# I

## M.I.T. IN 1939

WHEN THE GERMANS invaded Poland in the early autumn of 1939 the Massachusetts Institute of Technology was preparing to enter its seventy-fifth year. The years since 1865 had witnessed a steady growth with some larger jumps which are not of concern to this story. In the seventy-four years completed, the original registration of 69 students who greeted President Rogers in the fall of 1865 had become 1,000 after 36 years, but had not gone over 2,000 until the return of veterans from World War I, when it reached 3,000, mounting briefly to 3,500 in 1921–22. This 3,000 figure had remained relatively stable during the twenty years between crises, stable in number if not in distribution.

In 1935 the Institute had adopted a stabilized enrollment plan which was, by 1939, in its fourth year and hence fully operative; freshmen registrations were 605 out of 1,621 applicants. The total undergraduate enrollment was 2,379, and 721 graduate students brought the total to 3,100. This enrollment was no mere congregation of local residents; more than 70 per cent of all the students came from outside Massachusetts, 60 per cent from outside New England, 33 per cent from outside the North Atlantic States; 7 per cent were not from the United States at all, coming from 41 nations, including both Germany and Poland, the original combatants of 1939. In that year this graduate student registration was the largest in the history of the Institute and represented 170 American colleges and universities and 61 foreign institutions.

The 10 staff members, all professors, who had cared for the education of President Rogers' 69 had grown to an also rela-

tively stable figure of 683, of whom 282 were of faculty rank. The ratio of number of students to number of staff members was beneficently low, and this was the result of intention. In 1929, a decade before, for example, the staff had numbered 515, or 20 per cent less, for a student body of almost exactly the same size.

Spearheaded by the generosity of George Eastman, who contributed $20,500,000 to the growth of Technology, the original zero endowment of President Rogers had become, in 1939, $36,000,000, the seventh largest held by an educational institution in the United States. The original rented classrooms in the Mercantile Library Building on Summer Street in downtown Boston had become, in this same fateful year of 1939, a congeries of buildings and equipment valued at $16,000,000, as contrasted with a valuation of $7,000,000 in 1916. President Rogers' tiny first budget, magnified only to $86,000 by 1881, had grown for 1938–39 to an expenditure of $3,203,300, the largest in the Institute's history up to that time. The annual operating budget was derived 58 per cent from student fees, 35 per cent from investments, 7 per cent from other sources; expenditures for strictly educational purposes, on the other hand, accounted for 70 per cent of the annual expenditure.

Since 1916 the Institute had occupied the new buildings designed by Welles Bosworth for the Charles River site in Cambridge. On that date of occupancy the buildings had provided the students and staff of Technology with approximately 680,000 square feet of *working* space. Between 1916 and 1939 about 345,000 square feet had been added so that in the first year of crisis there was a total of some 1,025,000 square feet available.

The 3,100 students of 1939 were enrolled in 17 different departments and were taking 32 basic curricula,[1] all related to science or engineering. Many of these curricula had been pioneered by the Institute.[2]

By 1939 research work had been undertaken by various staff

members of the Institute which was to lay the groundwork for many of the most important war research projects later undertaken at Technology. This was true, for example, of the laboratories dealing with such diverse subjects as instruments, servomechanisms, electronics, radioactive materials, aeronautics, rapid analysis, X-ray, high voltage. In facilities, and in trained personnel to operate them, the institution had been preparing unconsciously for a crisis which it could not have foreseen; when the crisis came it was ready.

By 1939 the crisis could begin to be discerned clearly, even though the nation was at that time involved only spiritually and even though the spiritual involvement was not shared by all its citizens. In July, 1939, Dr. Karl T. Compton, President of the Institute, decided to canvass the alumni for information a year earlier than would have been necessary for the Register of Former Students. Therefore a questionnaire for the Register as well as one for the Placement Bureau was sent out on September 30, 1939, the opening paragraph of which read:

> Since war began in Europe we have observed here at the Institute an increase in the demand for trained men, especially on the part of industry. I am convinced that this demand will continue to grow as our country adjusts itself to the new conditions imposed by the foreign conflict.

The questionnaires were then totted, and the results enabled the Institute in 1940 to recommend men for key positions both in government and in industry.

The time was not ripe for the Institute to turn its activities to war, but the storm clouds were described accurately enough by Dr. Compton, in his ninth annual report to the Corporation in October, 1939, when he said:

> Our first duty, in this time of turmoil and danger, is to carry on our normal educational program as effectively as possible and with a minimum of confusion. Whatever course future events may take, the world will need young men versed in science and skilled in the arts of its application to promote human welfare.

After defining the Institute's second duty as the expansion and improvement of its efforts in research for public service, Dr. Compton continued:

In the third place, we should be alert to the needs and opportunities for service to our country in direct proportion to the degree of national emergency which may exist. For example, certain technical problems of national defense might properly now engage the attention of our staff which, under less portentous circumstances, should be given a lower priority or left to other auspices. If ever the extreme situation of a struggle for existence of our country or its ideals should befall us, then I am sure that we should do as we did in 1917 – temporarily subordinate our normal educational and research program, and place all our facilities at the disposal of the nation with suitable arrangements for their wise use.

A year later Germany controlled western Europe, and England was beginning her period of travail at the hands of the Luftwaffe. The situation was entirely clear to the Institute's president in his 1940 report, rendered fourteen months before the Japanese struck at Pearl Harbor. In this tenth annual report he said:

We are fortunate to serve an institution whose objectives in respect to national needs are so clear-cut and constructive. Established at a time when technically trained men were needed to develop uses for our great national resources and to pioneer in the new industrial era, the Massachusetts Institute of Technology has had no reason to change its basic objectives, whether in times of prosperity or depression, of peace or of war. Engineers are ever more needed to operate and improve the productive industries of the country; scientists are ever faced with opportunities to make discoveries which will create new industries and employment, or improve health and comfort, or add to the satisfactions of intellectual achievement; business men with technological training are increasingly able to cope with their problems as compared to those without it in this technological era. And in a time of military crisis, technological efficiency in production as well as in design of instruments of defense and offense is the basic element of national defense.

In my report last year, as the European war was just begin-

ning, I submitted my opinion that the Massachusetts Institute of Technology's greatest service, in threat of war as in time of peace, was to continue as efficiently and uninterruptedly as possible, its program of technological education and scientific research. That opinion still holds; but the progress of events has called for some new definitions of policy and modifications in procedure.

Where we possess facilities of personnel or equipment which can contribute in especially significant ways to the national defense program, we should direct them to this effort, always guided by our best evaluation of the national importance of this effort in comparison with other ways in which these same personnel and facilities might be used. We should make this possible by postponing less urgent research projects, by internal rearrangement of teaching schedules, and by carrying a more than normal per capita burden of work. We should not permit our facilities, many of which are unique, to be tied up in work of a type which can be well performed by many other agencies, and we should, in so far as possible, hold our staff together as a working unit. The teaching and research staff is certainly more effective intact than it would be dispersed, and as an integrated organization can exert a greater force for national defense.[3]

Dr. Compton then went on to describe ways in which this program was already being implemented, ways which are the theme of this book and which will therefore be expanded later. Even at this early time special training courses had been inaugurated; the wind tunnels and certain other laboratories were working full time on military problems. More than two dozen of the staff were specifically mentioned as having left for war duties; they were merely the scouts of a larger hegira to come.

The future was then predicted with great accuracy by Dr. Compton:

If the national emergency should become acute, the foregoing arrangements may have to be modified. It is conceivable that many of the Reserve Officers remaining on our staff may be called to active service, and that the number of regular students may be materially decreased. We may have to transform our activities very largely in the direction of emergency technical training courses and

war research. If so, we are prepared to carry on with as close adherence as may be possible to the basic policies and ultimate objectives which have guided us in the preceding arrangements.

Fourteen months before the attack on Pearl Harbor, therefore, M.I.T. had begun to mobilize. A year later, and two months before the attack, the Institute's president could report that more than two hundred officers and members of the Institute staff were engaged as experts for various operating or advisory agencies of the government, that those in this category whose salaries had continued to be paid by M.I.T. had contributed more than 50,000 man-hours to this service, that defense research contracts with the Army, the Navy, and the National Defense Research Committee had already been made which totaled more than the annual budget of the Institute in 1938–39. From this point on, the acceleration was rapid and by the time of the next report, ten months after war had been declared, every sinew of the Institute had been stretched tight as a partner in the national effort.

What this meant in detail will appear in the pages which follow. In general it meant that of the 680-odd staff listed in the fall of 1939 more than a third were away, on leave of absence or not, carrying on war activities of primary importance; that because of war contracts for research and little decrease in teaching responsibility the total staff on the Institute lists reached at the August, 1945, peak a figure of 6,200 or nine times normal; that at the 1944–45 peak the annual budget for the Institute was $44,354,800 or nearly fourteen times the 1938–39 figure; that the budget for supported research alone, also at the peak, was $39,970,900; that building space had been increased by 475,000 square feet or nearly 50 per cent. As was expected, war research made inroads on civilian graduate registration, and the Selective Service, paying little heed, in the long run, to the national need for technological education, reduced the civilian student body from the normal 3,100 of 1939 to a low of 1,165 in March, 1944, thus returning this registration to the totals of the decade 1890–1900. This reduction was partly compensated for, especially in the heart

of the war, by various special service courses, the ASTP for a short time and the Navy V-12 for longer, but even with these additions the total registration in the last two years of the war declined from 3,600 (November, 1943) to a low of 1,870 (March, 1945), or to about the pre-World-War-I level. This decline was equally marked in the Graduate School, where a normal 1939 enrollment of over 700 had been reduced to 349 in the fall of 1945, with a very large proportion of those who remained coming from foreign countries which were either not at war or were only nominal combatants.

These are the cold statistics of the Institute's contributions to the victory. They suggest little save that in a great event of this sort the Institute, like any other significant national institution, was significantly affected. The quality of the contribution needs more extensive analysis in order that it may be assessed; and it is this quality which is the subject of the succeeding chapters.

## FOOTNOTES

[1] Aeronautical Engineering, Meteorology, Architecture, City Planning, Biology and Public Health, Biophysics and Biological Engineering, Building Engineering and Construction, Business and Engineering Administration, Chemical Engineering, Chemical Engineering Practice, Chemistry, Civil Engineering, Economics and Engineering, Electrical Engineering, Electrical Engineering (Cooperative), Electrochemical Engineering, Food Technology and Industrial Biology, General Engineering, General Science, Geology, Marine Transportation, Mathematics, Mechanical Engineering, Mechanical Engineering (Cooperative), Metallurgy, Ceramics, Mining Engineering, Naval Architecture and Marine Engineering, Naval Engineering, Naval Construction, Physics, Sanitary Engineering. Even with this plethora of selection, 30 students, most of them juniors, were unclassified.

[2] Among them, as professional courses, are Architecture in 1865, Electrical Engineering separated from Physics in 1882, Chemical Engineering in 1888, Naval Architecture in 1893, Electrochemistry in 1901, Public Health (with Harvard) in 1910, Architectural Engineering in 1923, Aeronautical Engineering in 1926, Industrial Biology in 1927, Meteorology in 1928, and Food Technology in 1935.

[3] This proved to be more desirable than events made possible. The demand for individual services away from M.I.T. was simply too overwhelming to make achievement possible more than in part.