edge." But, regarding the second, he speaks of special relativity as follows in the Appendix quoted above: "All convection, uniform translatory motion [in free, *i.e.*, empty aether], would then be indeterminate, there being no standard frame in which to locate it . . .: it in no way discredits the theory of an aether, unless the intrinsic atoms of matter can be abolished also." Larmor characterizes Einstein's postulate of relativity as an "algebraic correspondence," "masquerading in the language of kinematics." The second gravitational theory of relativity of Einstein (1915) is epitomized as an "auxiliary construct," while "the absence of space and time and motion in the auxiliary construct is against reality."

It is distinctly interesting to observe that although Lorentz followed the brilliant new theories with all attention and determination, yet there remained in his mind vestiges of similar feelings. Thus he states in his Leyden Lectures 1910–12 (Silberstein-Trivelli's translation): "If we do not like the name of the 'aether' we must invent another name as a peg on which to hang all these things," and "can not deny to the bearer of all these properties a certain substantiality; and if so, then one may in all modesty call true time the time measured by clocks which are fixed in this medium and consider simultaneity a primary concept."

One may sympathize with, and admit the accuracy in detail of Larmor's position in regard to the relativistic theories: it is true that the work of Fitzgerald, Larmor, Lorentz and Poincaré had shown the special theory of relativity to be "just around the corner"; but it was only Einstein who grasped the significance of the actual situation. It is likewise true that the general theory of relativity of 1915 has not effectively entered into physical speculation; yet this second achievement of Einstein has also exerted a considerable influence on the course of physical thought. In fact it has been Planck and Einstein together who have broken the magical spell which the classical concepts of Newton had cast over scientific and philosophical thinking.

Larmor's mathematical-physical contributions extend over the entire classical field. His papers are extremely thoughtful and always repay careful reading. In the field of electromagnetism his contributions have been especially influential. Larmor's formula for the rate of radiation of energy from an accelerated electron is well known to all physicists, and the dispersion formulas due to him and Lorentz have been very useful.

When occasion required, he brought in subtle mathematical considerations, and always had the greatest appreciation of purely mathematical work. Indeed a number of his papers are essentially mathematical in character. His Presidential Address of 1916 before the London Mathematical Society, "The Fourier Harmonic Analysis and its Scope in Physical Science," shows a deep intuitive insight into the nature of these remarkable series, and a wide knowledge of their extremely varied applications.

Larmor was a well-known and much valued figure at International Mathematical Congresses, being a participant in the Rome Congress of 1908 and the three succeeding congresses at Cambridge, England (1912), at Strassbourg (1920) and at Toronto (1924).

The unmistakable impression which one gathers from his activities and writings, and from accounts by those who have known him, is that of a life of absolute sincerity and of unselfish devotion to the highest ideals, scientific and personal. He had a deep sympathy with younger people as witnesses, for example, his bequest to the University of Cambridge for medical and surgical assistance to the younger members of the faculty.

His own attitude is clearly revealed at the end of the first part of his Presidential Address, referred to above, where he tries to look forward in the midst of the First World War to "the promise of nobler and more disinterested times." Perhaps, in the midst of the second World War, we could not close in any way that would be more in accord with his outlook upon life than in voicing, as he did, the hope expressed by Shelley:

> The world's great age begins anew,
> The golden years return,
> The Earth doth like a snake renew
> Her winter weeds outworn.
> . . . . .
> A brighter Hellas rears its mountains
> From waves serener far,
> A new Peneus rolls his fountains
> Against the morning star.

WHAT MORE CAN ENGINEERING COLLEGES DO THROUGH ESMWT?[1]

By Dean GEORGE W. CASE

DIRECTOR OF ENGINEERING, SCIENCE AND MANAGEMENT WAR TRAINING DIVISION (ON LEAVE AS DEAN OF THE COLLEGE OF TECHNOLOGY, UNIVERSITY OF NEW HAMPSHIRE)

THIS topic is stated as a question. In line with the policies established since this program began, the effort will be to furnish information that may be useful to the institutions in answering the question

[1] Address at the fifty-sixth annual conference of the Association of Land-Grant Colleges, Chicago, October 28, 1942.

for themselves. This information will be in the nature of a progress report covering the period since Dean Seaton's report as director of ESMDT, made to this group one year ago.

By way of review, you may recall that the EDT program, starting in December, 1940, and with all courses closing before September 30, 1941, had a total of 120,000 enrolments. The ESMDT program, which was getting well under way one year ago, had a total for the year of about 438,000. In the current program, which is called Engineering, Science and Management War Training (ESMWT), the last available report shows 107,000 enrolments in classes active or completed. In addition, courses have been approved to start with additional authorized enrolments of 160,000.

The appropriation for the EDT program was $9,000,000, of which about 8¾ million had been allotted to approved courses at the close of the fiscal year. The ESMDT program had an original appropriation of 17½ million dollars, and a supplemental appropriation of 3 million, which unfortunately was not available until about May 1. This made a total of 20½ million available, of which about $20,300,000 was allotted to approved courses at the close of the fiscal year on June 30, 1942. The ESMWT program has an appropriation of 30 million dollars. This program started off very actively on July 1 with about 500 course proposals on hand to be approved as soon as the fiscal year had begun. Since July 1, proposals have been approved at about the rate of 1,000 per month, and with the preliminary estimated costs amounting to about 3 million dollars per month or at the rate of 36 million dollars for the fiscal year. It may be expected that the program will accelerate after the summer months are over, and on this basis an appropriation of 30 million dollars hardly looks sufficient. However, the office has learned by experience to expect a decrease of 20 to 30 per cent. between the cost estimates on preliminary proposals and the actual cost of the courses due partly to estimates being for a maximum enrolment. It appears from the figures available so far that the needs for training will make full use of the appropriation, or that they may somewhat exceed the appropriation. However, up to the present time, it has not been considered advisable to seek a supplemental appropriation.

In the plans for a program for 1943–44, a budget request has been submitted for an appropriation of 40 million dollars. This is based upon estimates of the Department of Labor that an employment peak for war workers will be reached about December, 1943.

There have been a number of developments in the nature of the program, one of the most significant of which is the increase in the number of women being trained. In the EDT program, the enrolments of women amounted to 811 out of a total of 120,000, or less than .7 of 1 per cent. In the ESMDT program, the enrolments of women amounted to 38,000 out of a total of 438,000 or nearly 9 per cent. In the ESMWT program, the enrolment of women has been running about 16 or 17 per cent. and is expected to increase.

A large number of the women are being enrolled in engineering drafting courses; others in ordnance inspection courses; still others in courses for the training of chemical technicians; and a number in the management field. The Civil Service Commission is requesting a full-time course of about ten weeks by which they hope to qualify women graduates in arts and sciences to take positions as junior engineers in federal services for which the commission recruits personnel.

Another trend in the program which appears to be increasing is full-time courses in which the students receive pay while they are in attendance in the course. This practice was established by the Army and Navy in such courses as Ordnance Inspection, Radio Inspectors or Technicians, etc. These courses, which include only civilian personnel, have run in length from about eight weeks to 26 weeks. In addition, the number of courses for commissioned officers has increased somewhat.

During this calendar year, full-time courses in which industry paid the students while attending have appeared in California and New Jersey. The number of such courses is small at the present time, but it does appear that industry in a number of states is interested in this method of securing trained employees. They are experimenting with it cautiously. If their needs become more urgent, this program may include more full-time courses on this basis.

The Civil Service Commission is also interested in the organization of courses on this full-time basis with pay. In these cases, the pay of the trainees would have to come from the departments of the government in which the trainees are to be employed. It is not certain at the present time how far this movement will go.

One development worth noting is the effort of the Civil Service Commission to make use of training which has already been given in ESMDT and ESMWT courses. The commission has taken from the files the names of several thousand trainees in fields in which they had urgent demands. They are sending application forms to these men at the rate of 2,500 per week and they report that they have secured applications from about 6 per cent. of this group. In order that the program may provide this service to the Civil Service Commission without interfering with the plans of industry, enrolment cards of men destined for industry should be stamped "Industry"

before being sent to Washington. The commission has also established the practice of surveying the lists of courses as they are approved, and attempting to get applications from the trainees in selected courses while the courses are in progress. About 3,000 trainees are being contacted per week in this manner at the present time, but it is too early to know how successful this effort will be.

One year ago the ESMDT program was engaged in the establishment of the course in Ultra-High Frequency Techniques at 40 engineering schools to meet an urgent need in the manufacture, operation and maintenance of aircraft detection equipment. The establishment of this course was preceded by an instructors' conference at the Massachusetts Institute of Technology, held in November, 1941. Before the fiscal year had closed, this course had been conducted in 45 institutions and had been given to about 1,100 senior students in electrical engineering or with majors in physics. At the close of the school year, the number that had been secured by the Army and Navy for the operation and maintenance of their aircraft detection equipment was small due to delay in contacting the men. Since that time, however, it appears that others have gone into the Army or Navy for this type of service.

During April and May, the institutions which had conducted these courses secured from their previous electrical engineering graduates about 1,100 applications for commissions in the Army or Navy, to enter upon this specialized field. From these applications, nearly 400 men were commissioned and sent to special full-time courses, including the Ultra-High Frequency Techniques. These men are now in service.

The schools are equipped and are willing to train additional groups of commissioned officers selected from the graduates of previous years, but the difficulty lies in finding such groups to be commissioned and trained. A recent canvass by the ESMWT office of 3,300 graduates secured less than 100 replies, indicating a lack of interest in commissions and training for this field. It appears that the primary service of the schools in Ultra-High Frequencies will be found in giving this course to their senior students.

During the summer, 20 additional institutions were authorized to conduct this course for their seniors, and a second instructors' conference was held at the Massachusetts Institute of Technology about September 1, at which representatives of 60 institutions were present. It is expected that in the 65 institutions participating in this work during the present school year approximately 1,300 senior students will receive the training, and it is evident that this year the Army and Navy intend to be much more prompt in contacting these men and securing more of them for the armed forces.

During the year the program had some experience in using radio broadcasting. The National Association of Broadcasters and associated stations, upon requests or encouragement from the Army and Navy, conducted a vigorous campaign of soliciting students in Fundamentals of Radio and the ESMDT office went along with this effort for a few weeks. It soon became evident, however, that this method of contacting and enrolling trainees had two serious faults. First, the number that could be enrolled by this method in a popular subject like radio was much more than the ESMDT funds could care for. Second, the method was not sufficiently selective. In the flood of applications most institutions were unable to select those who were likely to enter radio industry or radio service in the armed forces, and too large a percentage of the training appeared to be serving no immediately useful purpose in the war effort. Accordingly, this method of enrolment was discontinued.

There was and is, however, an urgent need for radio technicians, and when the supplemental appropriation became available, this training was resumed in a more orderly way with enrolments to be restricted to those employed in the radio industry, those enlisted in the Signal Corps reserve or those who were definitely headed for one of these services. Radio announcements have recently been used again quite successfully by having the announcement made or controlled by officers of the school or of the Signal Corps.

The complete story indicates that carefully controlled radio announcements, coupled with careful selection of applicants, may be quite useful, but that an uncontrolled broadcasting campaign is hardly compatible with efficiency in training for immediate service.

The ESMWT director and staff are constantly facing questions as to what may be included under this program. The Appropriation Act provides for courses to meet the shortage of engineers, chemists, physicists and production supervisors in fields essential to the national defense. It is always embarrassing when a well-planned course to meet some really urgent need must be disapproved on the ground that it has not been legally authorized in the act. But the Budget Bureau and Congressional committees have made it clear that even in this war emergency this limitation in the Appropriation Act should be observed with due care.

Doubtful borderline cases are often referred to the legal staff for a ruling. The question of training navigators for service at sea or in the air has been discussed by the Regional Advisers, the National Advisory Committee, and finally referred to the legal counsel of the Federal Security Agency. Excerpts from this opinion were sent to the institutions. The opinion does not support our giving courses in navi-

gation for deck officers or airplane pilots under the act appropriating funds for the ESMWT program.

On the other hand, a course in navigation requested for engineers in the Engineers' Corps of the Army has been considered acceptable. Likewise, courses in sanitation may be given for engineers but not for health officers. The act authorizes us to approve courses that are needed for the training of engineers, chemists, physicists and production supervisors, but this authorization does not include the same courses for persons engaged in other activities.

Courses to train teachers for teaching in this program have never been questioned, but the legality of courses in mathematics and physics for high-school teachers was not clear and no steps were taken in this direction until a legal ruling in their favor had been obtained. This favorable ruling was based upon the need for this training to meet teacher shortages which would affect adversely the qualifications of high-school graduates to take courses in engineering and physics. During the past summer, such courses were approved as an aid in providing high-school students with the foundation necessary for engineering training and thus being a step towards meeting the shortage of engineers. These courses will be continued on a part-time basis to upgrade high-school teachers where institutions find it feasible.

For high-school teachers in the more remote areas where the need is most acute, the correspondence method of instruction has been adopted after some study. This correspondence method will be limited to one standard course in physics and one in mathematics. The outlines and lesson materials for these are being prepared by a committee of experienced correspondence method teachers, headed by Dean F. O. Holt, of the University of Wisconsin. The courses will be made conveniently available to all sections of the country through about 20 institutions with long experience in conducting correspondence courses.

These borderline cases have been mentioned to indicate the type of questions that must be answered one way or the other. The institutions have accepted in a cooperative spirit the decisions that were reached, even though they may have had difficulty in agreeing with some of them.

There have been newspaper reports of overhead reorganizations in Washington affecting this program, and many here present may have questions whether this will affect the program. So far, no direct effect on the working of the program has been apparent.

This program operates in the Office of Education through powers and responsibilities delegated to the director by the commissioner of education. The Office of Education until recently has been entirely within the Federal Security Agency, of which Paul V. McNutt is the administrator. A recent order by the President transferred the functions relating to war training in the Office of Education from the Federal Security Agency to the War Manpower Commission, of which Mr. McNutt is chairman. The effect of this order is to change the organization under which the program operates. In the War Manpower Commission, President Edward C. Elliott, of Purdue University, as the chief of the Professional and Technical Personnel Division, has general direction of this program as well as that of the National Roster of Scientific Personnel, and the Procurement and Assignment Service for Physicians, Dentists and Veterinarians.

The War Manpower Commission operates many designated activities through 12 regional directors who have authority throughout their regions. These designated activities include the training programs below college level, but not the college-level training.

In general, then, it appears that so long as Dr. Elliott is satisfied with the conduct of the program, and so long as the War Manpower Commission system of regional directors is not imposed on this program, this change in overhead organization will not materially affect the conduct of the program.

In conclusion, it is hoped that this progress report has been of interest and that it will be of assistance to the colleges in answering the question proposed as the topic of this paper.

OBITUARY

HARRISON ESTELL HOWE

HARRISON ESTELL HOWE, editor of *Industrial and Engineering Chemistry,* died from a heart ailment, at his Washington home on December 10, 1942. He was sixty years old and had been editor of the publication for twenty-one years. His demise brought to a close a remarkable life devoted to the service of the chemical profession. Under his editorship *Industrial and Engineering Chemistry* rose to the foremost publication in its field and exerted great influence during the years of rapid expansion of industrial chemistry.

Dr. Howe was born in Georgetown, Ky., in 1881, a son of William James and Mary (Scott) Howe. He was educated at Earlham College, Richmond, Ind., where he received a B.S. degree in 1901. He did post-graduate work in chemistry at the University of Michigan and at the University of Rochester, receiving the M.S. degree from the latter institution in 1913.

What was to be a long and profitable association with chemical industry began for Dr. Howe in 1902 when he became chemist for the Sanilac Sugar Refin-