations of the Division.

"At present 'transferred funds', primarily furnished by the military, are keeping alive the Betatron and High Voltage Laboratories. If these funds should be sharply reduced, it would not be possible to maintain both efforts. The accuracy of this comment becomes apparent when one considers the direct research and testing allocation of the High Voltage Laboratory. In Fiscal 1953 it was \$15 000, which amount is intended to cover both personnel and overhead."