

# ORDNANCE ENGINEERING TRAINING

BY

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If anyone should be inclined to wonder at the growing company of Engineer Officers which marches through Whale Island he can comfort himself by the reflection that they are but carrying on a tradition which began in nineteen hundred and four when Engineer Officers and E.R.A.s first appeared in that establishment for instruction in hydraulic turret machinery. This training stopped at the outbreak of World War I and the requirement for Engineer Officers for these duties lapsed with the formation of the Ordnance Branch in 1919, but it was revived by the decision in December, 1928, to appoint one to each of the battleships H.M.S. *Nelson* and H.M.S. *Rodney* to advise on the maintenance of their 16 in. turrets. These appointments were maintained until the general introduction of G/E Officers in 1940; no special training was given before appointing these officers but it should be noted that their responsibilities were confined to maintaining the hydraulic pumps, an Engine Room Department commitment, and advising on the gun-mounting machinery. They had no responsibility for the latter nor were they officially required to concern themselves with fire-control equipment. Naturally, this came to be regarded as a training ground for appointments under the Chief Inspector of Gunmountings or in the Gunmounting sections of Dockyards. During the 1930's, a further system of training was instituted under which Lieutenants (E) were appointed to Overseeing Staffs to stand by the six-inch turrets for new cruisers, going to sea with them in due course, but again only in an advisory capacity and without being concerned in the fire-control.

During the period of re-armament preceding World War II the machinery for which the Gunnery Officers of ships were responsible was growing in extent and complexity and in 1939 the Bailey Committee recommended that Engineer Officers should be appointed to serve at sea under the Gunnery Officer and to be responsible to him for the work of the Ordnance Staff. These officers were to be given a course of sixteen weeks. The recommendations were adopted, a Commander (E) was appointed to H.M.S. *Excellent* for training duties, and in early 1940 the first course of the new Gunnery Engineer Officers, one Lieutenant Commander (E) and five Lieutenants (E), assembled to revive the old tradition of Engineer Officers at Whale Island; the warmth of their welcome will not be forgotten.

These sixteen-week courses continued throughout the war, but were rapidly overtaken by developments in Gunnery materiel and organization. The technical field to be covered during the course increased enormously and the G/E Officers became firmly integrated into the Gunnery Organization afloat and ashore. There was a great demand for such officers not only for ships and staffs in the Fleet but for technical and administrative duties elsewhere. Many of these duties called for a thorough knowledge of gunnery combined with a high standard of technical accomplishment; developments were taking place in the difficult fields of prediction, stabilization and servo-engineering and the utmost performance was demanded of every part of the equipment. Developments in warfare, particularly in air warfare, called for increasing refinements of technique in weapons. Before discussing current training it is worth considering where the Ordnance Engineer Officer fits into the complex pattern of technical development.

In the first place, he is emphatically not a designer. There have been, and will probably continue to be, cases of officers whose natural flair for invention has enabled them to make important contributions to design and even to originate it, but design and research in the fields we are considering are the functions of civilian specialists whose whole career has been devoted to acquiring the necessary knowledge and skill. The Ordnance Engineer is in no way a competitor of the scientist or design engineer; he is a technical interpreter, guide and assessor. He aspires to interpret the requirements to the research workers and designers, to economize their effort by directing it to the most profitable avenues, to use his seafaring experience to ensure that the product is suitable for the Service, and to give technical advice on assessing its merits. To do this he must have a good grounding of general engineering and current practice in the Ordnance field combined with a theoretical, and particularly mathematical, knowledge of a sufficient standard to talk to the designers and scientists in their own language and appreciate their results. He must have a wide enough outlook to project himself into the future and at the same time keep the balance between reckless innovation and cramping conservatism. He must be able to judge when to stop striving for ideal performance, when to accept 90% of the ideal for the sake of time or economy. All must be founded firmly on practical experience constantly refreshed by periods at sea or in other spheres such as Dockyards, where unpleasant difficulties cannot be overlooked; he must not be a back-room boy; his value is as a Naval Officer with a technical education.

Development and design are not the sole preoccupation of Ordnance Engineers; their first and transcending duty is the efficient maintenance of the equipment in the Fleet and associated with it are the functions of technical administration and the provision and organisation of spares and reserves. The chief difficulty in training O/E Officers and indeed all Ordnance personnel for the Fleet, lies in the multiplicity of types of equipment of widely different design. Unfortunately, for economic reasons, the advent of a new equipment is seldom accompanied by the prompt elimination of its predecessor. Training is therefore confined to teaching thoroughly the fundamental principles illustrated by an intimate knowledge of certain selected equipments.

The field was greatly increased by the addition of T.A.S. materiel in 1950 when Ordnance Engineering was extended to embrace both Gunnery and the mechanical aspects of underwater weapons. The extent of knowledge required in T.A.S. is a considerable one and the requirements for the engineer are similar to those in the Gunnery world.

The first step towards meeting present day requirements was to increase the G/E Course as it was then called for Lieutenants (E) progressively from 16 weeks to 9 months. This took place after the war. It was accompanied by the introduction of a measure of "user" gunnery by which is meant that the officers received instruction in the operation of the equipment and carried out drills and practices, including firings, in addition to learning construction and maintenance. This experience is essential to give an intelligent understanding of the requirements to be met, to enable the officer to take his place as a member of the Gunnery team in a ship and to impart confidence in his contacts with Gunnery Officers and ratings.

The electrical content of the new syllabi was inevitably increased by the wide application of servos, almost all of which depend on thermionic amplifiers and by the requirements of Gunnery Radar and electrical methods of computation. Electrical recording instruments are playing an increasingly important part in the development and servicing of gunnery materiel. The maintenance of the electrical materiel is the Electrical Officers' responsibility, but most of it is so inextricably mixed with the mechanical that it is impossible to acquire an adequate understanding of the whole system without a knowledge of both. The performance of an auto-control system for example is a function of a chain of components which may include electrical, hydraulic and mechanical units. Moreover, the O/E Officer is the only specialist in gunnery materiel and he must therefore be in a position to assist the Electrical personnel in applying their skill.

To provide officers qualified for posts in development and design, an advanced O/E Course was instituted in 1947. This is of two years duration, is carried out at the R.N. College Greenwich, and is the counterpart to the advanced Marine Engineering Course. A great deal of the instruction is common to both, the aim being to produce a Dagger Engineer with a bias towards Ordnance. Until very recently, the seniority of Lieutenants (E) specializing in Ordnance has varied from about four up to as much as seven years; it would be too late for those officers to undertake the advanced course after the specialist course and the system at present is for them to undergo a six weeks preliminary gunnery course in *Excellent* before proceeding to Greenwich. After completing the advanced course they return to Whale Island for a consolidation course of one month followed by one month in *Vernon* for the T.A.S. Conversion Course.

The introduction of the Basic Training Scheme for Engineer Officers has resulted in a complete reorganization of O/E Training to co-ordinate it with that of the other two specializations. After the Basic Course, candidates for O/E serve for eight months at sea to gain their Engine Room watch-keeping certificates followed by the Marine Engineering Consolidation Course in *Thunderer*. They then proceed to Portsmouth for the preliminary Gunnery and T.A.S. courses of seven and three weeks duration respectively. These two courses are based on the Executive Sub-Lieutenants Courses to give the officers a clear understanding of the work and problems of the Executive Officer user; there is in fact little difference between these and the Executive Courses and the parallel is maintained to the extent of these officers doing the same routine duties out of working hours as their executive counterparts. Apart from the direct professional value of the courses, which is great, it is probable that this extra measure of common training with the Executive Branch will be reflected in their later careers.

The Preliminary Courses are followed by the first term of the Specialization Course proper in *Thunderer*. This term is devoted to theoretical teaching in basic subjects, mathematics, mechanics, electricity, chemistry and profes-

sional subjects, servo mechanisms, principles of weapon control, stabilization, computation, including a mathematical introduction to the systems selected for practical study later. These studies are rounded off by two weeks laboratory work in the Military College of Science at the beginning of the next term and after that the course returns to *Excellent* for 14 weeks practical instruction in gunnery equipment followed by six weeks similar instruction in *Vernon*.

During this period in Portsmouth, visits are arranged to firms and establishments where development and production can be studied. In the middle of the third and final term of the Specialization Course the officers return to *Thunderer*, where six weeks are spent on revision, consolidation and a brief glance at the principles of design of certain types of equipment, followed by examinations. The whole training, including the Preliminary Courses, occupies nearly fifteen months but the field to be covered is such that the pace is hot during the Specialization Course proper. The first course under this new scheme completed in August, 1952.

The division of the course between four distinct and widely separated establishments makes a great deal of work in planning and co-ordination, and all this is repeated three times a year, but it is unavoidable as each has an essential part to play in the scheme. *Excellent* and *Vernon* are not equipped to provide academic engineering and laboratory instruction, nor would it be economic for them to be so equipped. *Thunderer*, on the other hand, cannot provide the vast range of equipment available in *Excellent* and *Vernon*. It is, moreover, a most valuable feature of the scheme that in the two latter establishments the O/E Officers find their feet in the Gunnery and T.A.S. worlds, get to know their contemporaries in the two Executive Long Courses and learn their way around two establishments which are at the centres of their respective spheres of influence. Many of these officers will be called upon to serve in *Excellent* or *Vernon* during their careers, many more will have frequent contacts with the two schools. The Ordnance Engineering Staffs in these schools have other functions besides instruction of Long O/E Courses and their presence helps to provide a high standard of instruction on materiel for other classes.

The course is a long one, longer than for either of the other Engineering specializations, but far from lavish in relation to the work to be done. After suitable experience at sea, these officers will be splendidly equipped for their profession. The subsequent experience is an essential part of the training and vital to the success of the scheme.

In 1947 it was decided that Engineer Officers of destroyers, when qualified, should assume responsibility for the Ordnance duties in their ships and since then courses have been provided in *Excellent* and *Vernon* for destroyer Engineer Officers not already qualified in O/E. The time available is necessarily very limited and the courses at present are of five to six weeks' duration. By concentrating on the equipment in the ship to which an officer is to be appointed, it is possible in this time to give him a working knowledge of it and sufficient general insight to enable him to extend his knowledge later if he has the inclination—and the time! Naturally, it is difficult to plan these courses far ahead as they depend on requirements for reliefs and the numbers in each course tend to be very small; it is a great day when as many as three officers arrive for instruction in the armament of the same class of ship. The result is that these courses are very expensive in teaching effort. The gratifying feature of them has been the genuine interest and enthusiasm shown by the officers. The specialist function of the Ordnance Engineer Officer should not be allowed to minimise the importance of his keeping in touch with the general and marine engineer-

ing world. His basic training and experience were obtained in these fields and in the course of his career subsequent to specialization he will be called upon to serve afloat in marine engineering posts. Provision has been made, therefore, for the O/E officer serving afloat in an O/E post to keep himself abreast of general and marine engineering by watchkeeping duties in the Engine Room Department (Article 11 (5) of *Engineering Manual* 1950). It must, of course, be realized that this is intended to provide training and experience in the interests of the officer as his responsibilities to the ship are entirely concerned with the maintenance of ordnance engineering materiel. By such means the specialist engineer should be able to fit himself for the wider general responsibilities and breadth of outlook needed for the highest ranks.

The rapid expansion of Ordnance Engineering during and after the war led to an acute shortage of officers for senior posts and as a temporary measure a course was instituted in 1950 for Commanders (E) and Lieutenant Commanders (E). In view of the general experience and seniority of these officers, the course was limited to six months. The third and last of these courses completed in April, 1952. Their place will be taken by a course of Senior Lieutenants also designed as a temporary measure to make good the present deficiency of O/E officers at certain stages of seniority.

The Ordnance Engineers of the Branch List, formerly Commissioned Ordnance Officers, are now members of the Engineering Branch of the Navy, and their systems of promotion and training have been revised making them similar to those of the other Commissioned Engineers. Until 1950, candidates for Branch Rank underwent a course of four months as ratings in *Excellent*; successful ones were then placed on the roster for promotion. Since 1950, promotion is by competitive examination; successful candidates are promoted to Acting Commissioned Ordnance Engineer forthwith and after a Divisional Course, appointed to *Thunderer*, where two-thirds of their time is spent in common training with other Branch Officers, Marine and Air, and approximately one-third on professional subjects. This is followed by a practical course of two months in *Excellent* and in the case of those who have not already done a T.A.S. Course as ratings, a further two months in *Vernon*.

The training of Ordnance Artificer Apprentices is similar to that of E.R.A.s except that their course in H.M.S. *Caledonia* includes 56 days elementary gunnery and T.A.S. After serving one year at sea as a Fifth Class, the O.A. Acting Fourth Class returns to the Gunnery School of his home port to complete his professional training by courses of 105 days gunnery and 78 days T.A.S. The examination at the end of these courses constitutes part of the qualification for advancement to Third Class. Up to three months' seniority can be gained on passing out from *Caledonia*, and a further three on passing out from the Gunnery and T.A.S. Schools. Direct Entry Artificers on completion of the R.N. P.O.'s course proceed to their Home Port Schools for preliminary Gunnery and T.A.S. Courses corresponding to the work done on these subjects in *Caledonia* by the Apprentices, with the addition of 18 days' work in mathematics, workshop practice and electricity. They also return after one year's sea service to qualify for advancement to Third Class, the courses being the same as for Artificers ex-apprentice. They can gain up to six months' seniority at this stage. National Service men do the Preliminary Course only. The Third Class course completes basic training, but the regular Artificer has not yet finished with the schools; owing to the variety of equipment which is met in the Service it is not possible to cover it all in basic training, and special courses are available

in certain difficult equipments. These courses are of two or three weeks' duration, and may be taken before being drafted to ships containing these equipments, or in many cases men are sent from their ships to do the courses. Particulars of the courses available and procedure are in A.F.O. 3795/51. Candidates for Chief O.A. undergo an advanced course of 37 days to qualify for the roster. In 1956 this course will be increased to 67½ days by the addition of an advanced T.A.S. Course.

The addition of T.A.S. materiel to the multiplicity of Gunnery equipments has made great demands on the Ordnance Artificers' technical capacity. The combined courses are long and arduous and even so it is not possible to include certain important and widely used equipments of which a fully qualified Artificer might be expected to have knowledge, hence the special courses already mentioned. These special courses complicate the drafting problem and are particularly vexatious in wartime. It is certain that much of the knowledge imparted during basic courses must become rusty for lack of practice. For all these reasons it appears that some measure of sub-specialization is desirable, and a scheme has been approved for sub-division of the Ordnance Artificers into Weapon and Control branches; each branch will deal with both the Gunnery and T.A.S. materiel. By this means, the demands made upon the men will be reduced to more reasonable proportions and there will be a gain in efficiency. Something of the kind has been in practice unofficially for many years as Artificers who have an aptitude for Control work tend to gravitate towards it in ship after ship. The courses will include those equipments for which special training is given now and still be considerably reduced in duration so that there should be an important reduction in the total training time. A.F.O. 3704/52 refers.

No description of Ordnance training would be complete without mention of the Quarters and Control Armourers. The title "Armourer" is an old one dating back to the earliest days of the Service. In the more modern Navy, Armourers preceded the Ordnance Artificers, prior to the formation of the Ordnance Branch. The title lapsed, except in the Royal Marines, until the introduction of the Quarters Armourers in 1948. They are a body of semi-skilled seamen user-maintainers intended to perform the simpler routine maintenance duties, to provide trained mates for Artificers and to relieve the Artificers of much work which does not call for a high degree of craftsmanship or engineering knowledge. They are proving very valuable and the capabilities of the best of them after a little experience are surprising. Their value is in proportion to the interest taken in them and the intelligence with which they are employed in individual ships. In action, a Quarters Armourer serves at a weapon and he is trained to maintain the equipment at which his action duty lies. There are courses of progressive standard for Third, Second and First Class Rates, and each course comprises training of the kind normally given to a Quarters rating of corresponding grade with the addition of mechanical and maintenance training. In addition, the Third Class Q.A. receives 42 days elementary craftsmanship training at an M.T.E. The Control Armourer was introduced in 1951 to perform similar duties in connection with Fire Control equipment; in their case the craftsmanship course is only 27 days.