

THE ROYAL NAVAL ENGINEERING COLLEGE, MANADON

BY

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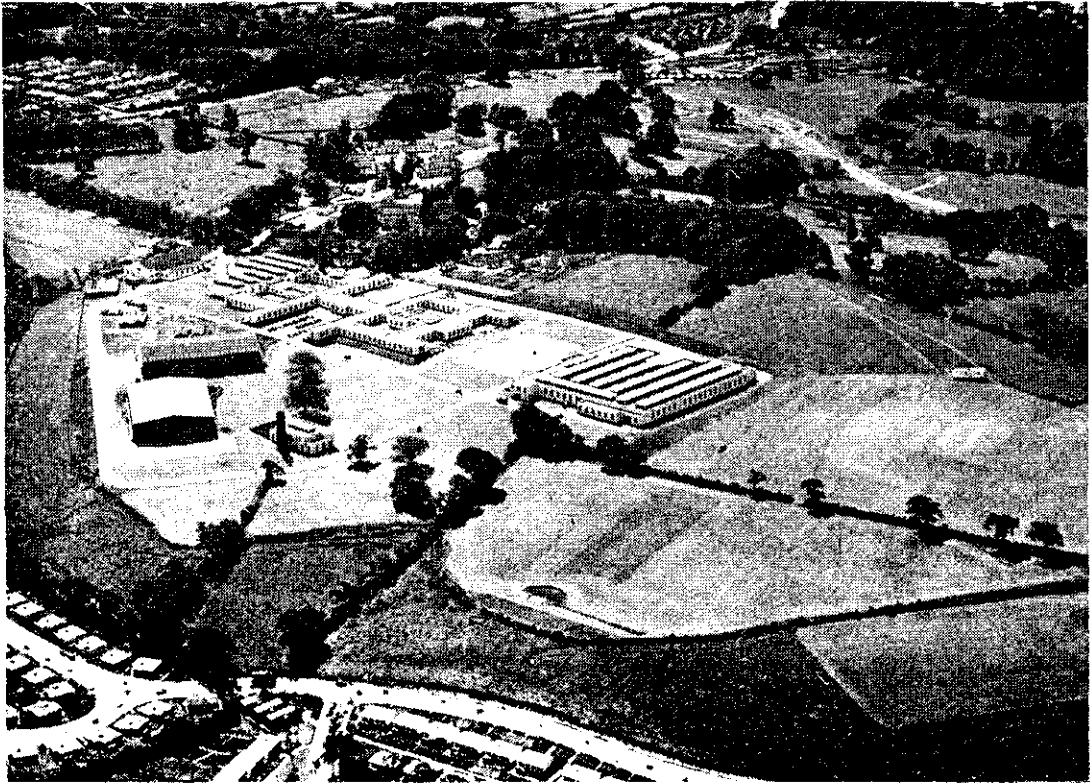
In Vol. 8, No. 1 of the *Journal of Naval Engineering*, there appeared an article entitled 'Keyham 50 Years Ago', which described the Royal Naval Engineering College, Keyham, and the course of training undergone therein by engineer officers at the turn of the century. It seems appropriate that an article describing H.M.S. *Thunderer*, the Royal Naval Engineering College, Manadon, and the courses of training some fifty years later, should follow. As was the case then, the Navy still trains its own engineer officers; in fact, it has done so for nearly three-quarters of a century, and experience in two world wars has confirmed the wisdom of this policy. It is the function of H.M.S. *Thunderer* to continue the training required to provide both leaders and mechanical engineers for the Navy. Its aim is to give modern training, of the highest possible standard, correctly adapted to each of these needs.

Background

Until quite recent times, the task of the Royal Naval Engineering College was comparatively straightforward. Although the Navy was then much larger, the machinery was straightforward, and the college existed almost solely to produce engineer officers capable of looking after men, and of operating and maintaining the ships of the fleet. There were no sidelines, though a few officers later sub-specialized in torpedo-tube engineering or in ordnance gunmounting engineering. Aero-engineering was in the hands of the Royal Air Force, which was entirely responsible for the operation and maintenance of the aircraft in carriers at sea. It will be seen, therefore, that the college had to produce, in the main, officers who were good all-round practical marine engineers, who could confidently expect to spend most of their service life at sea.

A small number of officers were trained to a higher standard and, after a short period at sea, spent much of the remainder of their service career in the technical sections of the Engineer-in-Chief's Department at the Admiralty. In conjunction with industry, a small amount of research and development was directed by these officers, but it can be stated quite fairly that progress in marine engineering virtually stagnated between the two wars, and that new classes of ships which were built and joined the fleet at that time, showed little advance on their predecessors, and their machinery was broadly similar to that fitted in merchant ships.

In the 1930s, several events took place which had a tremendous impact on the Engineering Branch. The growing realization that Germany was rearming in earnest, gave a great impetus to marine engineering since it was apparent that, in the event of war, the fleet would be virtually obsolete. Much more money was made available for building better and more efficient ships. The old, slow-running direct-drive turbine sets, with reciprocating auxiliary



THE ROYAL NAVAL ENGINEERING COLLEGE FROM THE NORTH-WEST

machinery, had given way to higher speed main turbines with reduction gearing and turbo-driven auxiliaries which, together with higher steam pressures and temperatures, greatly increased efficiency and endurance. The shipowners, recovering from the slump, had neither the time nor money for research and the risks of trying out new machinery, and so ordered 'the same again'. The Royal Navy had, therefore, to enter the field of research in earnest, as the merchant ship machinery no longer suited its requirements.

After many years of discussion, the R.A.F. handed over to the Navy the control of the growing naval air branch, and the Fleet Air Arm came into existence. This brought its attendant problems and necessitated the development of a team of specialized naval engineer officers to maintain and test its aircraft, and to deal with the flight deck machinery which became more complex as launching speeds increased. In gunnery, the rapid development of fire control systems and the greatly increased rate of fire, made necessary other specially qualified engineer officers to maintain the resultant complicated mountings.

It is clear that the ever-increasing momentum of advance in the science and practice of engineering since the latter part of the nineteen-thirties, make necessary, in the Navy, highly trained professional engineers. Moreover, they must not only be competent to operate and maintain the equipment within their specializations, but have also to be able to deal on level terms, with industrial firms and give a lead to industry and science on naval design matters.

Because of this wide range and diversity of requirements in present day naval engineering, it has become necessary to introduce, within one branch, three distinct sub-specializations, namely marine, ordnance and aeronautical engineering.

THE COLLEGE

The original college, built within the precincts of H.M. Dockyard, Devonport, when naval engineering was in its infancy, was opened in 1880. Though it served its purpose for many years, its classrooms and built-in equipment naturally became outmoded and its accommodation for 150 officers under training, quite inadequate. It is impossible, geographically, to expand the site to accommodate the present total, which includes representatives of Commonwealth and Foreign navies, of about 320 officers or about 90 per year.

In 1936, the Admiralty purchased an estate of 100 acres at Manadon, near Crownhill on the outskirts of Plymouth, as a site for a new college. Manadon House, for several centuries the seat of the Hall-Parlby family, stands in the grounds. It is an early 17th century building, designed perhaps by Inigo Jones, and beside it is one of the very few surviving ancient stone-built Dutch tithe barns. These two old buildings lend to the college an aspect which is in contrast with the modern buildings designed to house machinery, aircraft and other equipment of the mid-twentieth century.

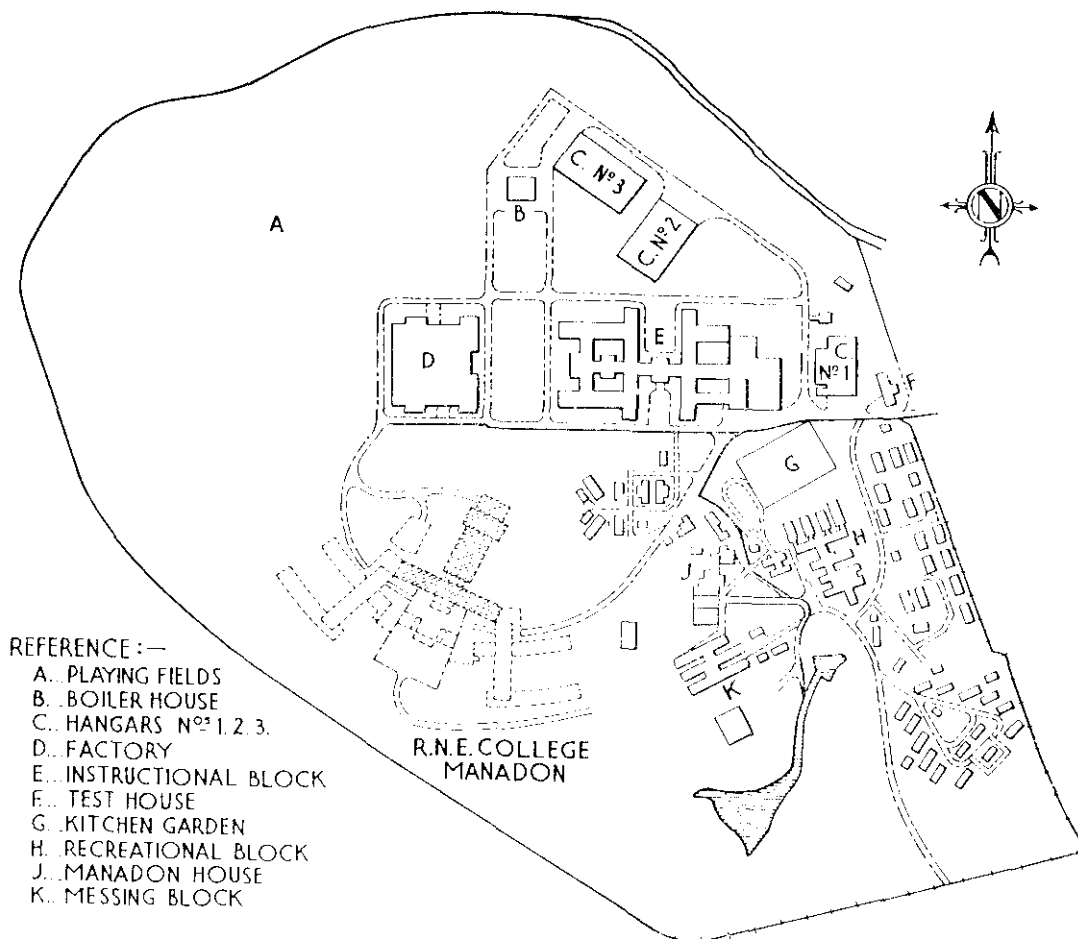
The new college was opened in May, 1940, the building developments having been made partly on a temporary and partly on a permanent basis. Living accommodation still consists of 'Ministry of Works' type huts. The temporary recreational block and No. 1 permanent hangar were completed in 1941 and the permanent instructional block (eastern section) was in use by 1945. World War II held up the complete transfer of the college from Keyham to Manadon, but nevertheless a million pounds were spent during the war on buildings and equipment.

During 1944-46 additional building was progressed under what was termed the First Building Programme. This programme included a further portion of the instructional block, containing classrooms and laboratories in permanent construction, two pentad type hangars, and living accommodation in temporary construction. In 1946 the whole establishment, comprising the old college at Keyham and the growing college at Manadon, was commissioned as H.M.S. *Thunderer*, under the command of a Captain (E).

The second phase of building included the completion in 1951 of the instructional block (which now covers 5 acres) and the engineering workshops locally known as the 'factory'. The former contains modern scientific laboratories and lecture rooms which, together with the workshops, form the nucleus of what it is hoped will comprise the finest engineering training facilities in the country.

As it stands, however, the college as a whole is still incomplete, and the following buildings have yet to be built :

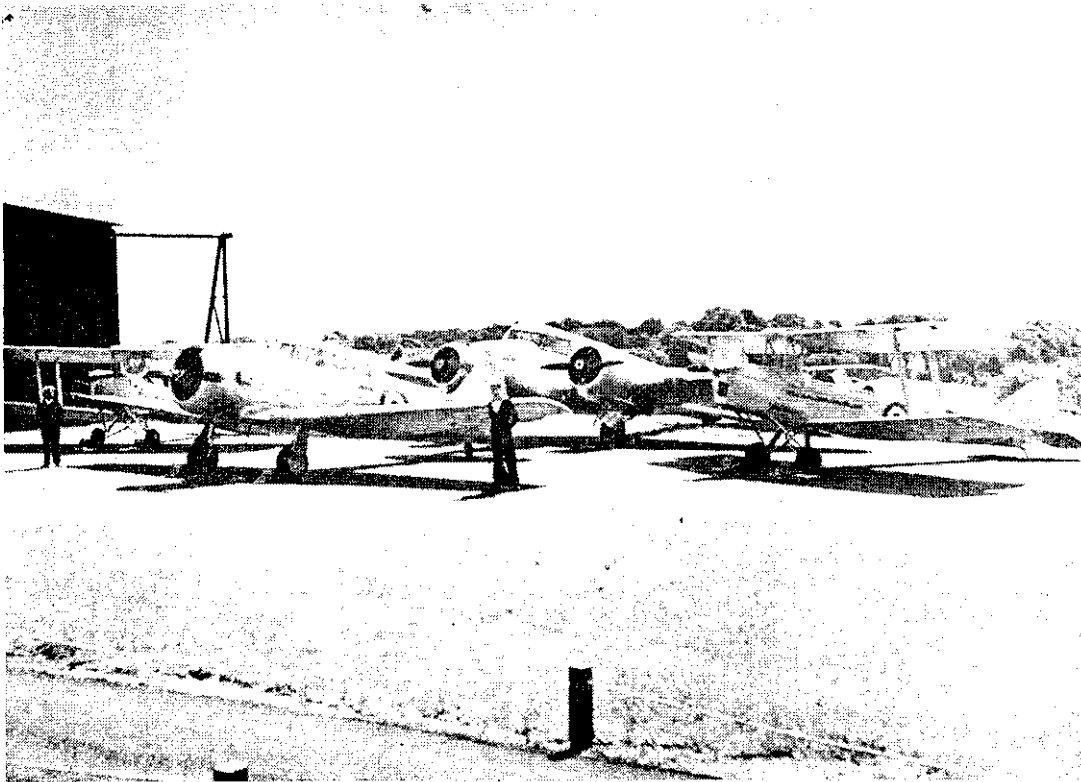
- (a) Permanent accommodation block for a total complement of 500 (including the staff), to enable all officers to be accommodated at Manadon, and to replace the temporary huts.
- (b) Electrical engineering laboratory to replace the obsolete one still in use at Keyham. Eventually all the existing buildings at Keyham will be taken over by Devonport Dockyard Technical College.
- (c) Laboratories for the study of aero-structures and aero-dynamics to replace existing temporary facilities.
- (d) A modern engine test shop to replace the obsolete shop still in use at Keyham.



Meanwhile, it is still necessary to use parts of the old college at Keyham, excluding the instructional block, and about 150 officers live there. The Mess Hall, claimed to be the second oldest mess in the Royal Navy, is used for important dinners as, even though it will only seat 175, it is preferable to the Nissen huts in which the officers at present dine at Manadon. Approval has at last been given to start building in 1955 part but only part of the new accommodation block. When complete this will provide messing accommodation and ante-rooms for 500 and, although the hutted cabins will have to remain in use until the whole of the new block is completed, there will be sufficient cabins to enable those at Keyham to be dispensed with.

RECREATIONAL FACILITIES AND AMENITIES

Nearly all forms of sport are catered for and officers are given every encouragement to take part in as many as possible. The old sports ground at Keyham was presented to the college by Lord St. Levan early this century. It comprises a rugby pitch, still among the finest in the West Country, a hockey pitch, cricket square, tennis courts and a pavilion. At Manadon there is plenty of space for playing fields, and as laid out at present, there are 2 rugby, 1 hockey, 2 soccer pitches, and a cricket square. None of these are, however, properly levelled and, until this can be done, Keyham remains the venue for first-class fixtures. Other facilities at Manadon include 3 hard and 2 grass tennis courts (two of the former having been presented by the Nuffield Trust), 2 squash courts and a fine gymnasium, which can be rigged for basketball and badminton, and in which college dances are held.



THE FLIGHT AT ROBOROUGH

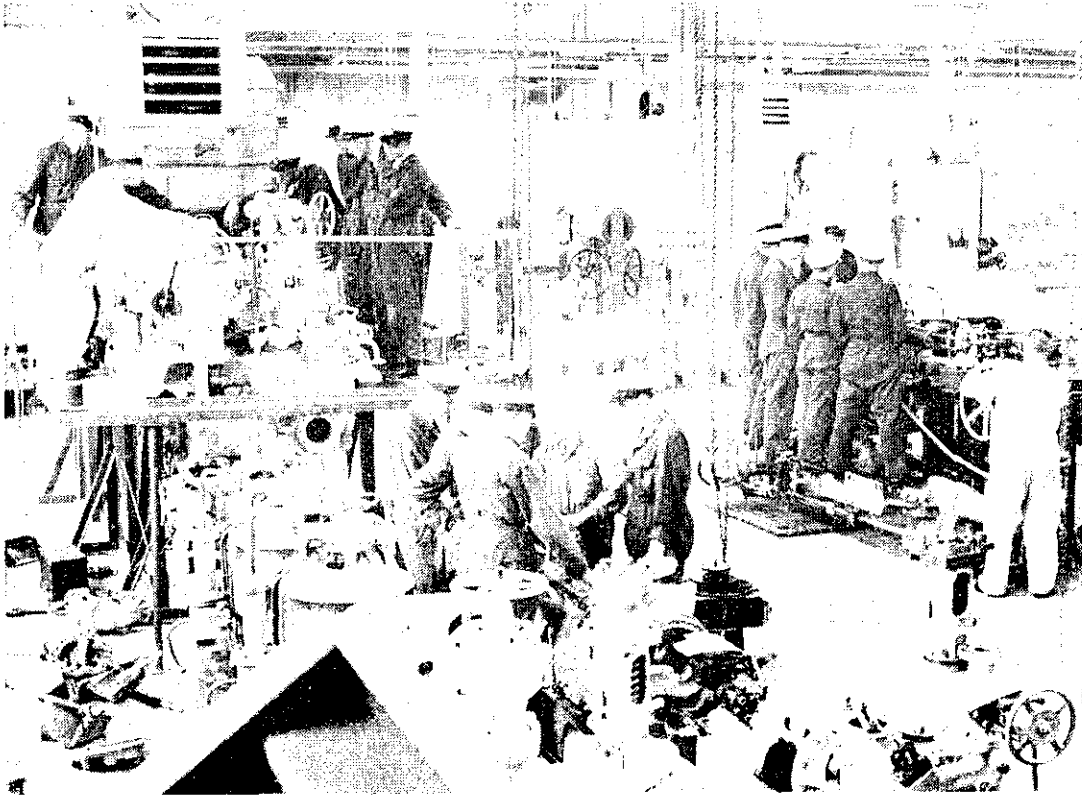
The boathouse, near Torpoint Ferry, contains ten sailing dinghies, a whaler, a gig, two motor dories and there are two yachts, *Galahad* and *Gauntlet*, and a 35 ft fast motor boat. In the summer these boats are in almost constant use for local and ocean racing.

In addition, there are the usual extra-mural activities. Numbers of officers go camping, hiking, riding and hunting and there is an active golf team which makes use of three courses in the district. For those officers interested in the Arts, there are a music circle, an orchestra, a dance band, and an Amateur Dramatic Society. There is also a cinema, and frequent lectures are given on current affairs, by prominent lecturers not otherwise connected with the college. There is a flying club at Roborough which can be used by officers on payment of a small monthly subscription. The college has its own flight of four service aircraft, consisting of two elementary trainers (Tiger Moths), an advanced trainer (Harvard) and a 'flying classroom' (Airspeed Oxford). Finally, there are a number of clubs which officers under instruction run themselves, for example, mountaineering, motor and model making, and shooting in the rifle range at Keyham.

The year is divided into three fourteen-week terms with a four-week leave period in the summer and three-week periods at both Christmas and Easter.

THE PRESENT SCHEME OF TRAINING

The widening field for engineer officers, and the changed circumstances outlined earlier, demand a more specialized training and a higher standard than hitherto. The pre-1939 system of training lasted for four years and, with certain additions superimposed, carried on into the war. The war showed the need for a revision of this scheme. After consultations with many university and other educational authorities, the present course was evolved. It was



THE FACTORY : MARINE AUXILIARY MACHINERY STRIPPING BAY

designed on the lines of a university Mechanical Science Tripos. Degrees are not awarded, but successful completion of the course in *Thunderer* exempts officers from the examinations for Associate Membership of the Institution of Mechanical Engineers and the Institute of Marine Engineers and, in certain cases, the Royal Aeronautical Society.

The essential features of the present scheme of training are:

- (a) Development of the qualities of leadership.
- (b) In the basic course, thorough grounding in those principles of science which are the essential foundation to the profession of engineering, whatever the subsequent specialization.
- (c) Specialization in marine, aeronautical or ordnance engineering.

The Basic Engineering Course

The two years of academic instruction, covering six terms of fourteen weeks, is designed on the lines of a university course. The onus of learning is placed more on the student than on the teacher so that the habits of thinking and learning, leading to progressive education as the student advances in his specialist career, are cultivated as much as possible. The basic course is not tied to the degree syllabus of any university, but the final examinations are set and marked by external examiners from such places as the Royal Naval College Greenwich, Cambridge, and London. The equivalent course at a university would take three years and the saving of one year at the Royal Naval Engineering College has been achieved in the main by shortening the leave periods.

The subjects taken in the basic engineering course fall into well defined groups:

- (a) Mathematics and the Sciences, including physics, chemistry and metallurgy, mechanics and thermodynamics. A good grounding in these subjects is essential to the mechanical engineer whatever his subsequent specialization. They lead up to more applied studies and to the study of the design considerations in later courses.
- (b) Practical Engineering and Engineering Economics. The former consists of training in mechanical drawing, machine design, the use of hand and machine tools and the basic principles of production engineering. Economics deals with the structure and problems of the engineering industry, with which, under modern conditions, the engineer officer had many dealings.
- (c) Electrical Engineering - a working knowledge of which is essential to the mechanical engineer.
- (d) Officer Training - divisional work, training in power of command, and subjects of general educational value, intended to develop the ability to lead and administer, and to broaden the outlook of young men who must become, not only competent professional engineers, but must, as officers, live up to the finest traditions of the Service.

Throughout the course, the aim is to develop reasoning power and the ability to think in the field of engineering, rather than to impart a large amount of detailed knowledge : that is to say, the conception is a liberal education on university lines, as distinct from a technological course with a definite purpose in view. Officers are encouraged to work and learn for themselves, rather than to depend on teaching. Lectures are consolidated both by example-working and by a substantial amount of practical work in the laboratories. Progress examinations are held at the end of the second and fourth terms. A final examination, set and marked by examiners drawn mainly from the universities, is held at the end of the sixth term. Towards the end of the two years' basic engineering course the officer under instruction chooses one of three specializations - marine engineering, aeronautical engineering or ordnance engineering : nearly all officers are given the course of their first choice.

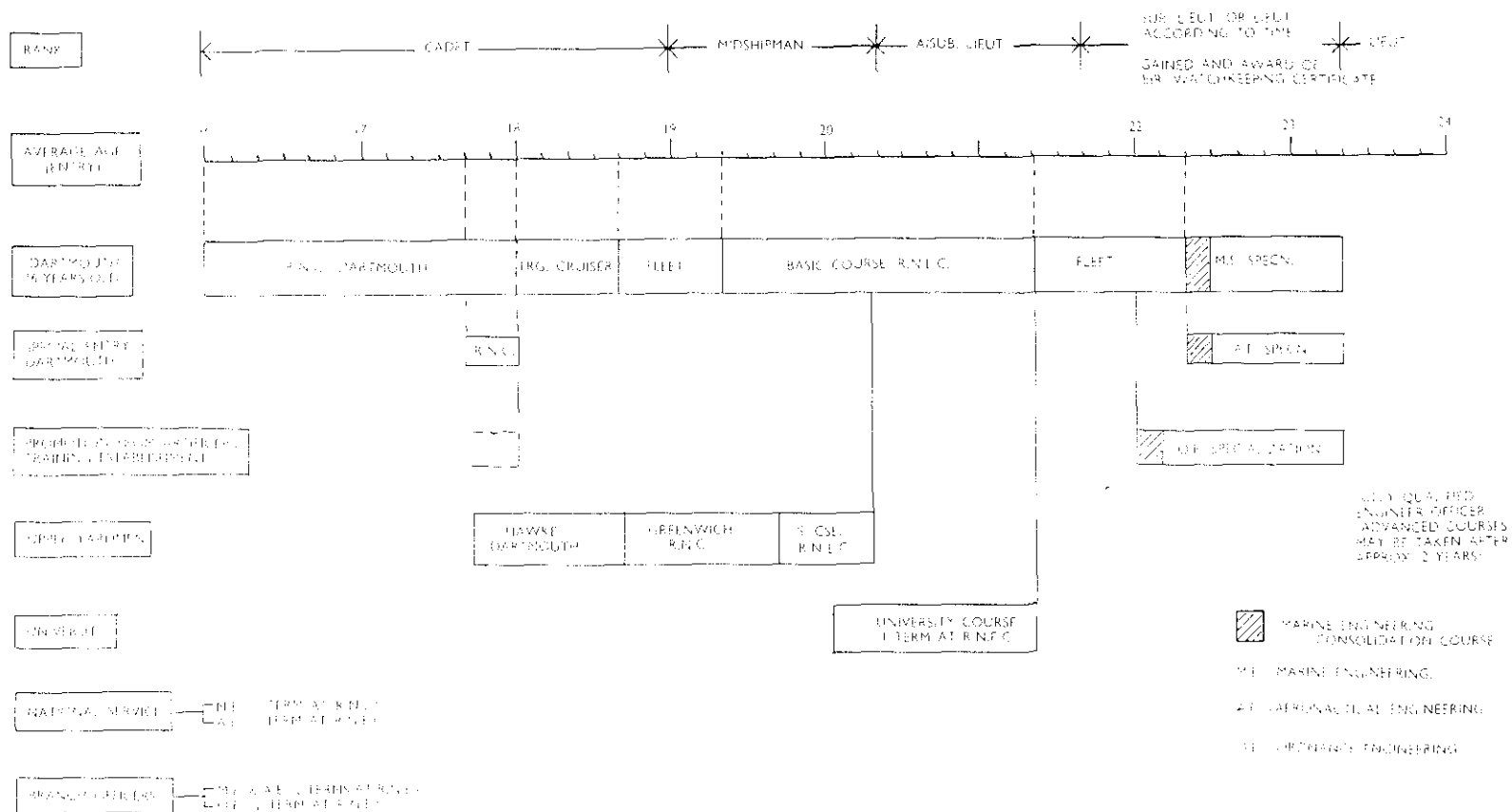
Sea Training

On conclusion of the basic course, officers are appointed to seagoing ships. A total of one year is served at sea by those specializing in marine and aeronautical engineering and a total of eight months by those specializing in ordnance engineering before returning to *Thunderer* for specialist courses. This period at sea is an integral part of the whole training and, as such, is in the hands of the Engineer Officers of the ships in which they undergo it - guidance if offered to the latter in A.F.O.3642 52 and Appendix 11A of B.R.16(50). Broadly speaking, they go to sea to start their training in practical marine engineering - how to run and maintain machinery, lead and look after men, live and contribute to ship life : in short to be individual engineer officers. They concentrate wholly on marine engineering and obtaining a watchkeeping certificate.

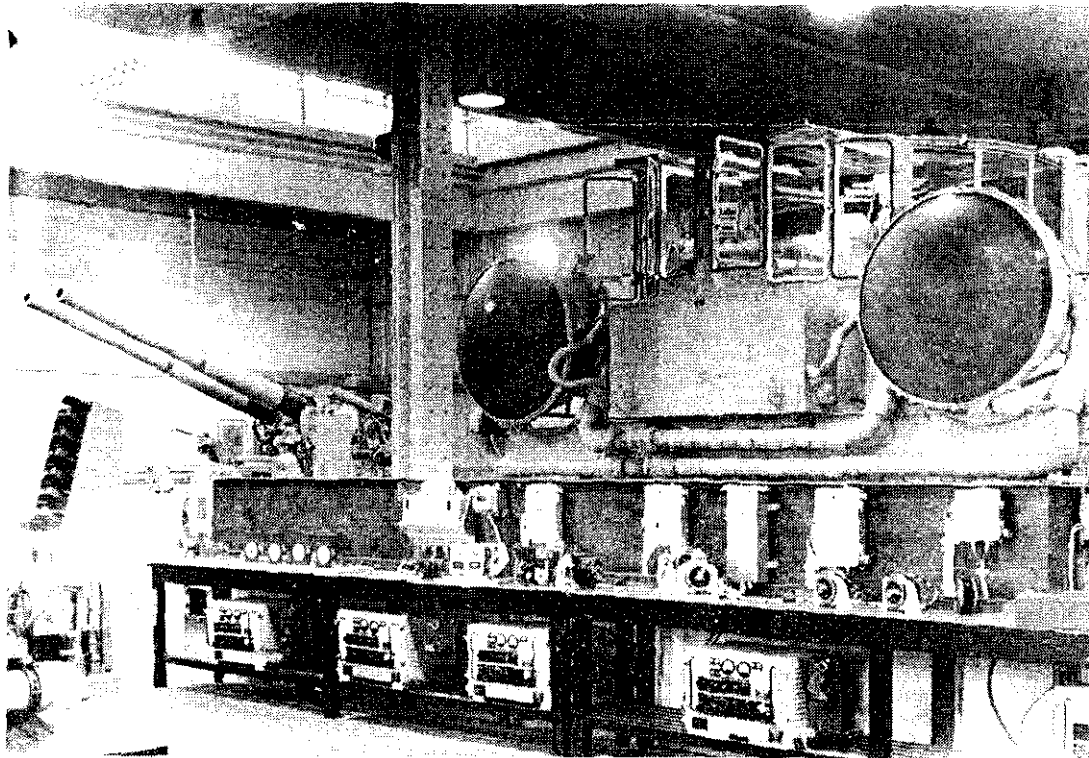
Specialist Courses

Immediately after returning from sea all officers, regardless of specialization, undergo a five-week consolidation course in marine engineering which includes an examination before starting their specialist courses. The specialist courses extend and apply the instruction previously given in the sciences, while new subjects, such as aerodynamics and electronics are undertaken, according to specialization. These are at post-graduate level and can be termed 'Courses in Applied Technology'. The object of the specialist course is to direct an

ENGINEER OFFICERS' TRAINING



Note: Up to the beginning of the Basic Engineering Course, the training is designed by the Institute of the Engineering Branch, is for practical purposes identical to that given to Midshipmen of the Executive Branch. The Basic Engineering Course is the first stage of professional training.



THE ORDNANCE ENGINEERING LABORATORY

officer's basic engineering knowledge towards the particular naval specialisation which he will pursue, and to broaden his knowledge of the theoretical and practical aspects of that sub-branch.

The main part of the course is directed towards acquiring the ability to operate, maintain, overhaul and (by constructive criticism or actual design proposals) improve the equipments used in marine, aeronautical or ordnance engineering. This is done by practical work on overhaul schemes and also by a study of the various types of equipment employed, working through design principles to representative examples. Officer training continues, and every effort is made to foster a broad and constructive outlook.

On conclusion of the course the officer is fully equipped to fill appointments in his specialization. At a later stage a small number of officers undergo further advanced courses of 2 years' duration at R.N. College, Greenwich, in the case of marine and ordnance engineer officers, and at the College of Aeronautics, Cranfield, in the case of aeronautical engineer officers, to fit them for posts in design, research and development in Admiralty departments, or with firms. If an officer specializes in aeronautical engineering and is physically fit, he can volunteer for flying duties. On completing his specialist course he will, in that case, take a course in flying and will be employed for a period in front line flying. A few go on to become test pilots.

ADDITIONAL COURSES

In addition to the basic and specialist courses, the following are also arranged for in the curriculum:—

Upper-Yardmen's Course- given to entries from Engine Room Artificer, Air Artificer and Ordnance Artificer branches ; duration 1 year during which the course is gradually merged with second year basic course ; passing out standard the same as basic course.

University Entry Course given to entries from university who have already obtained an engineering degree ; duration 4 months, subsequently proceeding to sea with basic courses : includes workshop practice, marine engineering and other subjects as required to achieve parity of knowledge with cadet entries.

Branch Officers' Course duration 6 months : academic and professional course in own specialization, designed to supplement practical experience already gained, which will enable them to attain a fuller appreciation of their duties at an early stage in their officer career.

National Service Air Engineering Course—duration 4 months : post-graduate professional course in the practice of aero-engineering.

National Service Marine Engineering Course—duration 4 months : post-graduate professional course in the practice of marine engineering.

Refresher Course -duration as required, usually 2 weeks : professional course for senior officers ; syllabus according to individual requirements.

Training Acquaintance Course—duration 1-3 days : short course on R.N. Engineering College training for officers concerned with training of engineer officers in the fleet.

Constructor Sub-Lieutenant and Probationary Assistant Electrical Engineer Course -duration 1 year approximately : part-time course preparatory to professional course at Royal Naval College, Greenwich. The course is designed to broaden the outlook of these officers, to give common ground with engineer officers with whom they will have to work later in their careers, and to direct their study and practical training to the particular requirements of their specialization.

Administration Course—duration 6 weeks : attended by senior Lieutenants and above : designed to prepare officers for the administrative duties of the middle and higher ranks and to give some indication of their immediate appointment potentialities : the course provides an intensive study of service administration with particular emphasis on technical administration.

Footnote.— *This article is the work of several officers ; the author has simply collated the results.*
