
**NATIONAL ROSTER
OF
SCIENTIFIC AND SPECIALIZED PERSONNEL**

**JUNE 1942
NATIONAL RESOURCES PLANNING BOARD**

NATIONAL ROSTER
OF
SCIENTIFIC AND SPECIALIZED PERSONNEL

JUNE 1942

REPORT OF THE
NATIONAL ROSTER OF SCIENTIFIC AND SPECIALIZED PERSONNEL
TO THE
NATIONAL RESOURCES PLANNING BOARD

UNITED STATES GOVERNMENT PRINTING OFFICE - - - - - WASHINGTON, D. C.
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NATIONAL ROSTER OF SCIENTIFIC AND SPECIALIZED PERSONNEL

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FOREWORD

The organization of the National Roster of Scientific and Specialized Personnel was a significant step in the development of wartime personnel policy in the U. S. A. Of all our scarce resources special training is the most important. Specialists can overcome almost any other known scarcity. They are the persons who maximize resources—raw materials, machines, and facilities, the energies of workers, the organization of power and transportation facilities, the tools of mathematics, the physical and social sciences, and the arts of management and administration.

The recognition of the need for a central clearinghouse not only for the names of specialists but also for the development of policies concerning the use of specialists took place in the summer of 1940. The National Resources Planning Board assumed an organizing responsibility and has retained an advisory role as the work of the Roster has grown and developed. However, the real success of the Roster has come from the recognition given to it by the many agencies of the Federal Government which use its lists and the wisdom of its operating personnel.

The service rendered by the Roster is hard to measure. But it is known that by November 28, 1942, 1,590 requests for specialized personnel had been received from Government agencies, war industry, and agriculture, and 136,593 names had been certified in response to these requests. There is no way of knowing how much valuable work has continued uninterrupted as a result of the way in which the Roster has functioned.

The work of the Committee on Wartime Requirements for Specialized Personnel of which Mr. Owen D. Young was Chairman during the winter of 1941-1942 further emphasized the problems which had to be faced if specialized personnel was to be adequately used under the heavy demands of wartime.

The inclusion of the Roster in the administration of the War Manpower Commission recognized the need for integrating the policies of the Roster with the general manpower policies of the Government. It was further recognized that the policies affecting this group should receive special consideration, as do other special groups, such as hard rock miners and certain agricultural employees.

The description of the Roster's work given here was prepared by Dr. Leonard Carmichael, James C. O'Brien, and the staff of the Roster, as a record of the organization and work of the Roster from its inception through June 1942. It is intended primarily for those who are concerned with the administration of this type of technical problem and those who are interested in the use of the wealth of information contained in the Roster's files for planning the use of specialized personnel.

The collaboration and continuing interest of the cooperating councils and many professional and scientific associations and societies has made the Roster a great cooperative enterprise. For this reason among others it has been an effective Government agency.

THOMAS C. BLAISDELL, Jr.,
Assistant Director.

I. ORGANIZATION

The Basic Need for the National Roster

Trained personnel is a national resource indispensable to the prosecution of the war. In a period such as the present, which witnesses an emergency expansion of America's armed forces, America's industry, and America's governmental structure, it is obvious that the national interest will be advanced by the use of every appropriate measure to make proper contact between the right man and the right job. The National Roster of Scientific and Specialized Personnel has been developed to meet this need at high professional levels.

The fundamental plan of the Roster has been to secure as nearly complete a registration as possible of all highly or specially trained Americans and to organize this master list in such a way that any special combination of skills or abilities required for particular emergency needs can be selected quickly and accurately. The Roster provides a service to assist in the proper procurement, evaluation, and assignment of personnel especially in scientific and other professional fields in which acute manpower shortages have been found to exist. The means by which these various ends have been accomplished are described in this report.

Throughout the work of the Roster three basic ideas have been emphasized: first, an effort to increase the efficiency of placement in specialized fields; second, the proper evaluation of needs and supplies of manpower in the fields served by the Roster; and third, the conservation and most effective use of the skills of America's specially trained citizens.

Experience in various European countries in the last war and in the first months of the present world conflict, shows that it is all too easy to allow immediate demands for one form of service to outweigh the less obvious but sometimes more fundamental demands of other types of work of national importance. Similarly, experience has shown that the sudden personnel demands of new research and industrial enterprise may readily dislocate in an unfortunate and sometimes unnecessary way, important current research and educational enterprise. Key men from established activities may be called into new positions because no other men for the new jobs can be located. Qualified men may be available but unknown to the agency charged with the new enterprise. The work of the Roster has now clearly demonstrated that a wide knowledge of the trained manpower of the Nation makes it possible in literally tens of thousands of cases to plan for the effective staffing of new war enterprises,

It can be said without any possible question that in its first year the National Roster has amply demonstrated its effectiveness as an instrument of recruitment and placement in war agencies and as a conservation device as well.

Each week in literally hundreds of cases, men who might have been selected for particular new positions have been allowed to continue in other war activities because individuals equally or sometimes better qualified, but previously unknown to the appointing agency, have been found by consulting the analytical lists of the Roster.

Historical Antecedents

Lists of individuals and groups of specially trained men have from very early periods been considered as fundamental in relation to special military and other governmental functions. In antiquity and in the Renaissance, scientists were sought out to assist in ballistic problems. Benjamin Franklin, David Rittenhouse, and other scientists were called upon by the colonies in the Revolutionary period to assist in many ways in the emergency fabrication of ordnance and other war materials. The American, Benjamin Thompson, Count Rumford, was instrumental in promoting the organization of scientific societies in America and in London and later reorganized the Bavarian Army. The National Academy of Sciences was brought into being during the Civil War by an act of Congress, approved by President Lincoln, as a means by which the Federal Government could avail itself of the special services of trained scientists. In the first World War, the National Academy continued to assist the Government in many ways. In 1916, the National Research Council was organized and in 1918 the Council was called upon for wide services of a scientific and advisory character by an Executive Order of President Wilson, signed in May 1918. In the present emergency, these older agencies have continued to serve the Government in many ways. In addition, new scientific agencies have been created for particular defense and war purposes. Under the Office of Emergency Management the Office for Scientific Research and Development has been created. Through this office the National Defense Research Committee and similar organizations in other scientific areas have been established. In all this work the importance of the proper recruitment of scientific personnel has been a central problem.

In the early days of the country, the problem of a correct knowledge and evaluation of scientific personnel in the United States was not a difficult one to solve. Even two generations ago personal acquaintance could embrace almost all the scientists of the country. But with the growth of specialized scientific and other studies and with the parallel increase in demand on the part of the Government for such services, the problem of properly listing the human resources of the Nation's highly trained specialists became increasingly important. In spite of certain abortive efforts during the first World War, no centrally organized Federal plan for the listing and proper allocation of the Nation's entire scientific and highly trained manpower had ever been undertaken before the present Roster was organized.

The great development during the last 20 years of the sciences and other professions in the United States made it obvious to a number of agencies that in the emergency period of 1940, the old laissez faire policy of dealing with the problems of the allocation of scientific personnel would have to be modified. It was clear that a procedure which would involve a national plan for the appropriate listing and utilization of experts was necessary and that such a plan would have to be adapted to the tempo of modern emergency needs. The development of similar plans in England also focused attention on the immediate desirability of devising such a plan for the United States. Memoranda concerning the importance of this step were presented to the Government from a number of scientific groups.

Establishment of the Roster

The National Resources Planning Board at the suggestion of its Science Committee set up the Roster of Scientific and Specialized Personnel, with the cooperation of the United States Civil Service Commission. The National Research Council, the Social Science Research Council, the American Council of Learned Societies, and the American Council on Education cooperated from the first. Many American scientists individually contributed important suggestions concerning the desirable form which the Roster should assume.

Plans for the initiation of the Roster were first formulated at meetings held under the auspices of the National Resources Planning Board on June 28 and 29, 1940. The final creation of the Roster resulted from the approval by President Franklin D. Roosevelt of the general plan early in July 1940. The basic plan of administration agreed upon was one in which the National Roster should be jointly operated by the National Resources Planning Board and the United States Civil Service Commission. The Roster operated under these agencies from the date of its in-

ception until April 18, 1942, on which date the President, by Executive order, created the War Manpower Commission under the Office for Emergency Management of the Executive Office of the President. This order transferred to the War Manpower Commission the National Roster of Scientific and Specialized Personnel of the United States Civil Service Commission and its functions.

Organizational Meetings

On June 28 and 29, 1940, the first meetings looking to the official organization of the National Roster were held. These meetings took place in the offices of the National Resources Planning Board and were attended by the following individuals:

- Mr. Frederick A. Delano, Chairman of the National Resources Planning Board.
- Mr. Charles W. Eliot, Director, National Resources Planning Board.
- Mr. Arthur S. Flemming, United States Civil Service Commissioner.
- Mr. Thomas C. Blaisdell, Jr., National Resources Planning Board.
- Mr. Albert Barrows and Mr. Ross G. Harrison, representing the National Research Council.
- Mr. Carl C. Brigham, Mr. R. T. Crane, Mr. Joseph P. Harris, and Mr. Charles F. Ascher, representing the Social Science Research Council.
- Mr. Leonard Carmichael, proposed Director of the National Roster, and Mr. James C. O'Brien, proposed Executive Officer of the Roster.
- Mr. W. H. Cowley, representing the American Council on Education.
- Mr. Henry G. Doyle and Mr. D. H. Daugherty, representing the American Council of Learned Societies.

At this meeting the possible objectives of the National Roster were discussed in broad terms.

The individuals attending the meetings of June 28 and 29, 1940, were constituted as a consulting committee. Mr. Carmichael and Mr. O'Brien were officially designated as director and executive officer, respectively, of the projected enterprise. Mr. Carmichael was named chairman of the Consulting Committee.

On Friday, July 19, 1940, the Consulting Committee reconvened in the offices of the National Resources Planning Board. This meeting was attended by the following individuals:

- Mr. Leonard Carmichael, Chairman.
- Mr. Ross G. Harrison, National Research Council.
- Mr. John S. Nicholas, National Research Council.
- Mr. Albert L. Barrows, National Research Council.
- Mr. W. H. Cowley, American Council on Education.
- Mr. Mortimer Graves, Administrative Secretary of the American Council of Learned Societies.
- Mr. H. G. Doyle, American Council of Learned Societies.
- Mr. D. H. Daugherty, American Council of Learned Societies.

Mr. Lewis Hanky, American Council of Learned Societies.
Mr. Carl Brigham, Social Science Research Council.
Mr. Joseph P. Harris, Social Science Research Council.
Mr. Donald Young, Social Science Research Council.
Mr. James C. O'Brien, Executive Officer.

At this meeting, the Director and Executive Officer reported the results of their studies during the preceding twenty days and proposed a course of action to take in developing the Roster as outlined in detail in the following pages. This basic plan was accepted and approved by the whole Consulting Committee, and this plan is substantially the one under which the Roster has continued its operations.

On Friday, November 15, 1940, the Consulting Committee of the Roster again convened in the office of the National Resources Planning Board. Present at that meeting were:

Mr. Leonard Carmichael, Director.
Mr. James C. O'Brien, Executive Office.
Mr. Waldo G. Leland, American Council of Learned Societies.
Mr. D. H. Daugherty, American Council of Learned Societies.
Mr. W. H. Cowley, American Council on Education.
Mr. John S. Nicholas, National Research Council.
Mr. Erle M. Billings, Consultant on Chemical Personnel.
Mr. Carl C. Brigham, Social Science Research Council.
Mr. Thomas C. Blaisdell, Jr., National Resources Planning Board.

Representatives of the administration of the National Roster reported to the Consulting Committee the progress which had been made since previous meetings. The Consulting Committee approved the policies and procedures which had been established by the Roster's administrators. At this meeting the Roster's operations were discussed in detail and a full report was made to the Consulting Committee as to future operating policies. These were approved and the framework of the organization was established.

During the week of June 24, 1941, there were held in the offices of the National Research Council a series of meetings of the Consulting and Evaluating Committees of the National Roster. In addition to representatives of the National Roster, the following individuals, representing the fields covered by the physical sciences, were among those present:

Mr. Thomas C. Blaisdell, Jr., National Resources Planning Board.
Mr. Ross G. Harrison, National Research Council.
Mr. John S. Nicholas, Sterling Professor of Biology, Yale University.
Mr. John J. Furia, American Management Council.
Mr. H. R. Aldrich, Geological Society of America.
Mr. Henry A. Barton, American Institute of Physics.
Mr. Erle M. Billings, American Chemical Society.
Mr. Walter H. Bucher, National Research Council.
Mr. G. W. Cottrell, The Mediaeval Academy of America.

Mr. C. E. Davies, American Society of Mechanical Engineers.
Mr. John A. Fleming, Carnegie Institute of Washington.
Mr. Lester Gardner, Institute of Aeronautical Sciences.
Mr. K. S. Gibson, Optical Society of America.
Mr. H. H. Henline, American Institute of Electrical Engineers.
Mr. Maurice Holland, Division of Engineering and Industrial Research, National Research Council.
Mr. C. M. Jansky, Jr., American Institute of Radio Engineering.
Mr. W. D. Johnston, Jr., United States Geological Survey.
Mr. E. J. Kennedy, Jr., American Institute of Mining and Metallurgical Engineers.
Mr. G. L. Loughlin, United States Geological Survey.
Mr. Joseph C. Moris, Office of Scientific Personnel, National Research Council.
Major Claude B. Ferenbaugh, War Department.
Captain Thomas Moran, Navy Department.
Mr. George T. Seabury, American Society of Civil Engineers.
Mr. Harlow Shapley, Harvard College Observatory.
Mr. L. C. Snider, American Association of Petroleum Geologists.
Mr. George Stetson, American Society of Mechanical Engineers.
Mr. Charles L. Parsons, American Chemical Society.
Mr. Thomas H. Urdahl, American Society of Heating and Ventilating Engineers.
Mr. John A. C. Warner, Society of Automotive Engineers.

The last half of the week was devoted to meeting of representatives of the fields covered by the social sciences. Excluding Roster officials, among those present were:

Mr. A. L. Funkhouser, American Statistical Association.
Mr. James Washington Bell, American Economic Association.
Mr. Halbert L. Dunn, American Statistical Association.
Mr. Steuart H. Britt, National Research Council.
Mr. D. H. Daugherty, American Council of Learned Societies.
Mr. John K. Wright, American Geographical Society.
Mr. Charles E. Merriam, National Resources Planning Board.
Mr. Carl E. Guthe, American Anthropological Association.
The Reverend Father John M. Cooper, American Anthropological Association.
Mr. G. W. Cottrell, The Mediaeval Academy of America.
Mr. Marston Morse, American Mathematical Society.
Mr. John S. Nicholas, Sterling Professor of Biology, Yale University.

During these meetings reports were made by the Roster as to its progress in the various fields discussed, and advice sought and received from representatives of the various scientific fields concerning methods of improving the Roster's prosecution of its survey of the Nation's human resources in the sciences.

These represent only the formal committee meetings of the many consultant committees to the National Roster. As a result of these original meetings Dr. John S. Nicholas of Yale University was appointed by the National Research Council to represent it on the

National Roster in all of the physical and natural sciences. Dr. Carl C. Brigham of Princeton University was named representative of the Social Sciences Research Council in its relations with the Roster and as chief consultant of that Council, in development of all the social sciences. Dr. Waldo G. Leland was named representative of the American Council of Learned Societies in developing the humanities and disciplines. Dr. William H. Cowley, president of Hamilton College, was named representative of the American Council on Education in its relationship with the National Roster. Mr. Erle M. Billings of the Eastman Kodak Co. was named chief consultant in the chemical and chemical engineering areas.

Throughout its whole operating existence, the Roster has been assisted at every step by the Nation's most

National Resources Planning Board

eminent specialists and scientists in designing the methods which have contributed so largely to its present effectiveness. Only through this assistance could the Roster have filled the emergency need for which it was designed.

The contribution of these men has been important in many ways. By their work in the early stages the Roster developed "check lists" and was able to secure address lists of men to whom the Roster questionnaire should be mailed. Volunteer groups also offered consultative advice on many subjects, especially in evaluating the scientific skills of men needed for posts requiring unusual qualifications.

The mechanics of putting into productive operation the general plan of the Roster is described in the following sections.

II. OPERATION

Objective

From the first, it was recognized that the fundamental objective toward which all facilities of the organization were to be directed was the organized recording of names, qualifications, and competencies of the country's citizens in the various highly specialized scientific and professional fields, so that such men and women could be evaluated in regard to their skills as such skills were needed by the Nation, and the most effective use made of these skills in connection with the national defense program.

Method of Assembling Information

Questionnaire

It was necessary to obtain certain basic information common to every individual on the Roster. It was also necessary to devise some technique for ascertaining in detail the highly special technical skills and competencies of these individuals in the particular field in which they were engaged. It was decided that a questionnaire method should be utilized. In order to render this method as objective as possible, all of the information which would pertain to scientists and other specialized workers, irrespective of field, was segregated in one general questionnaire form made up of 30 items.

In developing the general questionnaire the Roster received advice from individuals experienced in the preparation of such documents, including, in particular, specialists associated with such agencies as the Bureau of the Budget. Before the questionnaire was adopted in final form its effectiveness was tested by a sampling process in which the proposed blank was filled out by persons already engaged in scientific work related and unrelated to the defense program.

The ultimate significance of each question included was carefully weighed in order that the final questionnaire could be as brief as possible and still elicit the data considered necessary for the Roster. The questions were also designed to be answered in as nearly objective form as possible, although of course, certain items such as the individual's publications necessarily involved the appending of lists of varying lengths. In general, the questionnaire was designed to develop necessary information in such a way that it would yield readily to the numerical coding systems employed in recording the data. The general questionnaire is shown on pages 7-12.

Technical Check Lists in Special Fields

To supplement this general questionnaire, a series of fifty-two technical check lists were prepared.¹ These check lists differ from field to field. In each case, however, these lists consist principally of an analytical and functional break-down of the science or profession concerned. This objective analysis of the field was designed to assist in minimizing the effort required of each registrant in indicating his particular competencies and also made objective coding or classification readily possible in the office of the National Roster.

One of the most important tasks of the Roster was represented in dividing the many scientific fields into their logical and important subdivisions. If the break-downs were too broad they would not meet anticipated specific needs. If the subdivisions were too fine it would be difficult to record conveniently scientific skills within a particular field.

The primary responsibility for the items used in the technical check lists rested with representatives of the sciences involved. In general, the officers of one or more of the national learned societies in each field were consulted concerning the best way in which a check list could be constructed for the profession in question. A sample check list was then sent to the designated committee with a suggestion that it prepare one in similar form.

These committees have the task of organizing a balanced but subdivided classification of each professional field. The number of persons in the field and the nature of specialization in the field were both taken into consideration. In organizing the check lists a main heading and subgroups were set up. Under each such heading a series of appropriate subheadings were entered. Items of detailed specialization were then listed as far as possible under appropriate subheadings.

The Roster staff members adapted the lists of specializations to the demands of numerical coding and the major processing methods of the Roster. In every case an effort was made to make the new code numbers assigned in the office coincide with and amplify any existing governmental occupational code symbols.

To almost all of the technical check lists there was appended a brief so-called functional code, the purpose of which was to introduce an indication of the occupational status of the individual using the check

¹ For an example of a technical check list see p. 13. Additional information on the technical check lists, coding procedures, and other Roster operations may be obtained by application to the Roster office.

list. Nearly all of the check lists include the following items in the functional code: *Research, production, teacher, administrator, and operations*. The item *other* included in this list was usually checked by students in college who as yet had no practical experience in the field, although it was designed also to cover unanticipated occupations.

One of the most troublesome features of check list organization was the handling of fields which may be called polydimensional in their lines of specialization. For example, specialization in the field of history is often treated as tridimensional; that is, it is possible to approach the subject geographically, chronologically, and in terms of the point of view used in studying the subject, such as the economic or military approach to history.

A written classification covering these approaches is not difficult to prepare, but to make such a classification adaptable to punch card procedures involves a somewhat intricate arrangement. In the case of history, for example, the dimension judged to be of less magnitude—that of point of view—was combined with that of greatest magnitude—geography—into one four-digit code number. A “classification by chronology” of two groups of five items was then set up and the appropriate numerical symbol for chronology was appended to the given four-digit code number. This combination resulted in a five-digit number representing three lines of specialization.

It was necessary to deal with certain fields in rather special ways. In the case of management engineering, for example, two lists were prepared and sent out together. One covered management engineering in its principal aspects. The other listed important industrial fields. Specialization in any branch of management engineering is often related to a specific industry. By using this procedure it was possible to have the numeric symbols for the two lines of specialization contiguous on the punch card. This was accomplished by restricting the code designations for management engineering to the first three positions and those for the appropriate industries to the last two positions. Thus, selection can be made for specialization in management engineering in relation to the particular industrial experience desired.

Anyone who has thought in general about the organization of the “tree of knowledge,” as this tree has grown in modern American academic and professional lives, recognizes that overlapping fields are the rule rather than the exception. In every case where it was possible the decisions of the specialists as to the conventional boundaries of a professional field were observed. In a number of cases closely related fields were combined into one check list. This was considered

more desirable than the construction of several separate check lists, each with a necessarily large number of duplicated items. Thus, agronomy, horticulture, and plant pathology are combined into one check list. On the other hand, duplication—or at least close coincidence of items of specialization—necessarily appears in many check lists. For example, subheadings concerning the structure and function of the ear appear in the special check lists for anatomy, physiology, physics, psychology, electrical engineering, and radio engineering.

A list of the professional fields for which technical check lists were prepared will be found on p. 19 of this section.

The information concerning each individual obtained from the general questionnaire and the technical check lists is ultimately punched according to a numerical code on a series of cards which are used in the later analytical sorting procedures of the Roster. Each individual is provided with a set of at least six, eight-column punch cards distributed as follows: Name card, address card, master index card, and three supplementary cards identified at “A,” “B,” and “C.” The name and address card are utilized in the automatic compilation of lists of individuals needed for particular purposes. The remaining four cards of the set are used for selection processes. They contain a surprisingly diversified amount of technical information necessary for any purpose. Detailed description of the recording and use of the punch-card system will be found on p. 20 of this section.

After the numerically coded information on the general questionnaire and its appended technical check list has been reduced to punch cards and verified, the general questionnaires are sent to filing rooms where they are filed in numerical order, using the alpha-numerical system throughout. The questionnaires are not then again removed from this file until the individual in question is being considered in connection with some war assignment.

The Alpha-numeric System

Each questionnaire returned to the Roster office is assigned an alpha-numeric number. The purpose of this number is to facilitate the alphabetic handling of punch cards by numbers as well as by letters. This alpha-numeric system has not been widely employed, and it seems appropriate, therefore, to describe fully how it is utilized by the Roster.

The alpha-numeric number serves the same purpose as a serial number used to identify the person to whom a document relates. It saves the space on the punch card which would otherwise be used for name and address. Since the a-n sequence of numbers is identical

Form 3573 (C. S. C.)
February 1941

NATIONAL ROSTER OF SCIENTIFIC AND SPECIALIZED PERSONNEL

Jointly Administered by NATIONAL RESOURCES PLANNING BOARD
and UNITED STATES CIVIL SERVICE COMMISSION

All information submitted on this form will be held confidential

Where more space is needed, attach additional sheets

(Print or type)

1. Name Miss
Mrs.
Mr.
Dr., etc. (Title) _____ (Last) _____ (First) _____ (Middle) _____
Mailing address _____ (Number) _____ (Street) _____ (City) _____ (State) _____
Legal or voting residence (if a voter, give voting residence; if not a voter, give legal residence) _____ (State only) _____ (County) _____

2. Date of birth: _____ (Month) _____ (Day) _____ (Year)

3. Place of birth: _____ (State or foreign country only)
(If foreign born, give the name of the country, as of the date of your birth)

4. Citizenship (check one):
1 Native-born citizen of the United States, including foreign-born of United States citizen parentage.
2 Naturalized citizen: Cert. No. _____ Date _____ Court _____
3 First papers obtained: Date _____ Number of Declaration of Intention _____ Court _____ Country of which you are a citizen _____
4 Final papers applied for but not yet obtained.
5 If first papers not yet obtained, specify foreign country of which you are a citizen _____
6 Other (describe on separate sheet).

5. Marital status, dependents: (Do not fill in)
1 Single. 5
2 Married. 6
3 Divorced. 7
4 Widowed or separated. 8
 Dependents (Number completely dependent on you, other than husband or wife.)

Marital status
(Check one)

6. Race and sex:
Male Female
1 White 6
2 Negro 7
3 Yellow 8
4 Other 9

Items 4 and 9 include Polynesians, Filipinos, Indians, Hawaiians, and Malaysians; Items 2 and 7, persons partly or wholly of Negro blood. Check race in left column if male; in right column if female.

7. Military service:
(a) Have you ever served in the regular armed forces of the United States? _____ (Yes or no)
Period of service: From _____ To _____
Service and branch _____
Highest rank held _____
Nature of duties _____

(b) Have you ever served in the armed forces of any other country? _____ (Yes or no)
Period of service: From _____ To _____
Name of country _____
Service and branch _____
Highest rank held _____
Nature of duties _____

8. Reserve membership:
Are you now or have you ever been a member of the National Guard, or a member of the Reserves of the Navy, Army, Marine Corps, Coast Guard, or Public Health Service? _____ (Yes or no)
Period of service: From _____ To _____
Service _____
Branch _____
Highest rank held _____

9. Foreign languages (check proficiency):

LANGUAGE	Read			Speak			Auditory Comprehension		
	Exc.	Good	Fair	Exc.	Good	Fair	Exc.	Good	Fair
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

LANGUAGE	Read			Speak			Auditory Comprehension		
	Exc.	Good	Fair	Exc.	Good	Fair	Exc.	Good	Fair
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. Federal service:

(a) Do you now hold a full-time position in the Federal service? (Yes or no)

If "Yes," indicate: Dept.
Bu.

(b) If answer in (a) is "No"—

1. Do you now hold a part-time or consulting position in the Federal service? (Yes or no)

If "Yes," indicate: Dept.
Bu.

2. Have you ever held any position in the Federal service? (Yes or no)

11. What Federal civil service examinations have you taken?

Title of Examination	Year Taken
.....
.....
.....
.....
.....

12. Foreign travel and residence:

Indicate specifically the dates, duration, purpose, location, and nature of any foreign experience you may have had.

Country and subdivision (use official name as of 1935):

Dates of travel or residence

Purpose and nature

Please attach an additional sheet if more space is required to indicate your foreign travel.

13. Physical condition:

Specify any physical defect, disease, or disability. If none, write "None." (Emphasize particularly defects which may in any way limit your working capacity.)

14. Height and weight:

Height (Feet) (Inches) Weight (Pounds)

15. Name at least one but not more than three individuals, mainly responsible for the intimate direction of your professional work or training, and who are competent to judge your ability. Give the official titles of these individuals and the institutions or establishments with which they are connected:

.....

.....

.....

16. (a) Give, in the blanks below, a statement of your college or university education:

Name and Location of School	When Attended (Month and Year)		Major Department of Study	Degree Conferred		Honors (Specify, if any)
	From—	To—		Title	Date	
Undergraduate college.....						
.....						
Graduate schools (if working for degree which has not yet been obtained, indicate amount of work completed).....						
.....						
Other						
.....						

(b) Honorary academic or scientific societies (i.e., Phi Beta Kappa, Sigma Xi, etc.).....

17. In addition to your main field or fields of professional specialization as indicated on the attached Technical Check List, specify any professional or semiprofessional occupations or other skills you have acquired through study, hobbies, construction of instruments, etc. (for example, photography, aviation, public speaking, cryptanalysis, etc.):

Occupation or Skill	Describe Work or Study
.....
.....
.....
.....
.....

18. List all significant full-time positions you have held, including your present position. (It is not necessary to list every position you have held.) If more space is needed attach additional sheets.

Employer:

Business address:

(Number and Street)		(City and State)	Salary (Optional) \$..... per
Dates		Type of establishment or institution:	
From—	To—		

Title of position:

Your duties and specialty:

.....

.....

.....

.....

.....

.....

.....

.....

Percent of time spent in:

Teaching Research Administration

Employer:

Business address:

(Number and Street)		(City and State)	Salary (Optional) \$..... per
Dates		Type of establishment or institution:	
From—	To—		

Title of position:

Your duties and specialty:

.....

.....

.....

.....

.....

.....

.....

.....

Percent of time spent in:

Teaching Research Administration

18.—(Continued). List all significant full time positions you have held, including your present position. (It is not necessary to list every position you have held.) If more space is needed attach additional sheets.

Employer:

Business address:

(Number and Street)		(City and State)	Salary (Optional) \$..... per
From—	To—	Type of establishment or institution:	

Title of position:

Your duties and specialty:

.....

.....

.....

.....

.....

.....

.....

.....

Percent of time spent in:

Teaching Research Administration

19. (a) Please indicate in the space below in the order of your competence (beginning with your major field of competence, then your secondary field, etc.) not more than five of the fields in which you have chiefly specialized. The fields are identified by the 5-digit number symbols which follow each field of specialization enumerated on the attached Technical Check List. Please identify each of your specialized fields by placing the appropriate number symbol in the spaces below. For each field so selected and indicated below, place a check in the appropriate box at the right of each line to indicate the amount of time spent by you in that special field.

Number Symbol of Special Field of Competence (See Attached List)	Less Than 1 Year	1 to 2 Years	2 to 3 Years	3 to 5 Years	5 Years or More
1.					
2.					
3.					
4.					
5.					

(b) The Technical Check List also includes a list of "functions" indicating work status. Please select from this list the one item which is most nearly descriptive of your present or most recent work status. Indicate in the following space the number symbol of the item selected.

20. What do you consider as your principal professional field? If in a special branch of field, as organic chemistry, please indicate such branch. If in a borderline field, would you be classified, for example, as a physicist or an electrical engineer, a physiologist or a physician, an economist or a statistician, a biochemist or a biologist, etc.?

Specify your field here.....

21. List and briefly describe any special scientific or professional apparatus or other mechanical devices which you are competent to use:

.....
.....
.....
.....
.....

22. List other part-time or temporary positions (with or without compensation) which have increased your professional competence; include editorships:

.....
.....
.....
.....
.....

23. List your principal contributions in the form of publications, inventions, patents, etc.:

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

24. Describe any research or other special work which you now have in progress:

.....
.....
.....
.....

25. Describe any restricting conditions which would make it difficult for you to make yourself available for part-time consulting or full-time service:

(a) In your present locality.....

(b) In any other locality.....

26. What disadvantage to important research or other activities now in progress would result in the event that you were called upon to serve the Government?

27. (c) With what committees or other organizations having charge of the direction or control of important research undertakings have you been identified?

(b) Give the full title and address of the laboratory or other research organization (if any) with which you are now identified. This information should be given in such a way that it can be used in compiling a list of the active research laboratories and organizations of the country:

28. List important professional societies, if any, in which you hold membership. If there is more than one class of membership be sure to indicate your proper classification:

29. In what fields and in what way do you consider that you could be of special service to the Government?

Field:-----

Remarks:-----

Field:-----

Remarks:-----

30. If the Government should ask for your release, of whom should the request be made?

----- (Name) ----- (Title) -----

----- (Address) -----

FORM 5879-51 (GSC)
REVISED JANUARY 1941

NATIONAL ROSTER OF SCIENTIFIC AND SPECIALIZED PERSONNEL

JOINTLY ADMINISTERED

by

NATIONAL RESOURCES PLANNING BOARD

and

UNITED STATES CIVIL SERVICE COMMISSION

TECHNICAL CHECK LIST

ELECTRICAL ENGINEERING

ALL INFORMATION SUBMITTED ON THIS FORM WILL BE HELD CONFIDENTIAL

NAME: _____
(Last) (First) (Middle)

MAILING ADDRESS: _____
(Number) (Street)

_____ (City) (State)

Please check below those fields (not more than five) in which you have specialized. Transcribe the symbols of the fields which you check to item 19(a) of the questionnaire in accordance with the instructions given there. This check list was prepared with the collaboration of R. W. Sorenson, President, and H. H. Henline, Secretary, of the American Institute of Electrical Engineers and other prominent electrical engineers.

Field of specialization	Field of specialization
<p><u>MATERIALS</u></p> <p><input type="checkbox"/> Conductors 51.0.00</p> <p><input type="checkbox"/> Insulating materials 51.0.10</p> <p><u>ELECTRICAL MEASUREMENTS</u></p> <p><input type="checkbox"/> Instruments 51.0.50</p> <p><input type="checkbox"/> Measurements 51.0.60</p> <p><u>ELECTRICAL APPARATUS</u></p> <p><input type="checkbox"/> Batteries 51.1.00</p> <p><input type="checkbox"/> Generating equipment and motors, n.e.c. (exciters, converters, generators, etc.) 51.1.10</p> <p><input type="checkbox"/> Transformers 51.1.20</p> <p><input type="checkbox"/> Lamps 51.1.30</p> <p><input type="checkbox"/> Control equipment and switchboards 51.1.40</p> <p><input type="checkbox"/> Magnets and solenoids 51.1.50</p> <p><input type="checkbox"/> Heaters 51.1.60</p> <p><input type="checkbox"/> Rectifiers 51.1.70</p> <p><input type="checkbox"/> Furnaces 51.1.80</p> <p><input type="checkbox"/> Relays 51.1.85</p> <p><input type="checkbox"/> Miscellaneous electrical apparatus, n.e.c. 51.1.90</p> <p>Specify _____</p>	<p><u>ELECTRICITY AND MAGNETISM</u></p> <p><input type="checkbox"/> Magnetism and magnetic measurements 51.2.00</p> <p><input type="checkbox"/> Electrostatics 51.2.10</p> <p><input type="checkbox"/> Direct current phenomena 51.2.20</p> <p><input type="checkbox"/> Alternating current phenomena 51.2.30</p> <p><input type="checkbox"/> Electrical contacts 51.2.32</p> <p><input type="checkbox"/> Dielectrics 51.2.40</p> <p><u>ELECTRONICS</u></p> <p><input type="checkbox"/> Conduction in gases 51.2.50</p> <p><input type="checkbox"/> Electron tubes and circuits 51.2.60</p> <p><input type="checkbox"/> Photoelectric and thermoelectric apparatus 51.2.70</p> <p><input type="checkbox"/> Electron optics 51.2.80</p> <p><input type="checkbox"/> X-rays 51.2.90</p> <p><u>ELECTRIC POWER GENERATION</u></p> <p><input type="checkbox"/> Central stations 51.3.00</p> <p><input type="checkbox"/> Isolated plants 51.3.10</p> <p><input type="checkbox"/> Small power units 51.3.20</p> <p><u>POWER DISTRIBUTION AND TRANSMISSION</u></p> <p><input type="checkbox"/> Overhead transmission and distribution systems 51.3.31</p> <p><input type="checkbox"/> Underground transmission and distribution systems . 51.3.32</p> <p><input type="checkbox"/> Substation 51.3.35</p>

N.E.C. DENOTES: NOT ELSEWHERE CLASSIFIED

with an alphabetic arrangement of names, the use of this system also permits the mechanical sorting of punch cards on an alphabetic basis.

The basis for the operation of the system is a "log book" made up of 10 million numbers distributed among 10,000 ranges of 1,000 numbers each. Thus the first range is from 0001000 to 0001999; the last from 9999000 to 9999999. Each range of 1,000 numbers is also the range for an alphabetic series of names. Thus the first series noted above includes all names from Aaa up to but exclusive of Aab... On the other hand, the range 8000000 to 8000999 embraces names from Smith, Ia.. up to but exclusive of Smith, J. It will be seen from these examples that the assignment of name ranges is on the basis of the approximately equal frequency of occurrence of names in any large sample of population.

The name ranges used in the log books of the National Roster are derived from a break-down into 10,000 approximately equal segments of an alphabetized list of names derived from census sources. There is adequate provision for expansion since 10 million numbers are available for the "logging" of a probable million names.

The exact number to which a specific name is assigned within any given range of names is arbitrarily determined by the log clerk. For example, an Ian Smith might be assigned a number anywhere in the first 5 percent of the range of numbers 8000000 to 8000999. The next person, Ibiidum Smith, might also be assigned a number in the same range, but his number would follow Ian Smith's. This system of approximating numbers works satisfactorily principally because of the broad ratio of available numbers to numbers actually assigned. A typical example of the actual logging of names might be described as follows:

Assume a file which would eventually consist of a total of 50 names to whom numbers must be assigned for pay-roll purposes, and it is desirable to maintain these in alphabetic order for any of a number of reasons. The file at the outset contains only 5 names, but others will be added from time to time until the total of 50 is reached. A 2-digit number will be assigned to each, thus, allowing provision for a total of 100 names.

The first step is to divide the alphabet into 10 one-digit groups as follows:

- | | |
|----------------|----------------|
| 0 A through B | 5 Ma through O |
| 1 C through E | 6 P through R |
| 2 F through H | 7 S |
| 3 I through K | 8 T through V |
| 4 L through Mc | 9 W through Z |

The physical set-up for assignment of numbers would then be as follows:

O-A thru B 1-C thru E 2-F thru H- 3-1 thru K 4-1 thru Mc

- | | |
|--------|-------------------|
| 0----- | |
| 1----- | |
| 2----- | |
| 3----- | 3-Joseph McCarthy |
| 4----- | 4-John Doe |
| 5----- | |
| 6----- | 6-Wm. Jones |
| 7----- | |
| 8----- | |
| 9----- | |

5-Ma thru O 6-P thru R 7-S 8-T thru V 9-W thru Z

- | | |
|--------|---------------|
| 0----- | |
| 1----- | |
| 2----- | 2-Mary Wilson |
| 3----- | |
| 4----- | |
| 5----- | |
| 6----- | |
| 7----- | 7-Irene Roe |
| 8----- | |
| 9----- | |

Thus, assuming that the original five names to be entered were:

- John Doe—14
- William Jones—36
- Joseph McCarthy—43
- Irene Roe—67
- Mary Wilson—92

numbers would be assigned to them as indicated. Additional names could be entered in the appropriate positions and numbers assigned, maintaining the entire file simultaneously in both alphabetic and numerical sequence.

This is the basic principle underlying the numbering system used by the Roster, but, of course, multiplied many times. The Roster system utilizes a 7-digit number making provision for the ultimate entry of 10,000,000 names, though no such number is anticipated.

Processing of Roster Questionnaires

Questionnaires and associated check lists returned to the Roster office are sorted by field of association and coded before opening. This is possible because the return envelopes sent out with the questionnaires and checks lists are each inscribed with a numeric code indication. After the envelopes are opened the ques-

tionnaires and associated check lists are alphabetized and checked against a 3 by 5 card of addresses. Cards for which executed questionnaire are received are so marked. All miscellaneous correspondence or other pertinent facts affecting the status of the card file are noted on the faces of the cards. For example, questionnaires which have been returned because of faulty address or because the addressee is deceased are so noted.

As soon as these operations are complete, the questionnaires are sent to what is known as the "log room" where each is assigned an alpha-numeric number as described previously.

After the questionnaire has been assigned its appropriate alpha-numeric index number it is passed on to the code room for treatment.

The processing of questionnaires involves the preliminary translation of the written data into numerical symbols in accordance with a prearranged code system. There are a number of considerations involved in creating such a code for any specific type of data. These considerations contemplate the facility in encoding as well as that of decoding.

Number of Punch-Card Columns Assigned

The number of punch-card columns to be allocated to any given type of information is determined by the relative importance of the subject and by the number of significant items in the field which are likely to be checked or indicated in any great numbers. Thus, if knowledge of foreign languages is considered to be relatively important, 2 punch-card columns, permitting the use of 100 numbers for as many languages, are used. If this knowledge is considered to be relatively unimportant, a 1-column code permitting the use of 10 numbers for the more important languages or language groups, might be used.

Assignment of Numbers

The manner in which numbers are assigned is often of significance for both encoding and decoding procedures. When there is a probability that selections will be made on the basis of a related group or series of items, it thereby becomes important that the classification scheme be generic, i. e. on the basis of relationship among items rather than upon an alphabetic basis. This principle is made clear in the following description of a code for place of foreign travel. Under this code, the world is preliminarily divided into a maximum of 10 major geographical units, each designated by a digit from 0 to 9. Each of these principal subdivisions is subdivided into smaller units, usually countries, or continental areas. These in turn are subdivided into a maximum of 10 final units, which are countries or major subdivisions thereof. Under this system, the

first three designate all of America, with 1 designating North America; 2, South America; and 3, Central America. Europe is subdivided into major units, designated by 30, 31, 32, 33, etc. Number 33 represents the Balkan states, and is subdivided into 330 for Balkan states, general; 331, Albania; 332, Bessarabia; 333, Bulgaria; etc. Under this system the numbers ending in 0 are all reserved as an all-inclusive number, in this case representing travel through the major part of the Balkan states.

Under the system described above, each successive digit in a code number has a significance of its own. The successive digits indicate progressive specificity in the items concerned. This system facilitates selection, when a range of related items is desired, or when it is desired to select on a broader field as indicated by the first or second digit.

Provision for Code Expansion

The numbers in any code are so arranged as to permit expansion in any subgroup. This is accomplished by skipping numbers among every group of 10 numbers. The reason for this procedure is that in most codes which are prepared in advance of their use, it is impossible to anticipate every type of codable item likely to occur in the course of work. Provision must accordingly be made for inserting additional code items in their appropriate places. Some codes, as those for State of legal residence, are hardly likely to change, since an increase in the number of States in the United States is a remote possibility. The numbering of such a code requires no skipping of numbers.

Number of Code Subdivisions

In general, the number of subdivisions in any code is related to the probable frequency with which each item will be checked. In a language code, for example, there is the possibility of giving code numbers to about 3,000 different languages. If, however, the number of codable languages is limited to a maximum of 100 (2 columns), the number of code subdivisions (languages or language groups) is determined strictly by the probable frequency of occurrence of each item. Thus, under such a system, most of the commonly used Romance languages, as French, Spanish, and Italian, would each be assigned a separate number. On the other hand, the various languages of the Philippines can be considered as a group, since any specific language in this group will be of comparatively infrequent occurrence, at least as far as Americans are concerned.

Arrangement of Codes

For convenience in coding and for purposes of selection, all codes are arranged both alphabetically and numerically. The former is included for convenience

in finding the code number for a given time; the latter for determining the field or item which the number symbolizes, and to indicate the manner in which items are related in the classification scheme.

"General" and "Other" Codes

For many types of information, it is desirable to have codes for "other" items for each subgroup and for "general" coverage of a given subgroup in the code. An example of such codes may be found in the foreign travel code. Here the code numbers ending in 0 as the third digit refer to foreign travel throughout the subgroup. Thus 300 refers to all of the British Isles. Areas of lesser significance in any geographic subgroup are all given a code number ending in 9. Thus 159 is the code number for all of the smaller Leeward and Windward Islands which are not specifically listed in the group 140 to 151.

The Preparation and Use of Specific Codes

State of Residence and Place of Birth

This code of 2 columns is limited to a maximum of 100 items and is based upon the code used by the Bureau of the Census. The classification of States is on the basis of the conventional subdivision of the United States into regions. A classification of the States upon a regional rather than upon an alphabetic basis facilitates selections of cards for areas embracing a number of contiguous States, since the code numbers for such States often will be in sequence. Thus the Roster cards could quickly produce the number and names of, physical chemists, let us say, living in New England or on the West coast.

The section of this code devoted to foreign countries is a condensation of a similar code used by the Bureau of the Census. The countries selected for specific codes were those which were the country of origin of the largest number of residents of the United States. Because of their relative insignificance from this standpoint, all of Latin America, except Mexico, Cuba, and the West Indies, are given one number. Similarly, all of Africa is included under 99, "all other countries," because there are so few emigrants to this country. The place of birth is used in those instances when native-born persons are desired in a selection. The State of residence code is used when the geographical location of an individual is important, or when, in connection with selection for a position in the classified civil service, the apportionment law is effective and selections, therefore, can be made only from certain States.

Date of Birth

This is a four-column code, two columns each being given to month and to year. The months are arranged

chronologically, beginning with 01 for January and ending with 12 for December. The year of birth is coded by the use of the last two digits of the year given. For example, 1894 as the year of birth is coded 94. The advantage of this code is that it is self-coded, since it is unnecessary for the coder to refer to any code book. The date of birth code is used for selection of persons below or above certain age limits, as may be prescribed by law, or for a specific range in age as requested.

Citizenship Code

This one-column code lists six types of citizenship, or stages, in the application for citizenship. It is used in selections when United States citizenship or lack of it, is of significance.

Marital Code

This is a dual code, combining into one column (eight items) a code for marital status and dependents. The various categories of marital status are combined with a "no dependents" status in code numbers 1 through 4, and combined with a "have dependents" status in code numbers 5 through 8.

Race and Sex Code

This is a dual code combining into one column (eight items) a code for race and for sex. The male sex is combined with various races in codes 1 to 4 inclusive, and the female sex with the various races in codes 6 to 9 inclusive. This code makes it possible to select for sex in the range of codes 1 to 4 or 6 to 9, and for race by selecting on the two appropriate numbers.

Military Service and Reserve Membership

This dual code combines into one column (eight items) data with respect to both military service and reserve membership. As will be noted from the code, nearly all possible combinations, including military service under a foreign flag as well as in the armed forces of the United States, are provided for. The final item, "Now on active duty in any branch of the armed service of the United States" takes precedence over all other items. This code is useful in selections when the qualification of reserve membership or of previous military service is desired, or as a basis for eliminating from selections those already on active duty in the armed forces of the United States.

Language Code

This code consists of two sections and occupies nine columns on the punch card. The first section is made up of a two-digit code for languages, followed by a one-digit code for linguistic ability. By combining

the language (two digits) with a specific ability (one digit), we have a three-digit code showing the language and nature of ability therein. The punch card allows the indication of three such three-digit codes for as many languages.

The primary arrangement of the language code is on the basis of language families. Under each family are listed the languages believed to be of fairly common occurrence. The final item in each group is "----- languages and dialects, n. e. c.," a catch-all for all languages and dialects in that language family not specifically classified elsewhere. The code is based in part on the Library of Congress classification of philology. It was prepared with the assistance of Dr. C. K. Jones of the library staff, the American Council of Learned Societies, and other experts in the field. This code is arranged both alphabetically and numerically.

This code is useful in the selection of linguistic ability as a corollary qualification.

Federal Service Code

This one-column code is intended to provide information as to present or past Federal Service and as to the nature of this service with respect to its national defense status. It is useful in connection with determining the availability of persons being considered for a position.

Geographical Code

This three-column code for geographical location was prepared with the collaboration of the office of the geographer of the State Department. The starting point in preparing this classification was the conventional subdivision of the world into continental areas, with successive subdivisions along political and topographic lines. Extensive political entities, as China and Brazil, were subdivided into subunits, each with a specific code number.

The final main division in the code, "Oceanic Islands and Australasia," includes all islands which are not clearly parts of continents, or are a considerable distance from a continent.

Within each subgroup, the first item, ending in a zero, is used to code travel throughout the area. Thus 740 refers to travel through all of the East Indies. The final code, ending in a 9, is used for all subdivisions not specifically mentioned in the subgroup. Thus 759 refers to "East Indies, Other Islands."

A specific code has also been allocated for continent-wide travel. Thus, when travel through the greater portion of Asia is indicated, the code is 499; similarly for Africa, 599.

When travel to more than one foreign area in different continents is indicated, a combination code must be used, since there is provision in the punch card for but one foreign travel. This combination code has as its first digit the figure 8. The two subsequent digits are code numbers referring to the two areas in which the travel was indicated. The codes for foreign travel are arranged both alphabetically and numerically, for purposes of encoding and decoding, and are shown in appendix.

This code is useful as a corollary qualification when it is desired to select persons with specific professional qualifications who have in addition significant knowledge of a foreign country because of travel or residence therein.

Education Code

This three-column code is divided into two sections, a one-column code for extent of education and a two-column code for field of education. The first code consists of nine items denoting a progression in education from no university or college training to the possession of a doctorate.

The code for the field of education lists nearly one hundred fields or subjects in which degrees are most commonly granted. This list was prepared from a publication of the United States Office of Education in which were listed the titles of degrees granted by institutions of higher learning in the United States.

The arrangement of the code is on the basis of broad fields, beginning with the agricultural sciences, biological sciences, etc., and proceeding through various fields to arts and classics. General bachelor of arts degrees, not in any specific field, are coded 99.

This code is arranged both alphabetically and numerically. The latter lists all common designations for fields, including synonyms.

This code is used in selections when persons with specific academic qualifications are desired, either as to field or as to extent of education.

Special Skills Code

This code lists several hundred skills or occupations which are pursued on an avocational basis. The list of items was derived for the most part from a study of personnel records in which special skills and avocational interests were noted. The arrangement is on the basis of related occupational fields and parallels roughly the Bureau of Employment Security occupational classification. The original code was so devised that the unused numbers were distributed uniformly and evenly throughout. Thus, when new codes were added to the list from time to time, the items could be assigned in

their appropriate occupational category. The code is arranged both alphabetically and numerically.

The Special Skills code is used in selection for corollary qualifications which may bear some relationship to the fields of specialization previously selected. For example, a chemist with special skill in glass blowing, or a radio engineer who is also a radio operator, may be desired. In either case a selection on the second, or corollary qualification, could be made from this special skills code.

Principal Professional Field

In this code are listed most of the common professional fields, arranged on a basis similar to that of the education code. This code is used for the recording of answers to question 21 on the questionnaire and is useful for statistical purposes. This code was included in the punch card particularly for those persons working in border-line fields for whom fields of specialization would not give a clear picture as to the professional field with which they were most closely allied.

Scientific Apparatus Code

This code is confined to the scientific and professional apparatus which is unusual, recently developed, or of infrequent occurrence, and the use of which requires skill or training not possessed by the average scientists in these fields. Two lists have been prepared. The first is an alphabetic list of common scientific and professional apparatus which is not coded. The second is of specialized scientific apparatus which is coded. Coders first check a given item against the common apparatus list, and then, if the item is not found there, against the specialized apparatus list for a code number.

This list of apparatus was set up with the collaboration of the National Research Council, members of the technical staff of Science Service, and Dr. L. B. Tuckerman of the National Bureau of Standards. In addition, about 50 laboratories in as many fields were circularized for information as to specialized apparatus in their respective fields.

The three-digit code is arranged on an alphabetic basis.

Card Identification Code

This one-column code serves as a mechanical means of distinguishing among cards A, B, and C. The code 0 signifies the Index card; 1, the A punch card; 2, the B punch card; and 3, the C punch card. The latter three are coded automatically when the card is gang punched.

Occupational Classification

In assigning the code numbers to the break-downs of the Roster, every effort was made to have the two-digit symbols representing the broad fields conform to the Standard Occupational Classification formulated by an interdepartmental committee sponsored by the American Statistical Association and the Central Statistical Board. However, it was soon found that in this classification the space assigned to the professional occupations was insufficient to meet the needs of the Roster. The reason for this was that the Standard Occupational Classification was developed for two primary purposes: to make all statistical tabulations comparable, and for use of the Employment Service in the State employment offices where the emphasis is placed on clerical and mechanical trades employees. The Roster, on the other hand, in order to classify the special skills of the persons registered with it, needed a break-down considerably finer than was possible within the framework of the standard classification.

The following general classifications were then set up as the primary grouping for the fields covered by the Roster:

- 01-09 humanities.
- 10-29 } agricultural, biological, and medical sciences
- 90-99 }
- 30-39 physical sciences.
- 40-59 engineering and related fields.
- 60-89 social sciences.

Within these groups the specific numbers were assigned to the respective fields as follows:

LIST OF MAJOR FIELDS

ADMINISTRATION AND MANAGEMENT

- 63 accounting.
- 57 management engineering.
- 75 personnel management.

AGRICULTURAL AND BIOLOGICAL SCIENCES

- 92 animal sciences.
- 13 botany.
- 91 forestry and range management.
- 10 genetics.
- 90 plant pathology, horticulture, and agronomy.
- 11 zoology and entomology.

ENGINEERING AND RELATED FIELDS

- 56 aeronautical engineering.
- 42 architecture.
- 54 automotive engineering.
- 50 chemical engineering.
- 40 civil engineering.

ENGINEERING AND RELATED FIELDS—continued

- 51 electrical engineering.
- 58 heating, ventilating, refrigerating, and air conditioning engineering.
- 55 housing.
- 66 industrial design.
- 43 landscape architecture.
- 52 mechanical engineering.
- 59 mining and metallurgical engineering and mineral technology.
- 53 motion pictures—engineering, production, direction.
- 41 naval architecture and marine engineering.
- 44 planning—municipal and community.
- 47 and 48 radio engineering.
- 45 safety engineering.
- 49 testing of materials—engineering and technology.
- 46 transit and traffic engineering.

HUMANITIES

- 01 foreign languages.
- 02 philosophy.

MEDICAL SCIENCES AND RELATED FIELDS

- 21 anatomy.
- 28 anesthesiology.
- 20 bacteriology, immunology, and pathology.
- 24 experimental biology and medicine.
- 14 nutrition.
- 23 pharmacology and experimental therapeutics.
- 12 physiology.
- 29 psychiatry.
- 22 tropical medicine (and parasitology).

PHYSICAL SCIENCES

- 36 actuarial science.
- 37 ceramics.
- 30, 31, 32 chemistry.
- 35a geology.
- 35b geophysics.
- 39 horology.
- 34 mathematics.
- 33 physics and astronomy.

SOCIAL SCIENCES

- 71 anthropology.
- 60, 61, 62 economics.
- 81 geography.
- 72, 73, 74 history and political science.
- 86 professional education.
- 70 psychology.
- 88 recreation leadership
- 82 sociology.

SOCIAL SCIENCES—continued

- 83 social welfare.
- 76 speech pathology.
- 80 statistics.
- 89 trade and industrial education.

The break-down within each field and the range of numbers used was determined by two main factors:—

1. The amount of detail needed for proper classification of the registrants. This was determined by consultation with competent authorities in each field.
2. The number of prospective registrants in each field.

The code structure of the Roster has been found to be satisfactory as a classification of the millions of items so far recorded. Minor changes are constantly being made to meet special coding needs as they occur.

The Punch Card System

When the coding procedures are complete, the material, which has been reduced to numerical form, is ready for presentation upon the six punch cards assigned to each individual.

A file of punched cards technically known as an "expansive punch-card file" was adopted as most suitable to Roster needs because by this means only would the very diverse qualities of the million or so registrants who might ultimately be covered by the Roster be quickly and efficiently handled by the use of modern electromechanical sorting processes.

Design

The cards used by the Roster were especially designed for its needs. In devising this card, a thorough study was first made of all the available information which the questionnaire and check list contain. Then keeping in sight the fact that the ultimate objective is that of the selection of individuals to be certified to fill vacancies for which requests have been received, a determination was made as to just what information should be put on the punch card. After this was determined the actual design of the punch card was taken under consideration. Advice was sought of the foremost authorities on this subject who were available for consultation as to each item which was to be put on the punch card, and the most practical method of handling each such item as regards the method of coding and the location of the item on the card.

The punch card set-up as adopted by the Roster provides for six cards for each individual as follows:

Name card.—Containing the alpha-numeric number and the name in alphabet form.

Address card.—Containing the alpha-numeric number and the address in alphabetic form.

Index card.—Containing in numeral code all of the information extracted from the questionnaire which lends itself to such treatment and which could be of value for selection purposes. This card is placed in a master file in alpha-numeric sequence to serve as a reference point and as a basis for follow-up to bring information up to date.

A-B-C cards.—Containing the same information as the index card, except that the first three fields of specialization have been successively shifted on the card to facilitate selection. These cards serve as the selection file and are filed by field of specialization.

Use of Punch Cards

Before the punch cards outlined above can be effectively used, it is necessary to train operators in the specific tasks required. This training actually falls into three divisions: In the first place, operators are instructed as to the purpose, functions, and mechanics of the punching machine. They are impressed at this time with the simplicity of the punching operation. Card feeding, card ejection, and the use of skip bars are thoroughly explained. Next, keyboard exercises begin. The preliminary task required of the operator here is to memorize the standard key positions as the punch machine must be operated by a touch system if proper speed is to be secured. Exercises are next begun in which practice punching from actual documents, followed by careful correction, is assigned. The actual punching of cards is carefully checked at all points. Each group of documents as it comes to the machine room has attached a 3 by 5 card containing information which is checked as the questionnaires pass through this room.

The individual's alpha-numeric number is first punched, using columns 1 to 7. Following this, all of the other information described above in connection with the layout of the punch card is appropriately punched on the remaining columns of the six cards used. When this information has been completely punched both the cards and the documents from which the coded information has been secured are routed to the operator of the motor-driven verifying machine. The process of verification is exactly the same as that of punching. However, cards which are incorrectly punched in the first instance automatically stop the machine and may be returned to the original punch operator for correction. In this way the element of human error in transcribing coded information to punch cards can be eliminated. In general, the checking process requires about two-thirds the time required for initial punching. Extreme care is exercised in this phase of the mechanical process since an incorrectly

punched card would be completely valueless in the index.

Filing Punch Cards

As was shown earlier, the index cards, after being punched, are placed in a daily file. These cards are withdrawn each morning and counted by the first field of specialization. This is accomplished by placing them in a card counting horizontal sorter. This machine is explained in a later operation. The figures taken from the counters are entered on a master tally sheet, which is used in the preparation of production reports and production charts. When this operation has been completed the index cards are reproduced onto an "A" card, column for column, except that a "1" is punched into card identification number (column 48) and an "X" in column 77. The reproduction is accomplished by the use of the reproducing punch. This machine performs card punching automatically by copying the holes already punched in one set of cards to another set of cards which are not punched. The actual punching, of course, is determined by the wiring of the plugboard. There are two feeds in this machine, the reading unit and the punching unit. The reproducer is also wired so that if a column is not punched the machine will stop and indicate on a panel the incorrect columns. Each column being punched is wired in this manner to eliminate errors and omissions. The index cards are placed in the reading side and the blank "A" cards are placed into the punching side. The "A" card then becomes an exact duplicate of the index cards. The index cards are then interpreted, the following information being printed across the top of the card:

Alpha-numeric number.
State of residence.
Date of birth.
Education.
Fields of specialization (first, second, third, fourth, fifth).
Function.
Date of card.

The index cards are then set aside until a sufficient accumulation warrants sorting and interfiling. This will be explained in a later operation.

The "A" card is an exact duplicate of the index card with the exception of the two variations noted. The "A" cards are then taken and reproduced onto "B" cards with these variations. A "2" is punched in column 48, an "X" in 77, and the fields of specialization are transposed in this manner. From the order of first, second, third, fourth, fifth, they become second, third, first, fourth, fifth. This transposition is accomplished by the means of the plugboard. The

"A" cards are then interpreted in a manner similar to the index cards.

The "B" cards are then reproduced on the "C" cards with these variations: A "3" is punched in column 48; an "X" in column 77 and the fields of specialization transposed to read—third, first, second, fourth, fifth. Both the "B" and "C" cards are then interpreted in a manner similar to the index and "A" cards.

The "A," "B," "C," cards are put together and placed into the sorting machines, and sorted on columns 49-53. This places the cards in order by field of specialization. The cards are then filed manually into the qualifications file with a tab card preceding each change in the field of specialization, in order that any group may be readily available for reference, filing, or selection purposes. The index cards are sorted by the alpha-numeric number (card columns 1-7). After sorting they are interfiled with the original file by means of the Collator. This machine is also governed by a plugboard, which for this operation is wired to merge primary (original cards) and secondary (cards to be filed) cards into one group. This machine may also be used for a variety of operations,

several of which are explained in a later operation.

The name-address cards are sorted by the alpha-numeric number and interfiled in a manner similar to the index cards.

Thus the filing is completed in this order:

- (a) Index—alpha-numeric sequence.
- (b) Name, address—alpha-numeric sequence.
- (c) A-B-C—Field of specialization sequence.

Research file

In the past year there have been demands for statistical data which was to be culled from the punch cards. One such request was for a tabulation indicating for each professional field the number of people in age groups by decades. This was accomplished by the processing of the cards through the alphabetic accounting machine. This machine, too, is controlled by the wiring of a plugboard. By the means of a special device, known as digit selection, it was possible to get a complete set of totals for each field in one operation. Without this device it would have been necessary both to sort and tabulate the cards innumerable times to achieve the same result.

III. USE OF DATA

Certification Procedures

To provide adequate service, an informal certification section has been established in the Roster. It is the responsibility of this section to receive all requests for personnel or other information to analyze them as to content, and when necessary to verify the authenticity and the official source of such requests. These requests may be received in writing, by telephone, or through a call at the Roster offices by a representative of a governmental agency.

Analysis of Requirements

The requirements as to qualifications are written on the proper form by an employee of the certification section, where all necessary information is shown. The location of employment, the number of positions to be filled, the salary to be offered, the possible duration of the employment, and whether it is part time, full time, or consultative, are shown on the request sheet. Next are entered the desired fields of specialization, language requirements, if any, age, and any other necessary qualifications. Where possible, a formal job description is secured. A member of the certification section analyzes the information contained in these request sheets and checks them against all possible sources which might supply qualified persons. To do this all technical check lists which are in related fields, are examined as well as the check list for the principal professional field indicated. This is done in order to eliminate the possibility that sources of information in related fields might be overlooked or omitted.

After complete information has been received and a request sheet prepared, the information is then transferred to a conversion sheet. This conversion sheet is made up in such a way as to show any required qualifications in code and is for the use of the machine section. The required qualifications are entered according to code number on this request sheet following the order of importance of qualifications, showing also any qualifications which are desirable but which are not absolutely necessary. For instance, should the Roster receive a request by telephone from the Director of Personnel of a Government agency for a psychologist who has engaged in research in propaganda, and who is competent in the Hungarian language, these would be entered as primary qualifications. Should it also be desired that this person be familiar with race psychology and have some knowledge of Ukrainian, these would be entered as desirable qualifications, and

a sort would be made to include persons with these proficiencies as well. However, should there be an insufficient number of persons possessing all four of these qualifications, the two which are not essential could be eliminated. After the conversion sheet has been prepared it is transmitted to the machine tabulation unit where a sort is made.

Mechanical Sorting Techniques

The certification section issues to the mechanical section a request form bearing the qualifications necessary for registrants to possess to meet a particular requisition.

The first requisite is ability in a particular branch of a field of specialization. The cards for those sections of a field desired are pulled manually from the qualifications card file. This is done quickly and without loss of time by means of the identifying tab card placed in the front of each group.

The remaining requisites are processed through the sorting machine or the collator.

For example: Persons having a particular occupational status may be desired. The cards are placed in the sorting machine and sorted on column 74, which carries the punched code for function. All cards containing the given function are segregated from the others, thus eliminating those people not meeting the requirements for function.

The same process is repeated when the request calls for persons on a desired educational level or with training in a specific subject. It may be that persons living in a western State are needed for instance, California. A sorting machine equipped with a multiple-column selecting device is used. This device will segregate in one operation those living in California from all others.

The same procedure is followed for the selection of people having knowledge of certain languages; special skills, foreign travel, citizenship, marital status, race and sex, military service, Federal service, and the like.

When these operations have been completed there are two groups:

Those meeting all requirements and those mechanically rejected in each of the operations.

The former group is sorted by the alpha-numeric number and then placed in the tabulating machine. By the wiring of the plugboard, the machine prepares from the punch cards a printed list of the selected names and all of their qualifications. After the list

has been made the cards are sorted together with the rejected cards by the field of specialization and filed manually into the qualifications file.

This entire process is repeated, although with a few possible variations, for each request received.

A list of the machines used and their speeds are shown below in order that a clear picture can be obtained as to the rapidity with which any or all of the foregoing operations can be accomplished:

1. Reproducer----- 100 cards per minute.
2. Interpreter----- 60 cards per minute.
3. Sorter----- 400 cards per minute.
4. Tabulator:
 - (a) Listing----- 80 cards per minute.
 - (b) Tabulating----- 150 cards per minute.
5. Collator----- 240 cards per minute (one feed); 480 cards per minute (with both feeds operating simultaneously).

Some requests are received from agencies desiring to examine the questionnaires, others desire merely the names and addresses of persons competent in certain fields. In either case it is possible to sort the cards and furnish a printed tabulation, either of alpha-numeric questionnaire numbers, or names and addresses with certain information as to specialties printed in code.

After the tabulation report has been received from the machine tabulation unit, the questionnaires are removed from the file, a charge-out card being placed in the file for each questionnaire taken, showing the name of the person, questionnaire number, and the person on the Roster staff to whom the questionnaire is to go. These questionnaires are then sent to the certification section.

Should the number of persons selected in the machine unit be disproportionately large for the number of jobs to be filled, it might not be necessary to remove from the files all the questionnaires listed. In some cases, it is possible to make certain eliminations on the basis of the information printed on the machine tabulation report. However, as many questionnaires as appear necessary to furnish a sufficient list of eligibles are pulled from the files and sent to the certification section. The certification section then examines each questionnaire in detail to determine which of those individuals whose questionnaire have been pulled apparently meet all requirements as to qualifications. Examination is also made to ascertain, if possible, whether or not a person is available at the salary indicated, whether he would be available for part-time or consultative service, or whether he is engaged in some vital activity and his work should not be interfered with by referral to some other source of employment.

After this examination and any necessary eliminations have been made in the certification section, the

questionnaires are then referred in one of two ways: First, they may be referred directly to the official who has requested the information; second, they may be referred to an evaluating committee, which will make a further analysis of the qualifications of those persons referred by the certification section. Should the questionnaires be referred directly to the appointing officer, a descriptive certificate will accompany the questionnaires.

Should the request be of a very specialized nature the questionnaires may be referred to an evaluating committee which can make a detailed analysis of the problem. These evaluating committees are as a rule composed of a representative of a professional society in the field in which the request is made, a person in academic work in this field, or a representative of industry in the given field.

When the necessary preliminary analyses have been completed, the questionnaires of those persons who best meet the requirements given are referred to the appointing officer with the certificate attached. This certificate lists the names of all persons whose questionnaires are referred. On the certificate the appointing officer is requested to notify the Roster office of all actions taken. If he interviews any person listed, or if a person fails to reply to a communication, he is requested to show this information on the certificate when he returns it to the Roster offices. He is also requested to notify the Roster offices of any appointments made or of any declinations by persons to whom appointment is offered.

In some cases, generally to those positions in the classified civil service, referral of questionnaires are made through a representative of the Civil Service Commission stationed within a department to assist in recruiting for that department, or to the head of the appropriate examining unit in the Civil Service Commission. In this case it is the responsibility of this Civil Service representative to see that an adequate report is made on any actions taken concerning persons certified.

Referral of questionnaires may be made by mail, by special messenger, or by consultation of appointing officers in the Roster offices. In all cases, persons examining Roster questionnaires are urgently requested to return them to the Roster offices within a week from the time they are issued. The need for this request is obvious since the continued demands for personnel having the same high type of specialized training make it necessary that all persons who are not to be appointed be available for future certification.

When a certificate is issued it is the responsibility of the requesting agency to ascertain the availability of persons whose names are certified. In general a

determination can be made by examination of data contained on the questionnaire as to present position, research, and restricting conditions concerning acceptance of other employment.

The appointing officer reports to the Civil Service Commission concerning any appointments made which are within the regulations of the Civil Service Act. Should the positions to be filled be of the type which are not within the purview of this act, such as a position in the military service, a report concerning actions taken and appointments is made only to the Roster. After this report has been received, a form is made up for each individual certified and placed in his questionnaire. This form shows the department to which he was certified, the type of position, salary, and any other pertinent information. Should he be selected and appointed, this information is also entered. Further certificates on which names are listed are checked against this file so as to prevent confusion and loss of time which would be occasioned by certifying a person who had already been called into Government service for specialized activity.

Placements from Roster Lists

The confidential nature of nearly all of the appointments made from Roster lists to the War and Navy Departments and to other defense agencies makes it impossible in this general report to list the specific personnel demands which have been filled through the use of the Roster files. Something of the magnitude of the operation of the Roster, however, can be gathered from the fact that on November 1, 1941, more than 60,000 individual names had been presented to requesting agencies in connection with specific job specifications. This does not, of course, mean that 60,000 individuals have been offered positions as a result of the use of the Roster because, as noted above, it is the general policy of the Roster to provide an agency interested in recruitment at the high personnel level with a list of names together with full qualifications of individuals from whom a choice may be made for the positions under consideration. In many instances, of course, the demand is not for a single appointment but for many men of similar ability. In 1 case, for example, 1,380 definite job offers were made by telegram to engineers, information concerning whose abilities had been gained solely from Roster records.

It is not possible at the present time to give statistics concerning the actual number of individuals who have been appointed as a result of operation of the Roster, for two principal reasons: First, the information may be confidential, as reports are not made concerning employment in certain highly strategic areas; and second, in spite of a continued effort to follow up appointing

agencies, it is never certain that all appointments made from Roster material are reported. This is especially true in those cases in which the appointing agency is not by law or regulation required to report to any central personnel agency the number and kinds of appointments made to its staff.

The National Roster and the Civil Service Law

Since the recruitment function of the National Roster parallels the over-all recruiting function of the Civil Service Commission, it has been necessary to develop procedures in the selection of individuals for civilian governmental positions which can operate within the general framework of the civil-service laws, rules, and regulations.

In general, the civil-service law provides for the announcement of examinations for specific classes of positions as personnel needs occur in Federal agencies. Candidates are invited to file applications to participate in these examinations, and their qualifications are competitively rated. Registers of the names of qualified applicants are then established, and appointments to Federal positions are made in the order of candidates, rankings. In the scientific and professional areas particularly, the amount of competition is largely controlled by the conditions of the labor market. With opportunity for employment at every hand, individuals are content to be relieved of the necessity for competing in examinations. Thus, as demands for particular occupational groups expand, there is likely to be a corresponding diminution of competitors in open examinations. However, the Civil Service Commission has ruled that the fact that there are no eligible registers shall in no way impede the expansion of the Federal agencies to meet emergency needs. Employees must in some way be found.

It is in this connection, therefore, that the Roster has been most useful as a recruiting device. Persons who would not ordinarily compete in civil-service examinations have been willing as a patriotic duty to register with the Roster and to hold themselves in readiness for defense work if needed.

In general, therefore, it may be said that in recruitment for positions which must be filled in accordance with civil-service regulations the National Roster has supplemented the general activity of the Civil Service Commission. In every case of an appointment to a position falling in this category no selection may be made from the Roster list until it be ascertained that no fully qualified persons are available on existing eligible lists of the Civil Service Commission. However, much of the personnel service rendered by the National Roster has been to agencies which are not required by law or regulation to make personnel selec-

tions in accordance with the civil-service law. Notably, the authority for the recommendation of individuals for commissions in the Military and Naval Establishments rests entirely with the Secretary of War and the Secretary of the Navy. Many consulting and part-time positions may likewise be filled without regard to existing civil-service procedures.

The Roster and Private Industry

The breadth of the original commission to the National Roster, to recruit scientific and specialized workers for defense activity and to conserve the nation's manpower in these fields, was such that it has been necessary to formulate new policy almost as a day-to-day operation.

This is demonstrated by the changing definitions of the areas to which the Roster has extended its personnel service. In the early months, the Roster conceived its primary duty in the field of recruitment to be that of rendering service to governmental agencies having specific needs for qualified, specialized personnel. Gradually this service was extended to such quasi-governmental projects as those typified by contracts let and supervised by the National Defense Research Committee and carried out, in many instances, in the laboratories of private institutions.

After 9 months, however, it was realized that the gradual infiltration of skilled personnel into the ranks of the Government, with a corresponding drain on private industrial concerns and academic institutions, could well result in an undesirable displacement from the standpoint of industry, with a corresponding interference with the prosecution of private defense contracts. Therefore, a rapid survey of needs was made. This survey revealed that many defense contracts were as closely allied to the defense effort as any governmental activity could possibly be. There can be no doubt that the production of combat aeroplanes for military forces, the manufacture of arms and ammunition, and similar activities, constituted an integral part of the country's whole defense effort.

The Roster, therefore, has been gradually extending its service to those industries vitally concerned in defense production and has already provided the names of a relatively large number of skilled individuals to such industries. In doing this, constant consideration has been given to the movement of workers from one defense plant to another. In no case has a person been recommended for transfer from one defense industry to another as long as similarly qualified individuals were available in nondefense activities. And, in the few cases in which such movements have occurred a

preponderance of evidence was available indicating that the movement of an individual from one defense plant to another would not cripple the former and would be of strategic importance to the latter.

It is the purpose of the National Roster to continue to render such service to defense industries, and perhaps later to extend its facilities to academic institutions should such action seem desirable.

The Roster and Specialized Services

Selective Service System

In the operation of the Roster certain supplementary services have been undertaken in order to facilitate the accomplishment of the basic purposes for which the Roster was established. Notable among these supplementary services has been the work of the Roster in cooperation with the Selective Service System in establishing procedures by means of which information could be furnished to local boards concerning the special qualifications of highly trained individuals who appeared before these boards. The importance of such individuals in the whole defense effort made it necessary for the Roster to undertake this service, which was also specifically requested by the National Resources Planning Board in the interests of effective planning for personnel resources in the United States.

The project is concerned with making specific evaluations of the men of military age registered with the National Roster, and their most effective utilization in the national defense program, either as civilians or in some branch of the service.

The details of the operation of the relationship between the Roster and the Selective Service System as worked out by Dr. Stewart Henderson Britt, a special consultant of the Roster, is described in Appendix A.

The Office of Scientific Personnel

The unique and surprisingly complete character of the Roster files has led the office of the Roster to be consulted concerning projects requiring the utilization of some single yet complete source of information concerning the nation's human resources in the scientific and professional areas. Notable among these, as described in Appendix B, is the Office of Scientific Personnel. This agency set up by contract between the Office of Scientific Research and Development and the National Research Council is operated largely through a cooperative arrangement established with the Roster. The administrators of the Office of Scientific Personnel have all been appointed as consultants to the Roster and office space and other facilities have been afforded by the Roster to this agency.

Statistical Survey of the Learned World

Appendix C contains a preliminary report of a study undertaken by Dr. Leonard Carmichael, the Director of the Roster, and Robert Shosteck in an effort to gain not only a national but a world-wide view of specialized manpower resources in the sciences and professions. This task was undertaken in the first place in the belief that such information could be readily secured from the Library of Congress and other standard sources of information. It proved on investigation, however, to be true that no such compilation has apparently ever been made. The report presented here, therefore, must be taken as highly tentative. In fact, it should be emphasized that the figures given for countries other than the United States are merely stated as being the best figures available from some source. It is hoped that, gradually, informed individuals will assist the office of the Roster in making this information more complete. The obvious advantage of such information

in cooperative defense planning and in post-war planning need not be pointed out.

Statistical Information on Roster Registrants

Statistical findings concerning the age, sex, and professional association of Roster registrants are given in appendix D. It is obvious that the Roster is a very valuable source of statistical information concerning the learned world in America and, as noted above, in the original plan for the development of the Roster, a separate card file was contemplated which would make possible continued statistical studies of the Roster lists. Unfortunately, however, the unexpectedly intense use of the Roster list for appointments in the defense agencies have made it impossible so far to consider many statistical studies. We have also, because of daily operating pressure, been forced to refuse a good many requests to use the material to be found in the Roster in connection with special investigations.

IV. COMMITTEE ON WARTIME REQUIREMENTS FOR SPECIALIZED PERSONNEL

Even before the entrance of the United States into active warfare, it was becoming increasingly apparent in the light of the demands created by the defense and lend-lease programs, that sufficient efforts were not being made to insure an adequate supply and proper distribution of scientific and specialized personnel. After December 7, this inadequacy became even more marked as the armed services increased rapidly their rates of induction, and the war production program was doubled and then doubled again.

Establishment of the Committee

In recognition of the urgent necessity to have the entire problem of scientific and specialized personnel reviewed anew in the light of the current and potential demands for scientific personnel, the Committee on Wartime Requirements for Specialized Personnel was established by the National Resources Planning Board.

Members of the Advisory Committee

Owen D. Young, General Electric Co., *Chairman of Advisory Committee*
Leonard Carmichael, Tufts College; Director, National Roster of Scientific and Specialized Personnel.
E. C. Elliott, Purdue University.
Guy Stanton Ford, American Historical Association.
Marion B. Folsom, Eastman Kodak Co.
General Lewis B. Hershey, Selective Service System.
Edward F. McGrady, Office of the Under Secretary of War.
Monseigneur John A. Ryan, National Catholic Welfare Council.
John W. Studebaker, United States Office of Education.
Baldwin M. Woods, University of California.

Members of the Operating Committee

James C. O'Brien, *Executive Officer*, National Roster of Scientific and Specialized Personnel.
Stewart Henderson Britt, George Washington University, National Roster of Scientific and Specialized Personnel; *Executive Secretary of Operating Committee*.
Henry A. Barton, American Institute of Physics.
Maxwell Devoe, Department of Agriculture.
Mitchell Dreese, George Washington University.
John M. Gaus, University of Wisconsin.
Eli Ginzberg, Columbia University.
C. S. Marsh, American Council on Education.
C. B. Mattingly, Association of American Railroads.
James Mitchell, Civil Service Assembly, United States and Canada.
Willard Parker, Director of Personnel, State of Louisiana.
Henry Reining, Jr., National Institute of Public Affairs.
Lloyd Short, University of Minnesota.
Kenneth P. Vinsel, University of Louisville.
Arnold S. Zander, American Federation of State, County, and Municipal Employees.

The committee was charged with the responsibility of ascertaining the facts concerning the needs for professionally trained personnel in army, navy, the public service, industry, and education; the supply available; and of recommending policy so that this essential resource for the war effort could be efficiently utilized. This committee met under the chairmanship of Mr. Owen D. Young on January 3 and outlined a plan of investigation. It was planned that a report be submitted at the end of 60 days which would contain the available quantitative data and which would outline the basic policy for the more efficient utilization of scientific personnel in the war effort.

The members of the Operating Committee, familiar with the various aspects of the problem of scientific and specialized personnel, first reviewed the general field and then set about, through the instrument of subcommittees, to survey the demand for and the available and potential supply of specialized personnel. The members of the Operating Committee worked intensively for a 2-month period and met at frequent intervals to review their detailed findings and to discuss general policy.

Report of the Committee

The Advisory Committee met with the Operating Committee on February 28, and after reviewing the specific findings and the general recommendations of the Operating Committee, unanimously adopted the following report. This report reflects the data and deliberations of the Committee and is based on the following considerations:

1. The problem of the supply and the demand for professionally trained workers is receiving relatively little attention as compared with the problem of other workers.

2. No one agency or organization is at present charged with the over-all responsibility of studying continuously the demand for professionally trained workers in the war effort, the supply available, and the current and potential output of educational institutions and other training facilities. Many agencies appear to be unaware of what kindred organizations are doing about this problem, with consequent duplication of effort and neglected areas of service.

3. All agencies with which contacts were made expressed approval that the problem of professional manpower was being studied, and showed a willing-

ness to cooperate. Many emphasized the need for a continuing organization to deal with the problem.

4. Most agencies have not yet established a comprehensive system of collecting data concerning current and anticipated professional shortages; consequently, valid data are difficult to obtain. Special notice should be taken of the fact that the armed services have noticeable gaps in their data relating to the numbers of specialized personnel now in the services and that the information about potential demands is even less complete.

5. The Selective Service System is constantly in need of information about the present and potential demand for and present and potential supply of scientific and specialized personnel, preliminary to issuing circulars concerning deferments. It has found this information difficult to secure. Improved sources of information would doubtless expedite its work.

6. Data concerning demand and supply need to be compiled at regular intervals to be of maximum value. A short-term study such as was conducted by this Committee is but the initial step.

7. Continuous coordination and guidance of educational institutions and other training organizations is essential. Without financial aid from the government it will probably be impossible to insure an adequate supply of professionally trained workers.

8. Current recruitment and allocation procedures are not adequate to insure on a national scale the most effective utilization of existing and potential professional personnel.

9. The existing shortages in specialized personnel emphasize the necessity of securing as soon as possible information concerning women with professional training, for they represent the largest unutilized supply of specialized personnel in the nation.

10. A marked discrepancy between demand and supply in many professional fields is resulting in wasteful competitive bidding between Army, Navy, the public service, industry, education, and research. Only if quotas for professional personnel are established, the limited supply allocated, and provisions made for the training of new personnel, can the prevailing wasteful utilization of specialized personnel be eliminated.

11. The present uncertainties about the needs for specialized personnel and the absence of a national policy is having a bad effect upon morale, especially student morale, since the individual is at a loss to decide what to do in the light of the conflicting claims made upon him.

12. The absence of a national policy is also having the unfortunate result of stripping the staffs of many universities and colleges at a time when they may be

called upon to train large numbers of specialists in those fields in which acute shortages exist.

13. Mobilization experience in this and other countries shows the need for an orderly policy of procurement and assignment in this area.

14. The thinking of the committee, while dealing only with the problem of specialized personnel, held firmly at all times to the democratic philosophy of the Selective Service principle that each and every citizen is a combatant. His resources and his talents are at the command of the nation, and it is a national as well as an individual responsibility, to say where the citizen may best serve. The assumption of this responsibility by the national government is due each citizen and becoming daily more urgent in a war which is fought not only with Army and Navy but with factory, administration, and laboratory. In such a war, the question of personnel and its proper utilization certainly takes rank in importance with that of material.

Effective Utilization of Professional Manpower in the War

The effective utilization of the present and potential professional, scientific, and specialized manpower of the nation in the war effort requires a continuous appraisal of the supply of and the demand for professionally trained workers in the armed forces, the public service, industry, education, and research. In the light of these data, training programs should be directed and the available personnel distributed so as to be of maximum service in a total war. In order to achieve these ends, an organization must be established which will coordinate the agencies concerned and stimulate and direct a continuous program of *fact finding, training, and allocation* of available professional manpower.

This organization should consist of: (1) A policy-forming and appellate board of outstanding persons who are familiar with the problems of supply and demand for specialized personnel in the major fields of subject matter specialization; and (2) an executive director and staff vested with complete responsibility for the administration of the functions assigned to the organization.

The organization should perform the following services:

1. *A fact-finding service*, designed to ascertain the need for professionally trained individuals in the Army, Navy, the public service, industry, education, and research. The persons coordinating this program would work with existing agencies and make certain that adequate machinery is available to supply periodic reports on demands for professionally trained personnel. The data on existing surpluses and shortages

would be compiled into periodic reports. It would also be necessary to develop a comprehensive program of periodic reports concerning *supply* of professional manpower available. Such a program would involve close cooperation and coordination of effort.

The registration of all women between the ages of 19 and 45 should be undertaken as soon as possible to provide an inventory of the training and ability of the most available section of this total group. The registration of all males between 18 and 65 has provided a complete inventory of the manpower resources of the Nation.

2. *A training service*, designed to provide a clearing-house for information pertaining to available training facilities of all kinds which might be utilized to augment the available supply in occupations where acute shortages exist. The chief function would be to assure adequate training in the need for and adequacy of educational facilities. Without governmental aid it will probably be impossible to provide an adequate supply of professionally trained personnel. This training service should also be concerned with in-service training facilities particularly as they pertain to "up-grading" of subprofessional personnel. Careful coordination of military training programs and available training facilities in colleges and technical schools will doubtless result in a better utilization of existing training resources throughout the country. In cooperation with the scientific and professional groups, the training service would make analyses of the degrees of competence necessary to reach acceptable occupational standards and devise methods of accelerating the production of professional personnel.

3. *An allocation service*, with authority to establish professional personnel quotas for Army, Navy, industry, the public service, education, and research. Machinery should be developed by which each of these units might obtain its share of the available professional personnel supply without wasteful competitive bidding. There should be established through this agency a professional recruitment division with compulsory registration of professional personnel. This agency should also have the authority to establish professional personnel quotas. Mandatory recruitment through this agency and mandatory assignment of individuals may be necessary. Whenever individuals are assigned, every effort should be made to grant the individual within the established quotas the maximum freedom of choice in order that he may make the best use of his special talents. The establishment of quotas will probably be the central function of the allocation service. A survey of the existing distribution of specialized personnel and a reallocation of such personnel whenever such reallocation would contribute

to a more effective utilization may well be an important part of this service.

If the foregoing organization were established and authority granted it to proceed with fact-finding, training, and allocation services, the present wasteful system of competitive bidding could be eliminated and steps taken to insure an adequate supply of specialized personnel. This proposal envisages an extension of the basic principle of Selective Service. An orderly system of procurement and distribution of the trained manpower of the Nation would afford each individual an opportunity to serve where his ability is most needed and would thereby contribute to his morale as well as permit him to make a maximum contribution to the war effort.

Summary of Findings

It is clear that the following services should be maintained and developed, if present competitive demands for personnel by the Army, the Navy, industry, Government and research, and education are to be adequately provided.

1. A fact-finding service

This service is designed to assemble continuously the needs of the Army, the Navy, war industry, war research, education, national, state and local government, for trained individuals in professions, sciences, and other specialized fields, and to estimate in quantitative terms the probable needs for such men in each field.

2. An advisory service regarding training programs

On the basis of facts already secured by the Committee on Wartime Requirements, and to be secured through continuing studies by a fact-finding service, which are to be maintained, information shall be made available to those agencies primarily concerned with training programs, as well as to colleges, universities, and technical schools.

3. General procurement and assignment services

In order to deal with the competition between various agencies for specialized personnel, arrangements should be made for securing an equitable distribution of personnel between the armed services, research, industry, civilian government and education and training. A Board of representatives of these various agencies should evaluate the facts concerning the immediate needs of the various fields and agencies and, if necessary because of shortages, deal with the procurement and assignment of professional personnel to the various users. In any case individuals should be given the largest possible leeway in final assignment to a particular job.

Results of the Committee's Recommendations

On the basis of the Young Committee's findings, and with the approval of the Bureau of the Budget, in the Spring of 1942, it became increasingly apparent that only through a national assessment and continuing inventory of the supply of and demand for the professional and scientifically qualified citizenry of the Nation could there be an adequate utilization of this segment of the manpower in the prosecution of the war. Accordingly, at the suggestion of the Bureau of the Budget, there was set up within the framework of the Roster organization a division charged with the development of complete data concerning the supply of, demand for, and utilization of scientific and professional personnel in all areas and categories. Among the functions of this division are the relation of supply and demand figures to the rate of production of young scientists and professional men and women in colleges and universities, and the maintenance of liaison with institutions of higher learning through such agencies as the United States Office of Education, the American Council on Education, and similar organizations. The division is also charged with the development and analysis of statistical data concerning the needs of industry, the military service, and other consuming agencies for scientific and professional manpower as well as the manpower requirements of the large amount of scientific research now being carried on. Through the constant maintenance of these figures, broadgaged

national planning of training policies can be assured, since such programs must inevitably be based upon a complete knowledge of the number of trained specialists, the utilization of these specialists, and the rate at which they are produced.

During the same period, it was discovered that the skilled women of the country represent probably the largest single reservoir of unused talent in the professional areas. There has been established within the Roster's organization a unit charged with development of liaison with national and local women's organizations, women's colleges, and coeducational institutions, for the purpose of stimulating the complete registration of scientifically and professionally trained women.

By arrangement with the Selective Service System, the Roster is being furnished with a portion of the occupational questionnaire utilized in the general occupational registration of all males in the country between the ages of 18 and 65. In this way it is expected that during the months ahead the Roster will have a detailed record of the skills and qualifications of every professionally or scientifically trained or experienced man in the Nation.

With this centralized record of skills, all agencies of Government, including the military services, will have available current information concerning the whole manpower supply in the professions and sciences, and the country will thus be in a position adequately to utilize this great reservoir of skills.

V. THE IMPLICATIONS OF THE ROSTER FOR NATIONAL PERSONNEL PLANNING IN CONNECTION WITH EDUCATION AND VOCATIONAL GUIDANCE AND POST WAR PLANNING

In a diagrammatically simple and ideal free society, each individual would be performing only those tasks for which he was most completely suited. It is obvious that for many practical reasons this Utopian state of affairs has never been and probably never can be approximated, let alone fully achieved. As a goal, however, the ideal of fully adequate vocational adjustment for all citizens is a very worthy one. For many years it has been the aim of certain educators and employment managers to do what they can to bring about improved vocational guidance for young men and women. These individuals have associated themselves together in what is at times called the vocational guidance movement.

The National Roster is not without certain implications for proper vocational and personnel guidance so far as the future of our country is concerned. Insofar as such an aim is associated with the Roster, however, one must recognize at the outset what some of the essential limiting factors in human guidance are.

In the first place, the thesis that the bulk of citizens are born with specific patterns of talents which predestine them from the first for only one relatively narrow field of work has never been demonstrated. It is true, there are, within certain limits, probably inherited levels of ability and also there may be some inborn specific aptitudes; but for the most part, vocational guidance must concern itself with the discovery of the capacities of individuals at various levels in the educational ladder and the modifications of these aptitudes and abilities along socially approved lines. These basic psychological and even biological facts must be considered in planning any program of educational and vocational guidance.

Aside from facts of the sort just indicated, however, the great stumbling block in every program of guidance in peacetime is the fact that in attempting to advise a young man or woman what he should do in life, one is necessarily assuming a role of prophet. The difficulty of guessing concerning the future has led most experts in the field of vocational guidance to adopt two guiding principles: First, for the most part, those who attempt to assist high school or college students in the selection of a vocation ordinarily limit themselves to the provision of information concerning alternative vocations. The decision concerning the field for which the individual may wish to train himself is, in most instances, strictly placed in the hands of the young indi-

vidual himself. To put this matter in another way, self-guidance on the basis of proper factual evidence is considered to be the most satisfactory procedure in a democratic guidance program. Unfortunately, however, facts concerning the availability of vocational and professional openings in a changing society are very difficult to secure, and so there is a tendency on the part of those charged with guidance activities to attempt to allow general education to continue as long as possible, thus not only providing more citizens with wide basic training but also allowing the individual to alter his vocational choice when new conditions arise. This program is a conservative one, but it has obvious limits, because some time in the course of each life the final vocational choice must be made, and all too often this choice is determined by the "Boy Wanted" sign rather than by any particular preparation of the individual for his place in society.

Sometime, however, the Utopian state of affairs referred to in an earlier paragraph must be more nearly approximated, if our industrial and technical civilization is to be efficiently organized and if unnecessary human suffering and talent wastage is to be avoided. Preparation for most technical fields, however, demands years of intensive education, and the suitable direction of this education can only be determined by a knowledge of many factors, one of which is an estimate of the future demands of society for personnel in various fields. At the present time it is very difficult indeed to give to an adolescent boy, concerning whose talents everything possible is known, vocational advice that is at once *honest*, *wise*, and at the same time *specific*. If specific advice is to be given, facts must be determined concerning the employment trends of the future.

The work of the National Roster in the present war period has shown certain areas in which there is now a serious dearth of trained Americans. If the present war economy were to continue indefinitely, it would be relatively simple, on the basis of facts disclosed by the operation of the Roster, to make rather definite suggestions concerning suitable professional training for young Americans. For example, it would be possible to say that the field of radio physics is one that needs many more graduates than it has received in the past. If this advice were to be given today to a young man starting upon his higher education: "Study radio

physics," a second question would at once present itself. After the war is over, will radio physics continue to be a field in which many experts are demanded? Of course, this question and hundreds of others like it can never be fully answered, but by the amassing of facts the direction of trends can be secured.

Thus agencies, such as the National Resources Planning Board, which are directly concerning themselves with plans for the post-war world could well consider plans for the provision of personnel after the war as well as plans for industrial engineering and other developmental programs. It must be recognized, however, that such planning will at once involve the entrance upon highly controversial areas. For example, evidence today indicates that society now needs and probably will continue to need more medical and dental care than it is securing at the present time. There are also many more young men and women competent to study and become proficient in medicine and den-

tistry than are allowed to prepare themselves for these fields. Here one again meets the familiar economic paradox of a society constituted on traditional American lines. There are wide needs and wide potential resources, but no satisfactory plan for distribution has been worked out.

In view of the foregoing statements, it seems to the officials of the Roster that a carefully formulated series of questions concerning vocational trends and the possibility of vocational guidance should be drawn up. Once this agenda has been agreed upon in consultation with the National Resources Planning Board, a conference of educators and other individuals interested in human planning may well be brought together. This conference should discuss procedure by means of which more effective assessment of professional and vocational trends could be made available to those charged with vocational and professional guidance in connection with higher education in America.

VI. CONCLUSIONS AND RECOMMENDATIONS

During the 16 months of its existence, the National Roster of Scientific and Specialized Personnel seems definitely to have established that the function which it performs is one which is essential to an effective program of personnel management during an emergency period. While other organizational devices might have been found to meet the exigencies of the emergency personnel situation, the centralization of these various functions into the one organization has been demonstrated as an efficient method of handling a critical need. The segregation and appraisal of the scientific and specialized skills of the Nation's citizenry, has permitted a planned approach to a distribution of those skills where they are most needed.

The function of the Roster has been novel in the governmental structure in that it seeks to deal with areas of skills rather than areas of employment. Various Federal agencies have been designed to deal with various employment areas. One agency is concerned with the recruitment of civilian workers for the Federal Government; another, with the skilled-worker needs of private industry; the Military Establishments have hitherto largely depended upon their own sources to recruit candidates for commissions. As a result, there has been no one focal point of induction of the scientist or professional man into the civilian and Military Establishments of the Government and the research laboratories and production plants of private industries and institutions. The segregation and definitive analyses of the Nation's human resources in the sciences seem indispensable to a productive defense effort. Only in this way can these skills be adequately utilized.

The objectives of the National Roster, the recruitment of scientific personnel and the conservation of scientific skills, are being met and the byproducts of the central index are daily becoming more significant. Operating pressures have permitted little research into the wealth of material at hand in the National Roster. Such few studies as have been made, however, have provided interesting and important data in such matters as the potential supply of skilled workers in strategic occupations, the necessity for accelerating training efforts, and the actual reservoir of skills which may be available to the Nation as wartime needs develop. The recruitment of scientists measured in terms of tens of thousands amply shows the role the scientist is playing in present emergency efforts. This fact alone suggests that some central index to the skills of the Nation should

be available to the Federal Government not only in an emergency period but in peacetime as well.

In a sense, only the first stage in the development of the Roster has now been accomplished. Basic working procedures have been established, fully tested, and shown to be useful and efficient. More than 60,000 names have been supplied to war agencies for consideration as a result of the analytical use of its files. Records show that of this number many thousands have actually taken up work with the Government as a result of the operations of the Roster. The whole pattern of operation of the Roster has demonstrated itself to be so successful that it is clear that plans must now be made for its continued growth and development.

The future development of the Roster must, it seems, take two general lines. In the first place, as the war effort becomes more nearly total, the present very real shortages in highly trained manpower in certain fields are bound to be even more acute. This means that the Roster will be called upon in this country to assist in the conversion of specialists from one field to another. This function is now one of the main fields of the British National Register. The growing shortage in engineering and other fields also suggests that the Roster must do everything in its power to make its files in certain areas as complete as possible. In order to do this, new procedures will have to be developed to reach "hidden experts" who are not now listed. Coverage must also be extended to fields which have not yet been canvassed. The importance of conservation and of the proper democratic allocation of expert talent is now also becoming greater in the day-to-day operation of the Roster. Every effort must be made to plan wisely in connection with the allocations resulting from the changing demands of the war. This will be even more important as war impinges upon the already all too limited supply of American specialists. In the second place, it is not too early for the Roster to begin to plan to assist in the great problem of the proper reallocation of American experts, once the present emergency is over. This procedure of reallocation at best will be extremely complicated and will be charged with the greatest potential danger for the Nation. Is it too early to suggest that if the specially trained scientists and other experts of the Nation have been essential in the war effort they may also be basically needed in the task of creating a better post-war world? The proper use of manpower in true reconstruction, however, will not come about by chance but must be

planned. This seems clearly to suggest that the Roster should begin now to formulate procedures by means of which it may play its full part in post-war personnel adjustment.

Planning for the post-war period in relation to the Roster should be in two separate but interrelated spheres. In the first place, plans are already being discussed by means of which all highly trained individuals in the armed forces and other war agencies, who are subject to demobilization and who are not listed on the Roster, be included at the earliest possible moment so that the Roster procedures may be used as one agency to assist in efficient demobilization and effective post-

war personnel placement. In the second place, the Roster should now begin to consider, as suggested above in the section on post-war planning, procedures by means of which the continued use of the Roster may assist in the construction of an effective post-war economic and social order. In this connection especial attention is called to the recommendation given in the section under personnel planning that a conference or series of conferences be called to discuss the relationship between the Roster and the prediction of professional and vocational trends in connection with vocational guidance and personnel planning for post-war America.

APPENDICES

APPENDIX A¹

Orientation

On July 28, 1941, final plans began to be formulated whereby the National Roster of Scientific and Specialized Personnel might make specific evaluations of the men of military age registered with the National Roster. This project was to be concerned with their most effective utilization in national war activities, either as civilians or in some branch of the service. Data were to be supplied both to the National Headquarters of the Selective Service System and to the War Department. Preliminary plans had already been worked out by Dr. Leonard Carmichael and Mr. James C. O'Brien, and at an earlier date they had conferred with Mr. Frederic A. Delano and Mr. Thomas C. Blaisdell, Jr., of the National Resources Planning Board; with Gen. Lewis B. Hershey and Lt. Col. Carlton S. Dargusch of the Selective Service System; and with Lt. Col. (then Maj.) C. B. Ferenbaugh of the War Department.

Background data

The first step in setting up the project was to secure information from various sources as to actual needs, or possible needs, for technically trained men in the near future. Conferences were held with representatives of the Defense Unit of the Bureau of Labor Statistics; the Office of the Coordinator and Director of Training of the United States Civil Service Commission; the National Headquarters of the Selective Service System; both the Personnel Procedures Section of the Adjutant General's Office and the Personnel Division of the General Staff of the War Department; and the Shore Establishment Division of the Secretary's Office of the Navy Department. In addition, data were secured from the certification files of the National Roster concerning calls for technically trained individuals and also from the report of Mr. William E. Workmaster dated February 27, 1941.

As a result, it became apparent that there were certain fields represented in the National Roster where the demand for technically trained persons was not very great, but that in other fields individuals with technical skills were very much needed, so much so in fact that in certain areas there was either an actual or an anticipated shortage of experts. As an instance of the fields in which the demand for individuals in war work is not very great, botany and anatomy are con-

venient examples. This is not to say that botanists and anatomists are not important individuals in the field of science; it simply means that there are not many demands for individuals in botany or anatomy, and almost no indications of possible shortages of well-trained individuals in these fields. On the other hand, real needs exist for individuals in such fields as the following:

- Mathematics.
- Naval Architecture and Marine Engineering.
- Aeronautical Engineering.
- Chemical Engineering.
- Civil Engineering.
- Electrical Engineering.
- Mechanical Engineering.
- Mining and Metallurgical Engineering and Mineral Technology.
- Accounting.
- Bacteriology.
- Economics.
- Psychology.
- Statistics.
- Physics and Astronomy.
- Radio Engineering.
- Personnel Administration.

The order of the above list does not indicate order of importance. In fact, one of the most important problems of the work has been that of "priorities," that is, the question of which of the above fields should be dealt with first.

In order for the activities to function smoothly, only one field of specialization could be circularized at a time. However, as will be apparent in a later portion of this report, it is possible to move quickly from one field of specialization to another by circularizing another field just as soon as one is finished, and in the meantime to begin the sorting and evaluating procedures on the previous fields. The plan, then, was to handle the cases in the fields listed above first of all, and then eventually to deal with *every field* of specialization coded in the National Roster.

Forms and Questionnaires

The next step involved the formulation of appropriate form letters and questionnaires. These were worked out, edited, and rewritten many times; and they were checked and approved by the officials of the National Roster of Scientific and Specialized Per-

¹ Prepared by Dr. STUART HENDERSON BRITT, special consultant of the Roster.

sonnel, and with representatives of the following agencies:

National Headquarters of the Selective Service System.
Personnel Procedures Section of the War Department.
Personnel Division of the General Staff of the War Department.
Secretary's Office of the Navy Department.
Division of Statistical Standards, Bureau of the Budget.

Copies of each form and questionnaire² may be listed as follows:

(1) Form Letter 1, to be sent to every man registered with the National Roster who was *born on or after July 1, 1913, and on or before July 1, 1920.*

(2) Green questionnaire to be sent with Form Letter 1, in order to secure the following information: The man's status with respect to Selective Service; a list of those individuals who have the most complete knowledge of his technical skills; the name and address of his employer, if any; and a statement of the exact nature of his present duties, especially insofar as they may relate to national defense.

(3) A mimeographed form, sent with Form Letter 1 (1) and the green questionnaire (2). This mimeographed form is sent in order to prevent registrants from sending us information more than once.

(4) Form Letter 2, to be sent to every man who returns the green questionnaire, except the following:

Reserve officers.

Any individuals now in active service with any branch of the Army or Navy.

Men classified as I-C (member of land or naval forces of the United States).

Men classified as IV-A (man who has completed service).

This form letter instructs the man to notify the National Roster if he is about to be inducted into the Army, and tells him briefly of the plan whereby information concerning his technical skills may be sent to the National Headquarters of the Selective Service System, or to the War Department, or to both.

(5) Confidential letter of inquiry to the reference. In those instances in which an evaluation is to be made, this letter is sent to every individual listed on the green questionnaire as one who has knowledge of the man's technical skills.

(6) Salmon-colored questionnaire, asking for confidential statements from the reference concerning the man. This questionnaire accompanies the Form Letter (5) to the reference.

(7) Confidential letter of inquiry to the employer. In those instances in which an evaluation is to be made, this letter is sent to the employer, if any, listed by the man on his green questionnaire.

(8) A yellow form for confidential statements of the employer. This accompanies the form letter to the employer (7).

(9) A form for recommendation of an individual to the National Headquarters of the Selective Service System as one "who possesses certain special qualifications by reason of which he may now or later become a necessary man in civilian occupation." Instead of using the name of the National Roster, this form is set up on the letterhead of the Selective Service System, with the name of Lewis B. Hershey, Director, appearing at the bottom.

(10) A statement to the War Department concerning any man whose probable date of induction into the Army is known. Information is sent to the Personnel Procedures Section of the War Department on this form, indicating the man's educational training, occupational experience, if any, plus other pertinent data concerning his technical skills and qualifications.

To clarify the statements made under (5) and (7) above—"In those instances in which an evaluation is made"—we are concerned primarily with investigations and evaluations of men in the following classifications:

Not yet classified by their Selective Service Local Board.

Class I-A (available; fit for general military service).

Class I-B (available; fit for only limited military service).

Class II-A (deferred for limited time; necessary man).

Class IV-E (conscientious objector available only for civilian work of national importance).

As indicated above (4), the questionnaires of men in Class I-C (member of land or naval forces of the United States) and Class IV-A (man who has completed service) are simply filed with the Roster questionnaire, and no further action is taken. For men in all other classes, Form Letter 2 is sent (4), but no evaluations are made.

Operating Procedures

The actual machinery for operations may be briefly described as follows:

After due consideration of possible occupational needs and after consultation with other representatives of the National Roster, an order is sent the machine room for the complete tabulation of all men within the field chosen who were born on or after July 1, 1913, and on or before July 1, 1920. The tabulations of the machine room show name, address, what check lists have been filled out, and the principal fields of specialization within the scope of the check lists. The following are then sent in one envelope to every individual listed on the machine tabulation: Form Letter 1 (1), the green questionnaire (2), the mimeographed sheet (3), and a return envelope. On each green questionnaire is stamped the field number and the log number of the man; and the return envelope is stamped with

² Copies of these forms and questionnaires may be inspected at the offices of the Roster or the National Resources Planning Board where they are on file.

his field number preceded by a "7" (used as a symbol on all mail to indicate that it should be routed to this office). The envelopes are counted before being mailed so that there is a record of the number of men circularized in each field.

As soon as the green questionnaires are returned by the individuals, they are sorted according to field of specialization. They are then sorted into three groups within the field of specialization:

1. Those cases where no action is necessary because the man is connected with some branch of the service. (Compare (4) above.)

2. Those cases where an evaluation is necessary because the man is in Class II-B, III-A, or IV (with the exception of IV-E).²

3. Those cases where an evaluation is necessary because the man is not yet classified, or is in I-A, I-B, II-A, or IV-E.

In the first instance—men now connected with some branch of the service—the green form is sent to our files to be combined with the Roster questionnaire, and no further action is taken. In both the second and third groups every individual receives Form Letter 2. In addition, for every individual in the third group, the form letters and questionnaires are sent to his references, and also the form letter and questionnaire to his employer, if any.

Each step in this process is marked in the appropriate space at the top of the green questionnaire with an accompanying date. In all instances where the man falls in the second group, the green questionnaire is returned to the Roster files as soon as Form Letter 2 has been sent. However, in the case of the men in the third group the green questionnaire is sent to the file room with instructions to combine the green questionnaire with the Roster questionnaire and to return both to the Roster office for further evaluation.

As the salmon-colored forms from the references and the yellow forms from the employer come in, they are also combined with the Roster questionnaire and the green questionnaire, ready for evaluation. In every instance where a man indicates, either on his green questionnaire or by telegram or letter, that he is about to be inducted into the Army in the very near future; that is, within the very next few weeks—a special evaluation is immediately begun of his case. In certain instances information is sent to the National Headquarters of the Selective Service System on Form 9; and in all cases where a man is likely to be inducted soon, appropriate information concerning him is sent to the Personnel Procedures Section of the Adjutant General's

Office of the War Department on Form 10. A weekly check is made of all cases ready for evaluation so that, in those instances where the probable time of a man's induction is approaching, a special evaluation may be made of his case. The rest of the questionnaires and other information concerning the men in each field are placed to one side to await evaluation of experts in that particular field.

Evaluations

For each field of specialization represented in the Roster, a letter is sent to the President and to the Secretary of the national society (or societies) in that field several weeks before our green questionnaires go out to men of military age in that field. Copies of the type of letter to these societies are attached herewith as exhibits (11) and (12). In these letters the President and Secretary of the particular society are informed of the general plan; and are asked to name experts in their field who are within easy traveling distance of Washington, D. C., are capable of judging the competence of other men, are over 28 years of age, and would probably be willing to meet in Washington with other experts in their field to evaluate the papers of the men of military age. After nominations have been received, a selection is made of at least three individuals, and they are asked if they would be willing to meet together in Washington, D. C., as a consultative committee (exhibit 13). No compensation is given, but travel and subsistence expenses are paid. Just as soon as the number of questionnaires in a particular field has decreased to a point where only a few are coming in a day, the three members of the evaluating committee are invited to meet together in our offices at the National Roster. Here the entire project is explained to them in all its details, both as to the aspects which concern Selective Service and those which relate to the War Department; and available data as to needs or shortages in their fields are presented.

The committee then begins its evaluation. Available to them are the following for each man: His Roster questionnaire, one or more check lists, his green questionnaire, and as many questionnaires of references and employer (if any) as have been returned. The evaluators are asked to divide the cases into two groups:

1. Those in which the National Headquarters of the Selective Service System should be notified that this man "possesses certain special qualifications by reason of which he may now or later become a necessary man in civilian occupation."

2. Those in which no such recommendation should be sent to Selective Service.

Following these judgments of the evaluators, Form 9 is sent to the National Headquarters of the Selective

² There are also special cases of undeliverable envelopes, and of men erroneously listed as in the age limits stated above.

Service System for all men in the first group. In both groups, Form 10 is filled out and sent to the Adjutant General's Office of the War Department in any instance where a man's probable date of induction is indicated. Information is not sent to the War Department in those cases where probable induction date is unknown. but registrants have been instructed in Form Letter 2 to notify the National Roster of Scientific and Specialized Personnel if they are about to be inducted, and at that time we can write the War Department concerning their technical training and skills.

As soon as recommendations have been sent to the War Department and to the Selective Service System, the Roster questionnaire and all the other data are combined and returned to the permanent files of the Roster.

Illustrative of the above procedures, approximately 810 green questionnaires were sent out to male mathematicians of military age late in September. At the meeting of the 3 expert mathematicians in the middle of October, sets of papers on 324 men were presented to them for evaluation. Of these, 168 were selected by them as papers of individuals who should have information sent to Selective Service concerning their special qualifications, and the remaining 156 as papers of men about whom there should not be any recommendation to Selective Service.

Information for Selective Service and for the War Department

Concerning the Roster's recommendations to Selective Service, six copies are made in each case of Form 9. Three of these copies are retained in the Roster files: One kept in the "Appropriate Action Taken File" of this office, one filed with all other Selective Service forms of the same sort, and one returned to the permanent files of the Roster with the questionnaire. For the three copies which go to the National Headquarters of the Selective Service System, one copy is retained in their files, and two are sent to the appropriate State Director of Selective Service, who in turn retains one copy in his files and sends the other along to the appropriate Local Board. However, the National Headquarters of the Selective Service System has reserved the right to withhold action on any case deemed advisable, although their office is supposed to notify the Roster in such instances.

In connection with the data sent to the Adjutant General's Office of the War Department concerning the technical training of a man who probably will be inducted, the Adjutant General's Office notifies Roster officials very promptly in each individual case as to exactly what action, if any, has been taken. Most frequently this means the Roster is sent a carbon copy of the letter from the Adjutant General's Office to the

Commanding Officer of the Corps Area in which the man is likely to be inducted. In other instances, special letters are received from the Adjutant General's Office concerning the disposal of the case, indicating whether the man is believed to have sufficient technical competence to be of special value to the Army in his field of specialization.

Obviously there is no guarantee that can be given in advance that the information supplied by the National Roster either to Selective Service or to the War Department will result in any special privilege. As for Selective Service, each Local Board has the right to deal with its own cases. As for the Army, the special technical skills of any inductee may be needed by the Army at the time of his induction, or there may be personality factors or other elements which result in his assignment to duties other than those relating to his field of specialization. However, the data supplied by the National Roster have, in general, been of direct assistance to both of the above agencies with respect to classification problems; and we have every reason to believe that the information supplied by the Roster is of very practical use to them.

Individual Cases

In every instance in which a man registered with the National Roster communicates with the Roster, either by letter or by telegram, concerning his possible induction into the Army, he is advised that an evaluation is being made. It is also indicated that, regardless of his eventual classification by his Selective Service Local Board, appropriate data concerning his technical training or qualifications has been or will be sent to the War Department. In general, it has seemed advisable not to tell him directly that the National Headquarters of the Selective Service System either will or will not be advised concerning his case, although there are some exceptions to this general policy. Also, a great deal of correspondence is involved with references, or other interested persons, such as employers and representatives of various scientific societies.

This office is also handling a large number of letters daily from individuals not yet registered with the National Roster but who are of military age and, apparently, because they have heard of our project with relation to Selective Service, now wish to receive a copy of the green questionnaire. In all such cases, the individual is properly registered with the National Roster at the same time that information is secured concerning his status under Selective Service. In addition, in every instance in which a technically trained man of military age informs the Roster that he is about to be inducted into the Army, all appropriate papers are immediately sent him and the process of

evaluation begun just as soon as possible. Even though the field of specialization has not as yet been reached in mailing, it seems essential that each individual case of this sort should receive attention. As the project becomes more widely publicized, the number of such individual cases is increasing. Together with the cases in fields already reached where the date for induction is very soon, this means that a rather large number of special cases must be handled quickly. So far as possible, this is done with the aid of expert evaluators in the field represented; but where the time is so short that this is not feasible, the evaluation is made by members of the executive staff of the National Roster.

This matter is in part related to the information now presented to registrants at Selective Service Local Boards throughout the country. As a direct result of an information bulletin prepared in this office of the Roster, a Memorandum was sent out by the National Headquarters of the Selective Service System to all State Directors on September 29, 1941, in which the purpose and functions of the Roster are described and the suggestion is made that scientifically and technically trained men register with the Roster. This Memorandum instructs all Local Boards to post it on their bulletin boards (exhibit 14). A supplementary Memorandum (exhibit 15) was sent out by the National Headquarters of the Selective Service System on October 17, 1941; this Memorandum refers to the earlier one, and deals specifically with the form sent out on individual cases (exhibit 9).

Men in the Service

In addition to the phases of work dealing with potential inductees, certain aspects of the project relate directly to men already connected with some branch of the service. In this connection, there are three types of problems which are dealt with directly.

First of all, in every instance in which a man who is registered with the National Roster writes with respect to his present assignment to duties, appropriate information concerning him is sent to the Adjutant General's Office in the case of the War Department,

and to the Shore Establishment Division of the Secretary's Office in the case of the Navy Department. The man is also advised by the Roster that information concerning him is being sent to the War or Navy Department, as the case may be; and that department later notifies the Roster what action, if any, has been taken in the case. In certain instances this office then writes to the man again, passing on to him information supplied by the War Department or Navy Department.

In many instances, however, on the basis of available information, it seems expedient not to write the War Department or Navy Department concerning the man; and in such cases he is advised to take up his problem himself through appropriate military channels. In no instance is the National Roster concerned with classification problems in either the Army or Navy unless the man himself writes for advice or assistance. This is mentioned specifically because there have been cases where parents, rather than the men themselves, have written to the National Roster asking for assistance in securing a change of duties of their sons.

In the second place, although the general plan has been to take no action in the case of reserve officers, there have been one or two instances where an employer of a reserve officer has asked the Roster's advice because of the apparent need for the reserve officer as a civilian in work relating to national defense. Since this office is directly concerned with the most effective utilization of men in the national defense program, these cases have been taken up directly with various divisions of the War Department and the Navy Department.

In the third place, contacts are now being made with the Reemployment Division of the National Headquarters of the Selective Service System. Here the attempt will be made to see that men released from the Army will be informed of the purpose and functions of the National Roster of Scientific and Specialized Personnel. It is hoped that the scientifically and technically trained men who are not already registered with the National Roster will thus be informed of its existence, and will be encouraged to register with the Roster in their fields of specialization.

APPENDIX B

The Office of Scientific Personnel has made extensive use of the facilities of the National Roster of Scientific and Specialized Personnel, and has depended in large measure on its files to secure information concerning the men best qualified to give important scientific aid to the governmental agencies cooperating in the war program. Working in close cooperation with the Roster, the Office of Scientific Personnel has selected and secured over 600 men for commissions in the Army

and Navy, in addition to locating men for work in the National Defense Research Committee laboratories and other defense agencies employing scientists.

Dr. Henry A. Barton and Dr. J. C. Morris, chairman and director respectively of the Office of Scientific Personnel, have been appointed to serve as consultants to the National Roster. In this capacity they have been of particular assistance in the fields of physics and radio engineering, in which there are acute shortages.

The Office of Scientific Personnel has cooperated with the Roster in securing lists of names to be included in the fields of physics and astronomy. It is at present handling the recircularization of men trained in these fields for the Roster, and is checking the list of those presently enrolled with the Roster in an effort to make it as accurate, complete, and up to date as possible.

The Roster has called on the Office of Scientific Personnel for suggestions in connection with the working out of suitable procedures by which to inform the local Selective Service Boards of the importance of the civilian duties of a number of men registered in the Roster, and to inform the Army of special qualifications of men chosen for Selective Service. In this connection the Office of Scientific Personnel is assisting Dr. Britt of the National Roster in making recommendations con-

cerning all physicists and radio engineers subject to call for Selective Service.

Where the need for men has been particularly acute, the Office of Scientific Personnel has augmented the information contained in the standard questionnaire by obtaining confidential evaluations of the ability and personal characteristics of the men registered in such fields. This has been done with respect to acoustics, electronics, radio engineering, and optical instruments, and will be extended to other fields as the need arises.

The Office of Scientific Personnel is presently conducting for the Roster a circularization of the physics departments of the American universities and colleges to determine the availability of all physicists expected to secure degrees during 1942.

APPENDIX C
STATISTICAL SURVEY OF THE LEARNED WORLD

Number of Persons Engaged in Scientific and Professional Occupations Arranged by Countries

WESTERN HEMISPHERE

TABLE 1.—Fields 1 to 14

Field No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Accounting	Agricultural sciences, n. e. c.	Anatomy	Animal sciences except veterinary science	Anthropology	Architecture	Astronomy	Bacteriology (includes pathology)	Botany	Chemistry	Dentistry	Economics	Entomology	Forestry
North America:														
United States	191,600		600	17,500	996	22,000	630	2,300	1,300	60,000	77,213	14,436	2,300	14,800
British Honduras										7	4			
British West Indies											177			
Canada		1,300			14	1,298	900			3,318	4,037		190	510
Costa Rica		67		21		11					55			
Cuba					6	443					1,050			
Dominican Republic	38		3			12		1	4	13	148	9		1
Guatemala		5			9						85			
Haiti					4	150					60			
Honduras	972	46				3		12	1	12	96	5		
Mexico		21			74						900			
Nicaragua		5		35		6					45			
Panama		15				83				12	77			
Puerto Rico	992				4	61				375	143			618
Salvador		6		3		2					120		1	
South America:														
Argentina	2,511	209			20	729		1,100		505	4,100		20	
Bolivia		2			2	13				4	50			
Brazil		2,190			14	50				100	10,000			
Chile	2,000	10	2		5	500		20	10	75	800	15		5
Colombia		79		2	9	183				40	650		2	
Ecuador		45			4	60			1		300			
Paraguay		18			1						65			
Peru		30			27	127				18	450			
Uruguay				72	1	350			7	9	725	20	1	7
Venezuela		21		8	4	20					125			

Footnotes: See "Sources of Data," below.

WESTERN HEMISPHERE—Continued

TABLE 2.—Fields 15 to 28

Field No.	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	Aero-nautical engineering	Auto-motive engineering	Chemical engineering	Civil engineering	Electrical engineering	Heating, ventilating, and refrigerating engineering	Mechanical engineering	Mining and metallurgical engineering	Marine and naval architectural engineering	Radio engineering	Safety engineering	Testing materials	Traffic and transit	Other, or all branches of engineering
North America:														
United States.....	\$4,000	\$6,500	\$3,400	102,000	157,800	\$3,300	\$4,300	\$15,000	\$1,500	\$2,570	\$1,114	\$2,000	\$316	-----
British Honduras.....	-----	-----	-----	9	5	-----	6	-----	-----	-----	-----	-----	-----	-----
Canada.....	-----	-----	-----	7,524	3,937	-----	2,859	2,478	1,000	-----	100	-----	-----	-----
Cuba.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	375
Dominican Republic.....	-----	2	10	75	5	-----	8	15	-----	-----	-----	-----	-----	-----
Guatemala.....	-----	-----	-----	89	17	-----	21	-----	-----	-----	-----	-----	-----	17
Honduras.....	-----	-----	-----	55	2	-----	2	1	-----	-----	-----	-----	-----	210
Mexico.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	280
Panama.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	233
Puerto Rico.....	-----	-----	181	576	56	-----	313	-----	-----	-----	-----	-----	-----	-----
South America:														
Argentina.....	-----	-----	-----	1,542	-----	-----	-----	-----	-----	-----	-----	-----	-----	84
Bolivia.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	33
Chile.....	-----	-----	30	100	150	-----	300	400	-----	-----	-----	-----	-----	-----
Peru.....	-----	-----	-----	185	25	-----	25	35	2	-----	-----	-----	-----	33

Footnotes: See "Sources of Data," below.

TABLE 3.—Fields 29 to 42

Field No.	29	30	31	32	33	34	35	36	37	38	39	40	41	42
	Genetics	Geology and geophysics	Geography	History and political science	Horticulture (including agronomy and plant pathology)	Journalism	Law	Landscape architecture	Library science	Mathematics	Medicine	Medical specialties	Meteorology	Nursing
North America:														
United States.....	\$1,020	\$4,770	\$755	\$6,760	\$3,600	\$51,800	\$160,600	\$1,500	\$29,600	\$5,500	\$175,300	\$19,400	\$1,300	\$300,000
British Honduras.....	-----	-----	-----	-----	-----	-----	22	-----	-----	-----	22	-----	-----	-----
British West Indies.....	-----	-----	-----	-----	-----	-----	448	-----	-----	-----	372	-----	-----	-----
Canada.....	-----	-----	-----	-----	417	3,343	-----	-----	374	-----	10,021	-----	-----	-----
Costa Rica.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	170	-----	-----	-----
Cuba.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3,100	450	-----	-----
Dominican Republic.....	-----	4	3	12	29	96	523	-----	19	15	418	-----	-----	-----
Guatemala.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	500	-----	-----	-----
Haiti.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	225	-----	-----	-----
Honduras.....	-----	-----	1	4	5	22	352	-----	-----	-----	190	-----	-----	77
Mexico.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	10,000	-----	-----	-----
Nicaragua.....	-----	-----	-----	-----	4	-----	-----	-----	-----	-----	240	-----	-----	-----
Panama.....	-----	4	-----	-----	58	-----	275	-----	-----	-----	175	-----	-----	-----
Puerto Rico.....	-----	-----	-----	-----	31	101	610	-----	56	-----	583	-----	-----	1,761
Salvador.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	200	-----	-----	-----
South America:														
Argentina.....	-----	-----	-----	-----	248	136	5,584	-----	1,265	-----	11,900	1,160	-----	-----
Bolivia.....	-----	-----	-----	-----	4	-----	176	-----	-----	-----	180	-----	-----	-----
Brazil.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	25,000	220	-----	-----
Chile.....	-----	20	8	25	75	75	2,500	-----	15	3	2,061	-----	-----	-----
Colombia.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,000	-----	-----	-----
Ecuador.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	600	-----	-----	-----
Paraguay.....	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	150	-----	-----	-----
Peru.....	-----	-----	-----	-----	151	-----	550	-----	-----	-----	1,200	-----	-----	-----
Uruguay.....	4	1	-----	-----	120	-----	-----	-----	-----	-----	1,500	80	-----	-----
Venezuela.....	-----	-----	-----	-----	28	-----	-----	-----	-----	-----	1,200	-----	-----	-----

Footnotes: See "Sources of Data," below.

WESTERN HEMISPHERE—Continued

TABLE 4.—Fields 43 to 54

Field No.	43	44	45	46	47	48	49	50	51	52	53	54
	Nutri- tion	Personnel adminis- tration	Phar- macy	Physics	Physi- ology	Psychol- ogy	Social welfare	Social science n. e. c.	Statist- ics	Veteri- nary science	Zoology (biology, if aster- isked)	Miscel- laneous
North America:												
United States.....	400	*3,800	*106,000	*6,800	*650	*3,400	131,000		44,800	112,000	*2,300	
British West Indies.....										24		
Canada.....			4,000	982	200		1,177		37	1,046		
Costa Rica.....			212						7			
Cuba.....			2,500						22			
Dominican Republic.....		2	218	1	6	5	1	4	3	6	1	
Guatemala.....			400						12	3		
Haiti.....			96						5			
Honduras.....			142				2	4	3	3		
Mexico.....			10,000						23			
Nicaragua.....			150						13			
Panama.....			154						6	3		
Puerto Rico.....			250					518		26		
Salvador.....			150						5			
South America:												
Argentina.....			10,000		300				35	371		
Bolivia.....			75						14			
Brazil.....			6,150						45			
Chile.....	5	10	1,850	4	3	3	40	5	25	40	10	
Colombia.....			1,000						42			
Ecuador.....			500						18	12		
Paraguay.....			100						9			
Peru.....			800						10	7		
Uruguay.....			1,000						14		*98	
Venezuela.....			1,000						15	2	7	

Footnotes: See "Sources of Data," below.

EASTERN HEMISPHERE

TABLE 5.—Fields 1 to 14

Field No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Account- ing	Agricul- tural sci- ences, n. e. c.	Anat- omy	Animal sciences except veteri- nary science	Anthro- pology	Arch- itecture	Astron- omy	Bacteri- ology (includes pathol- ogy)	Botany	Chemis- try	Dentist- ry	Econom- ics	Ento- mology	Forestry
Europe:														
Belgium.....						1,000							227	
Bulgaria.....					14	500			72		15		52	
Denmark.....					51	1,200	500		318	200		676	125	
Eire.....	673				41	560				145	1,115			
France.....		10,050			157	8,000			600	950				
Germany.....			319		320	36,000		300	900	14,000	12,120		400	5,000
Great Britain.....	13,944	10,500			720	16,637	1,000			15,000	14,722	5,000	700	1,350
Hungary.....					5	725				568				
Italy.....		735			70	6,000			206	300		432		
Latvia.....						97			75	305		370	382	191
Norway.....						110					1,061			
Romania.....					53	344					131			
Soviet Russia.....		31,700			17	5,000						1,107		
Sweden.....					112	625			430	550			250	2,148
Switzerland.....					51	1,500				830	1,188			5,600
Yugoslavia.....					35	181					353			
Asia, Africa, etc.:														
British Malaya.....	784				4	90				8				
Ceylon.....	75					8				23	43			
China.....					35									
Dutch East Indies.....											133			
India.....					16	220					4,022			
Japan.....					400		910			4,332	17,984			
Thailand.....					1	21								
Australia.....	4,241				24	1,555		85	231	1,987	3,139			
Egypt.....					9	207					593			
Union of South Africa.....					82	730					724			

EASTERN HEMISPHERE—Continued

TABLE 6.—Fields 15 to 28

Field No.	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	Aero- nautical engi- neering	Auto- motive engi- neering	Chemical engi- neering	Civil engi- neering	Electrical engi- neering	Heating, ventilating, and refrigerating engi- neering	Mechanical engi- neering	Mining and metallurgical engi- neering	Marine and naval architectural engi- neering	Radio engi- neering	Safety engi- neering	Testing materials	Traffic and transit	Other, or all branches of engi- neering
Europe:														
Bulgaria.....														220
France.....				580										
Germany.....	1,000		5,796	5,272	30,723	1,500	44,518							
Great Britain.....	1,478	2,900	878	11,548	17,058	1,000	12,295	3,050	2,500					
Hungary.....														2,000
Italy.....					820									7,975
Latvia.....							367							270
Norway.....					166									3,150
Romania.....														106
Soviet Russia.....														35,000
Switzerland.....														1,000
Turkey.....														95
Yugoslavia.....				432			154							1,500
Asia, Africa, etc.:														
British Malaya.....		18	4	43	50		47	22	9					119
Ceylon.....														19
India.....														12,500
Japan.....	1,478		7,628		9,400		17,796	3,776						21,390
Thailand.....														44
Australia.....				1,832										746

TABLE 7.—Fields 29 to 42

Field No.	29	30	31	32	33	34	35	36	37	38	39	40	41	42
	Genetics	Geology and geo- physics	Geogra- phy	History and pol- itical science	Horti- culture (includ- ing agron- omy and plant pathol- ogy)	Jour- nalism	Law	Land- scape archi- tecture	Libray science	Mathe- matics	Medi- cine	Medi- cal special- ties	Meteor- ology	Nursing
Europe:														
Belgium.....		294	800							200		644		
Bulgaria.....		65					376				330			
Denmark.....		350			450					117	800	674		
Eire.....						786	1,759		259		1,953			5,534
France.....					1,800									
Germany.....		1,450	1,000			17,277				1,100	51,067	5,573		286,000
Great Britain.....	113	1,370	6,600							1,250	38,304	3,132	700	
Hungary.....											3,700	353	280	
Italy.....						1,475					16,972			
Latvia.....					467					156	1,073			
Norway.....			950	300			892				2,000		20	
Romania.....							1,132				323	2,106		
Soviet Russia.....							2,315				120,000			
Sweden.....				600							1,879	580		
Switzerland.....						300					3,500			
Turkey.....							9,496				10,900			
Yugoslavia.....							2,380				4,747			
Asia, Africa, etc.:														
British Malaya.....							218				120			
Ceylon.....											830			360
China.....			400								6,761			
Dutch East Indies.....											1,288			1,510
India.....											89,068			
Japan.....				900							52,792	8,388	582	56,590
Thailand.....							28				111			
Australia.....		74					3,522	4,630	1,363		4,769	175	49	19,739
Egypt.....											3,524			
Union of South Africa.....											3,098			5,571

EASTERN HEMISPHERE—Continued

TABLE 8—Fields 43 to 54

Field No.	43	44	45	46	47	48	49	50	51	52	53	54
	Nutri- tion	Personnel adminis- tration	Phar- macy	Physics	Physi- ology	Psychol- ogy	Social welfare	Social science n. e. a.	Statist- ics	Veteri- nary science	Zoology (biology, if aster- isked)	Miscel- laneous
Europe:												
Belgium.....				160							*150	
Denmark.....			200			49					*230	
Eire.....										507		
Germany.....			18,220	1,500			13,014			6,307	450	*1,285
Great Britain.....					480	750	7,248		1,050	2,264	*1,172	*1,700
Hungary.....			600			70		1,703				*1,000
Italy.....				47				15		569		*19
Latvia.....			156							139		
Norway.....											*100	
Romania.....										68		
Soviet Russia.....										17,000		
Sweden.....									190			
Switzerland.....			900							550		
Turkey.....			96									
Yugoslavia.....			1,500								*30	
Asia, Africa, etc.:												
British Malaya.....			26									
Ceylon.....										9		
China.....				218	112							
Dutch East Indies.....			121									
India.....										4,368		
Japan.....			21,802	100						2,100	638	*1,632
Thailand.....			7									
Australia.....			2,793				136			277		
Egypt.....			879							367		
Union of South Africa.....			1,440									

- 1 Roentgenology.
 2 Tropical medicine.
 3 Home economics.
 4 Archeology.
 5 Ceramics.

Sources of Data

NORTH AMERICA

United States:

¹ Census, 1930.

² Membership of professional society, from National Research Council Bull. 101, 1937.

³ Data from National Roster files, 1941.

⁴ Miscellaneous official sources.

British Honduras: West Indies Yearbook 1939, for legal and medical fields; Census of 1931 for engineering.

British West Indies: West Indies Yearbook, 1939.

Canada: Census of Commonwealth, 1931; society membership from National Research Council Bull. 101, 1937.

Costa Rica: See "Fields" below.

Cuba: Minerva, 1937, for engineers; "Fields" below for others.

Dominican Republic: Data from U. S. diplomatic representative, 1941; see also "Fields" below.

Guatemala: Census of Capital, 1938; see also "Fields" below.

Haiti: See "Fields" below.

Honduras: Data from U. S. diplomatic representative, 1941; also from Census of 1935.

Mexico: Minerva, 1937, for engineers and architects; see also "Fields" below.

Nicaragua: See "Fields" below.

NORTH AMERICA—Continued.

Panama: Census, 1930, for other than "Fields" below.

Puerto Rico: Medical Directory, 1940, for doctors; all others, Census, 1935.

Salvador: See "Fields" below.

SOUTH AMERICA

Argentina: Data from U. S. diplomatic representative, 1941; Minerva, 1937, for society memberships; and "Fields" below.

Bolivia: Anuario Kraft and "Fields" below.

Brazil: See "Fields" below.

Chile: Data from U. S. diplomatic representative, 1941; see also "Fields" below.

Colombia: See "Fields" below.

Ecuador: See "Fields" below.

Paraguay: See "Fields" below.

Peru: Green Guide, 1938-39 for fields other than those listed in "Fields" below.

Uruguay: Minerva, 1937, for other than "Fields" below.

Venezuela: See "Fields" below.

EUROPE

Belgium: Minerva, 1937, and Index Generalis, 1939, for society memberships.

Bulgaria: Minerva, 1937, for society memberships.

Denmark: Minerva, 1937 for society memberships; also "Fields" below.

EUROPE—Continued.

- Eire: Census, 1936.
 France: Minerva, 1937; Index Generalis, 1939.
 Germany: Census, 1933; Minerva, 1937; Index Generalis, 1939.
 Great Britain: Census, 1930; Minerva, 1937, Brit. Med. Directory, 1940; Dentists' Reg. of United Kingdom; Kalendar, Royal Inst. Brit. Architects.
 Hungary: Minerva, 1937.
 Italy: Census, 1936.
 Latvia: Statistical Annual, 1937.
 Norway: Census, 1930; Minerva, 1937.
 Romania: Romanian Annuary, 1931-32; Bucharest Annuary, 1937.
 Soviet Russia: Data from Embassy of U. S. S. R.; "Planned Economy," 1939, No. 7; and other sources.
 Sweden: Minerva, 1937.
 Switzerland: Census, 1930.
 Turkey: Census, 1935; Turkish Commerce Yearbook, 1931.
 Yugoslavia: Statistical Annual, 1938-39, for medical and dental fields; Commercial Directory, 1934-35; and Annuaire Oriental, 1932, for other fields.

ASIA, AFRICA, OCEANIA

- British Malaya: Singapore and Malayan Directory, 1939.
 Ceylon: Ferguson's Ceylon Directory, 1940.
 China: Interior Dept. Yearbook, 1936, for physicians; Minerva, 1937, for all others, except anthropologists.

ASIA, AFRICA, OCEANIA—Continued.

- Dutch East Indies: State Yearbook, 1938, for all fields.
 India: Census of India, 1931; see also "Fields" below.
 Japan: Jap. Dept. Comm. Yearbook, 1934, for engineering fields; Jap. Labor Yearbook, 1933, for medical and related fields; Minerva, 1937, for other fields.
 Thailand: Stat. Yearbook, 1937; Directory for Bangkok and Siam for legal field.
 Australia: Census of Commonwealth, 1933; see also "Fields" below.
 Egypt: Statistical Annuary, 1937-38, for medical and related fields; see also "Fields" below.
 Union of South Africa: Official Yearbook, 1939; see also "Fields" below.

Fields

- Statisticians: Survey, Inter-American Statistical Institute, 1940, for all American republics.
 Anthropologists: International Directory of Anthropologists, 1940, for nearly all countries.
 Architects: Fifteenth International Congress of Architects, 1939, except for British Empire; for Great Britain and possessions, Kalendar, Royal Institute of British Architects, 1938-39.
 Medical Professions: Data compiled by Pan American Sanitary Bureau, 1941, for all American nations, for fields of medicine, dentistry, and pharmacy.
 Agricultural Scientists: Data from 1940-41 survey of American republics by Division of Agricultural Cooperation of Pan American Union.

APPENDIX D

National roster of scientific and specialized personnel, distribution by professional field, sex and extent of education, Sept. 1, 1941

Field of specialization	Male						Female						Combined					
	Doctorate	Master	Bachelor	4 years college, no degree	Others	Total	Doctor of philosophy	Master	Bachelor	4 years college, no degree	Others	Total	Doctor of philosophy	Master	Bachelor	4 years college, no degree	Others	Total
Languages.....	2,403	1,109	1,310	107	477	5,406	382	498	288	9	89	1,266	2,785	1,607	1,688	116	506	6,672
Genetics.....	391	136	74	11	59	671	44	28	8	2	84	435	184	82	13	61	755	
Zoology.....	1,379	897	562	28	281	3,147	121	78	35	13	247	1,500	975	597	28	294	3,394	
Physiology.....	504	40	9	1	1	554	50	10	4	1	64	554	50	13	1	1	618	
Botany.....	613	183	65	2	5	868	128	64	14	1	208	741	247	79	3	6	1,076	
Bacteriology, immunology, and pathology.....	1,252	271	282	17	40	1,862	132	78	87	8	16	321	1,384	349	269	25	56	2,183
Anatomy.....	439	21	12	1	3	476	45	4	1	1	50	484	25	13	1	3	526	
Tropical medicine.....	236	27	18	1	4	285	9	3	1	1	13	245	30	18	1	5	298	
Chemistry.....	6,950	6,937	18,345	1,201	3,347	36,780	395	441	748	41	47	1,672	7,345	7,378	19,093	1,242	3,394	38,452
Physics.....	2,420	1,576	1,280	80	209	5,565	87	103	55	2	9	256	2,507	1,679	1,335	82	218	5,521
Mathematics.....	1,732	1,467	678	26	38	3,541	170	371	202	5	6	754	1,502	1,838	880	31	44	4,205
Geology.....	505	982	1,972	147	477	4,483	27	38	24	7	96	332	1,020	1,996	147	484	4,579	
Actuarial science.....	9	93	267	8	99	476	3	11	1	1	15	9	96	278	8	100	491	
Speleology.....	17	6	13	2	26	64	1	1	1	1	1	17	6	13	2	20	64	
Horology.....	135	1,616	5,814	291	1,355	9,211	135	1,616	5,814	291	1,355	9,211	135	1,616	5,814	291	1,355	9,211
Civil engineering.....	4	76	313	51	269	713	4	76	313	51	269	713	4	76	313	51	269	713
Marine engineering.....	9	41	366	59	584	1,059	9	41	366	59	584	1,059	9	41	366	59	584	1,059
Safety engineering.....	2	31	125	8	100	266	2	31	125	8	100	266	2	31	125	8	100	266
Traffic engineering.....	107	347	903	73	702	2,132	1	1	2	2	6	108	348	905	73	704	2,138	
Radio engineering.....	69	201	564	35	236	1,105	1	10	3	1	16	70	211	567	36	237	1,121	
Testing material engineering.....	331	593	1,903	137	316	3,280	2	12	1	1	16	331	595	1,915	138	317	3,296	
Chemical engineering.....	226	1,336	5,394	218	1,203	8,377	2	3	8	1	2	16	228	1,339	5,402	219	1,205	8,393
Electrical engineering.....	114	1,055	4,495	287	1,476	7,427	3	5	2	2	11	117	1,055	4,600	288	1,478	7,438	
Mechanical engineering.....	2	12	69	9	121	213	3	3	2	3	3	2	12	69	9	124	216	
Motion pictures engineering.....	48	215	1,047	99	1,141	2,550	4	4	4	4	4	48	215	1,047	99	1,145	2,554	
Automotive engineering.....	55	328	1,627	138	986	3,134	55	328	1,627	138	986	3,134	55	328	1,627	139	988	3,137
Aeronautical.....	99	303	1,125	97	1,104	2,728	4	6	11	1	10	32	103	309	1,130	98	1,114	2,760
Management engineering.....	18	158	851	95	693	1,815	1	1	3	3	5	19	159	851	95	696	1,820	
Heating and ventilating engineering.....	330	854	2,729	154	611	4,678	5	2	4	1	12	335	856	2,733	154	612	4,690	
Mining and metallurgical engineering.....	1,042	806	398	17	104	2,367	61	61	27	1	160	1,103	867	425	17	105	2,517	
Economics.....	1	39	175	35	392	642	3	1	1	1	6	1	42	176	36	393	648	
Accounting.....	1,523	629	123	6	9	2,290	434	384	58	1	878	1,957	1,013	181	7	10	3,168	
Psychology.....	234	119	69	14	21	457	47	28	26	11	112	281	147	95	14	32	569	
Anthropology.....	1,885	1,068	348	17	48	3,366	235	299	65	16	615	2,120	1,367	413	17	64	3,981	
History and political science.....	284	868	894	81	496	2,623	64	482	284	19	112	961	348	1,350	1,178	100	608	3,584
Personnel administration.....	53	37	5	4	99	17	73	34	4	6	130	70	110	39	10	229		
Speech pathology.....	535	529	433	25	103	1,625	60	86	84	4	5	239	595	615	517	29	108	1,864
Statistics.....	209	135	73	8	41	466	22	36	25	15	98	231	171	98	8	56	564	
Geography.....	423	245	95	3	17	783	49	56	38	1	8	150	472	301	133	4	23	933
Sociology.....	30	241	504	43	148	966	3	70	146	9	37	265	33	211	650	52	185	1,231
Recreation leadership.....	993	822	635	21	67	2,538	27	17	7	2	53	1,020	839	642	21	60	2,591	
Horticulture, agronomy, and plant pathology.....	135	982	2,267	71	416	3,871	1	1	5	2	8	136	982	2,272	71	418	3,879	
Forestry and range management.....	349	650	5,867	67	258	7,211	1	4	20	1	26	350	684	5,887	57	250	7,237	
Animal sciences.....	28,095	28,111	64,114	3,782	18,743	142,845	2,628	3,343	2,353	109	448	8,881	30,723	31,454	66,467	3,891	19,191	151,726