

Training Scientific Personnel

By William Oncken, Jr., Director of Training
Naval Ordnance Laboratory

Those of you who have read the recent report of the President's Scientific Research Board¹ will recall a number of significant findings, of which some are of special interest to training organizations in Federal and industrial scientific and technological establishments. I have selected three for your particular attention which have important training implications.

1. Expenditures for research and development by all three segments of the research triangle—the Government, Industry and the Universities—totalled more than \$1.1 billion in 1947, of which about half was spent on military development work and half on industrial research. This is six times the figure for 1930, is nearly double the average for 1941-1945, and is the highest figure in our history. By 1957 we should have at least doubled our budget for this purpose. (Vol. 1, pages 12 and 13.)

2. Manpower resources (scientific and engineers) increased at only about one-tenth of the rate of research and development expenditures during the critical period of 1940-1947. This disparity was due both to the sharp contraction in the production of technically trained personnel during the war and to the exceptional rate at which research and development expenditures expanded. (Vol. 1, page 16.)

3. Since the Federal and industrial scientific manpower shortage must not be alleviated at the expense of the University teaching staffs whose task it is to turn out fresh talent, the laboratories must themselves place still greater emphasis upon the scientific aspects of their personnel development programs, and must do so in cooperation with our academic institutions. (Summarized from Vol. 1, pages 23 and 58.)

It is the purpose of this paper to describe the Scientific Personnel Development Program at the Naval Ordnance Laboratory, a program evolved during and after the war

to meet its manpower utilization requirements, which were typical of the requirements of research and development laboratories all over the nation. The findings of the President's Board cited above have clarified the current scientific manpower situation and have provided us with a frame of reference within which we may interpret current trends in the industrial training field. This discussion then, will be limited to those aspects of personnel development at the Naval Ordnance Laboratory which grew out of the conditions reported on by the President's Scientific Research Board.

The Laboratory is made up of about 1,800 persons of whom one-third are professional scientists and engineers. The remaining two-thirds compose the supporting administrative, fiscal, clerical and labor forces. Since its principal output is new ordnance items, for production in most cases by private contractors, the laboratory is not concerned with actual production, advertising or sales and is not burdened with the kind of administration which such functions would entail. Commanded by Rear Admiral Frank E. Beatty, USN, and under the scientific and technical direction of Dr. Ralph D. Bennett, it is primarily a civilian activity working for the Navy Bureau of Ordnance on projects not otherwise assigned to private contractors.

There are three personnel development programs in operation directed toward our scientific and engineering personnel and two which are concerned with the clerical and labor groups. The latter two are operated along lines well established by the Navy Department for its shore establishments and will not be elaborated upon here.² The first three are entitled:

1. Professional Advancement
2. In-service Specialized Training
3. Vestibule Training

We shall briefly take up each of these in order.

1. Particularly Volume One, entitled "A Program for the Nation," August 27, 1947. Obtainable from U. S. Government Printing Office at 20c per copy.

2. See "The Navy's Civilian Training Program," by Capt. S. L. Owen, *Journal of Industrial Training*, November-December, 1947, for a full discussion of this phase of Navy Civilian Training.

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Professional Advancement programs are concerned with assisting younger scientists and engineers in gaining professional competence and recognition. Their objective is an elevation of the scientific potential of the laboratory both through the development of personnel already employed and through the attraction such programs will hold for the kind of superior talent we are endeavoring to employ. These programs are:

The Graduate Study Program

Through a cooperative arrangement with the nearby University of Maryland, the Naval research agencies in the Washington area have been able to set up a large variety of graduate scientific and engineering courses on Government premises just after working hours. They are taught in most cases by Government scientists and are given full residence credit by the University toward advanced degrees in the physical sciences, mathematics and engineering. Of these, seven courses are held at the Naval Ordnance Laboratory and 235 of its professional employees are enrolled in the inter-agency Graduate Study Program. Through arrangements concluded with several graduate schools throughout the country, there are now six candidates for the doctorate employed by the Laboratory on Naval research projects which also satisfy the thesis requirements of those institutions and will be fully accredited by them for degree-granting purposes. In order to assist younger employees to pursue planned and coherent academic programs as opposed to haphazard accumulations of credit hours, an Advisory Committee on Graduate Study has been established in the Laboratory. It is composed of some of our top scientists, engineers and technical administrators, and includes a member of the Training Division.

Professional Society Activities

Through another Laboratory-wide group, the Committee of Professional Society Representatives (representing 15 of the 40 societies having members throughout the Laboratory), means are sought to encourage participation in professional society activities. The Training Division has a member on this committee whose responsibility it is to implement its recommendations as indicated by the Techni-

cal Director. Thus far, administrative and fiscal policies have been formulated to facilitate the presentation and publication of the results of research and engineering programs through society meetings and the Journals. It is also concerned with advising on the policies followed by the Administration in trying to select wisely and fairly the persons whom it sends to professional society meetings of interest and significance. Last year one of our senior scientists was sent to Paris to present a paper at a meeting of a scientific society of which he is a member.

Specialized In-Service Training. In order that the Laboratory may be better able to assume the work load placed upon it by the Navy Bureau of Ordnance, there must be constant improvement in the existing correspondence between the knowledges and skills available in our 564 scientists and engineers. When shifting emphases in fleet requirements reduce this correspondence appreciably, the adjustment must often be made through specialized courses tailored to meet the need. In addition, the Laboratory has itself become the only activity possessing the facilities and experience necessary for work in certain highly specialized fields. Expansion of any one of these fields within the Laboratory requires the training of personnel who are transferred to it. Finally, there are a number of "know-how" courses which are given principally for general work improvement. The titles of some of these in-service specialized courses currently available are: Automatic Regulation, Ammunition Handling for Safety, Technical Report Writing, the Fire Control Problem, Design of Experiments, Design for Quantity Production, Basic Principles of Ordnance Design, and Micro-wave Engineering (seminar).

Although such courses as these are administered by the Training Division, this does not give the whole picture. The primary responsibility for personnel development is shouldered by the line supervisor, who will therefore often go ahead on technical training programs for his own section without calling on the Training Division for assistance. Classes of this kind are conducted informally during working hours and relate directly to

the work at hand. They may range from a series of talks on "The Nature of Underwater Explosions" to another series on "Electronic Memory Circuits." One division of the Research Department runs a weekly series of technical talks on matters relating to research in supersonic aerodynamics, and invites a number of outside speakers each year to address this series.

The Training Division, on the other hand, is usually called upon to assist in setting up those specialized, technical training programs for which no single instructor can be found, or for which no body of subject matter has yet been assembled and organized for instructional purposes, or to set up courses involving a considerable amount of administrative detail. The Training Division maintains performance records on all employees taking courses operated by it. Employees taking instruction directly from their supervisor are, of course, not formally graded. The supervisor's own evaluation of the individual's overall performance is more important and becomes part of the official record when efficiency ratings are made out.

Vestibule Training. This involves five separate programs, each discussed in the paragraphs below.

● Junior Professional Training Program is a one-year course for newly hired college graduates. It is, in a manner of speaking, an "aptitude" test, but unlike conventional psychological tests it takes a year to administer. At the year's end some of the trainees will be transferred to the permanent laboratory staff, the others may be dropped. Some of those who are retained receive a substantial increase in pay. Of the twelve months devoted to this training program, ten are spent in an on-the-job rotation schedule, while the remaining two are spent in the classroom. The two kinds of training alternate so that between two rotational assignments there will be a short classroom term. At the close of the program the Training Division compiles the following data on each trainee:

- 1) Extent of participation (voluntary) in the Graduate Study Program.
- 2) The ratings supplied for on-the-job periods by each supervisor on each trainee.
- 3) Grades earned by the trainee in the classroom phases of the rotational program.

These data are used by the Technical Director and the department heads in determining the disposition of each trainee when the year is over.

The program has a number of advantages: first, it insures that only the better trainees are allowed to join the permanent staff; second, it shortens the time usually required to match round pegs and round holes; third, it serves to induct the trainee into the Laboratory's working team so that he will know what to expect of his supervisor and what his supervisor should expect of him; and fourth, the trainee will be stimulated to consider carefully what direction his professional development should take.

At present there are fourteen trainees participating—all June, 1947 graduates. Two others were lost to "outside competition" offering better pay. Ironically one of these was another Federal Agency.

● Student Aide Summer Work Program is designed primarily to serve as summer employment for science and engineering students, starting with juniors and continuing through the final stages of graduate study. This program has been made possible by the Civil Service Commission and is being engaged in by other Government scientific activities. The Laboratory will take on twenty students this summer as a pilot group, and will expand the program in subsequent years if successful. Perhaps its success will be judged largely on the extent to which we will be able to induce the superior ones to seek permanent employment at the Laboratory when their formal schooling is over. In any case, it will be an excellent screening device for our Employment Office.

● The Cooperative Education Program is in the planning stage only. It envisions an arrangement similar to those common to some industries whereby a student will spend six months or so alternately in school and in the Laboratory, until he obtains his degree. This will provide an economic advantage for the student as well as an opportunity to gain some professional maturity along with his studies. The Laboratory would have the advantage of having plenty of time to "screen" each student so that only the better ones are offered permanent positions. Students finally hired under this program would probably not

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need to go into the Junior Professional Training Program described above, but would be assigned directly.

● The Naval Reserve Program is part of the Navy's emergency manpower mobilization plan. Practically all the scientists and engineers who served as Naval Officers during the last war are still in the Naval Reserve. They have the privilege each year of requesting two weeks' active duty at sea or at any Naval shore activity in which they have a professional interest. With the help of the Navy Bureau of Ordnance, the Laboratory has been able to build up an evergrowing technical manpower reserve which the Bureau has earmarked for duty at the Laboratory in case of a national emergency. It is the purpose of these annual two-week training periods to keep this reserve oriented toward the scientific and administrative problems of the Laboratory so that when called to active duty they may be able to assume positions of responsibility almost immediately.

● The Ordnance Postgraduate Program is participated in by the Laboratory as a service to the Post Graduate School of the Naval Academy. Regular line officers specializing in ordnance are sent by that school to a number of Naval ordnance establishments for varying lengths of time. These range from two weeks to two years, depending upon the degree of specialization sought. Eventually a few of these officers will be assigned to the Laboratory in positions of responsibility. While under training they are assigned to work directly with operating scientists and engineers, and are called together frequently for technical lectures by Department and Di-

vision Chiefs. This close contact between the career scientist and the career Naval Officer on the working level is as important to the latter as to the former in the shaping of their attitudes toward Naval Research.

The program is not intended to make an engineer or scientist out of a Naval Officer, but to place him in training situations in which he can gain the perspective he will need to be able to assume administrative responsibilities involving civilian scientists. For experience has shown a considerable incompatibility to exist between the scientist bent on developing one of the scientific disciplines and the Naval Officer who has spent his life cultivating another kind of discipline. This incompatibility can be dealt with effectively at the working level. Essentially, then, this program is designed to assist in preparing Naval Officers for future positions of responsibility in the administration, but not in the supervision, of military scientific research.

The Naval Ordnance Laboratory is but one small part of the entire Naval Establishment, which in turn is a small part of the Federal Government. Little of what is described in this paper could have been accomplished without the cooperation of other Federal activities in the Washington area, the assistance of the University of Maryland, or the forward-looking policies of the Civil Service Commission. The result is that this Laboratory and some of its sister Naval Laboratories having similar personnel development problems are finding themselves in an increasingly better position to hire, develop and retain their fair share of the nation's best scientific talent.

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