

I.C.E. TRAINING FOR SENIOR RATINGS

BY

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Now that Internal Combustion Engines of various kinds are becoming relatively more prominent in the Royal Navy, it is thought that many Engineer Officers would like to know what to expect from the I.C.E. trained senior ratings who are drafted under A.F.O. 1019/52 as part complement.

Instruction is given in the I.C.E. School section of the Mechanical Training Establishment, Chatham, to senior engine room personnel of the three naval depots.

The main course, which takes 16 weeks, will be briefly described, and subsidiary courses merely referred to as they are at the time of writing, since training requirements have varied widely, giving priority to different courses at different times.

Little is known of the degree of success now achieved, as the trainees disperse to general service and practical results are difficult to judge, but the few reports which do come back are encouraging. In the past, the value of some of the instruction given was more conspicuous; as for example, the short courses on invasion craft machinery, the results of which spoke for themselves.

DESCRIPTION OF THE I.C.E. SCHOOL

The M.T.E. is situated within the dockyard on St. Mary's Island, amidst the pleasant environment of naval sports grounds. It is sufficiently near the Royal Naval Barracks to benefit from all naval facilities, without being so near that workshop routines, which are often noisy, are in any way interrupted.

There is a study block and cinema, and a large modern workshop building which houses the running, stripping, and demonstration engines, with the offices overlooking the engines. Each study is equipped with a film strip projector and visual aids appropriate to its allotted function. A disused boiler test house exists, eminently suitable for running a gas turbine, when one becomes available. The instructional staff and all Chief and E.R.A.s on the main course live on the premises, whilst all other ratings are accommodated in the Royal Naval Barracks. Drafts are administered by the Commodore, R.N. Barracks, and the Engineer Officer-in-Charge, M.T.E. is responsible to the Rear-Admiral (E), Staff of C.-in-C. Nore for the instruction given.

Location

The fact that this port was chosen for I.C.E. training, may have some connection with the long association that Chatham Dockyard has always had with submarine engines; and more recently, the important role it has played in the design and development of the A.S.R.1. Further I.C.E. background in this locality is supplied by the major overhaul depot for Perkins and Coventry engines; also the C.A.V. Ltd. maintenance school and injection pump factory, which came into the district in place of Short Bros. seaplane works.

History

The need for the I.C.E. School arose when offensive operational planning against Germany and Italy indicated that large numbers of assault ships and craft would be required. At this stage of the Second World War, the provision of engines for most of these vessels was a production load more suitably borne by the U.S. industry, and it was decided to provide a very large number of diesel engines as manufactured by the General Motors Corporation of America.

Arrangements were made for the technical training of the officers and men of the engineering branch who would man and maintain this diesel driven fleet. For the intended training school, the present site was allocated, and the officers and ratings who were to form the school staff were appointed to a preliminary technical course at Cleckheaton, near Bradford. This course was mainly staffed and equipped by the General Motors Corporation.

On completion of the Cleckheaton course, the Officer-in-Charge, Diesel Engineering School, a Commander (E), assisted by a Lieutenant-Commander (E), then set about organizing studies, demonstration models, lecture material, films, visual aids and synchronophones. The American films and film strips then supplied were of excellent quality for basic instruction, and have stood the test of time to the extent of being in full use in the present syllabus.

The school opened in August 1942 with a mixed class of 31 engine room ratings of all grades and, shortly afterwards, also began to accept R.N.R. and R.N.V.R. Engineer Officers. The principal special course of two weeks instruction on General Motors engines was intended for ratings, both 'Continuous Service' and 'Hostilities Only' including Chief and E.R.A.s, C.P.O.S.M.s, P.O.S.M.s, Motor Mechanics, L.S.M.s and S.M.s. From the inception of this course until it closed in June 1946, the names of trainees recorded as having passed through totalled 15,094.

Another course, of one week on British made Paxman engines for landing craft, was run concurrently with the General Motors course, for the benefit of R.N.R. and R.N.V.R. Engineer Officers and engine room Chief and Petty Officers. The Paxman course ended in December 1945 after having trained 662 officers and 3,237 senior ratings.

Some of the early diesel courses were accommodated in a sailing ship, H.M.S. *Pekin*. This situation was unique as the ship had masts and yards but no engines at all. The complement was almost 100 per cent. Engine Room Branch, and most of these were 'I.C.E. only' at that. It was in the charge of an Engineer Lieutenant-Commander.

Many of the officers and men who passed through the school had an eventful war career afterwards, taking part in assault after assault, in operations from North Africa to Normandy. They were among those present at North Africa, Sicily, Salerno Anzio, Elba, Southern France, Normandy, Burma and the Aegean Isles, and on minesweeping duties.

In June 1946, the present 16 weeks course was instituted. It was intended for E.R.A.s entered under the National Service Act, and for P.O.S.M.s as they became available to replace Motor Mechanics shortly due for demobilization. Classes of 30 were trained and allocated in the ratio of 15 for Combined Operations, 6 for Coastal Forces and 9 for I.C.E. driven minesweepers, equally divided between the three depots. On completion of this course, the ratings were sent for a further two months functional training to depots appropriate to their allotted duty—H.M.S. *Roseneath* for Combined Operations and H.M.S. *Hornet* for Coastal Forces.

From November 1947 onwards, no further E.R.A.s under the National Service Act were sent for the 16 weeks course, and classes on completion were no longer sent to Combined Operations and Coastal Forces, but were all dispersed to their own depots for general service. From this date, main courses have consisted of C.S. and S.S. ratings, although National Service E.R.A.s are now beginning to re-appear as R.N.S.R. for 20 days—1st, 2nd and 3rd year training.

Current Courses

I.C.E. Courses listed in A.F.O. 3545/53 are :—

- (a) 16 weeks I.C.E. course C.S. and S.S. Engine Room C.P.O.s and P.O.s.
(E.R.A.s with Unit Certificate, P.O.S.M.s with Boiler Room Watchkeeping Certificates.)
- (b) Refresher courses C.S. and S.S. Engine Room C.P.O.s and P.O.s.
(Various). (E.R.A.s with Unit Certificates, P.O.S.M.s with Boiler Room Watchkeeping Certificates.)
- (c) 14 days course R.N.V.R. Engine Room C.P.O.s and P.O.s.
- (d) 20 days course R.N.S.R. E.R.A.s.

In addition there are :—

- (e) 14 days course R.N.R. Engine Room C.P.O.s and P.O.s.
- (f) 16 weeks course .. Foreign Nationals by special arrangement.
- (g) One month course .. E.V.T. Engine Room C.P.O.s and P.O.s.
- (h) 14 days course Sea Cadet Corps—May to September.
- (i) 3 days course—Preservation, Identification and Packaging. For Main courses and Admiralty civilians.
(One day, followed by two days practical in Dockyard.)

Of the above, R.N.S.R. E.R.A.s, (d), is now on the upgrade in numbers, competing in demands with the main courses.

Courses (b) and (e) are temporarily in abeyance.

Foreign Nationals, (f)—the following 16 weeks courses have been given to :—Egyptian 41, Chinese 16, Pakistan 7, Israeli 5, Burmese 10, Ceylonese 4 and a further Burmese course is booked.

E.V.T., (g), is a minor commitment, classes being limited to six are therefore absorbed in main courses.

Sea Cadets, (h), were first accepted in September 1947, since when the course has become a regular summer feature by custom. Total trained to date 285.

Main Courses (a)—There are four concurrent 16 weeks courses with the R.N.S.R. course, (d), sitting in with the appropriate section for first or second year training. In 1954 there will also be 3rd year R.N.S.R. trainees.

Maximum number acceptable per class	40
Average number per class (excluding R.N.S.R.)	12
Total C.S. and S.S. trained	1,800
Failures	33



BASIC CLASS—FIRST MONTH



WORKSHOP VIEWED FROM THE OFFICE

THE 16 WEEKS COURSE

Composition of the Classes

Main courses are mixed. That is to say, Chief E.R.A.s, E.R.A.s, Chief Mechanics, Mechanics, C.P.O.S.M.s and P.O.S.M.s all work together, with the exception of foreign ratings who form a separate class.

Classes start with a considerable difference in aptitude between individuals, which sometimes results in a little sorting out at the end of the basic section. As the course progresses, the improvement in the work of P.O.S.M.s is conspicuous as they become more adept and more interested. Some E.R.A.s would like to go faster, but these usually become group leaders for practical work and, on the whole, mixed classes work very well together. The average E.R.A. obtains about 72 per cent. compared with 65 per cent. for the average P.O.S.M., but the top places are by no means exclusively won by E.R.A.s. Trainees' notebooks are assessed but no marks are awarded for mechanical skill.

All ratings accepted for the main course should first have completed their basic engine room training ; E.R.A.s should have their Unit Watchkeeping Certificate ; P.O.S.M.s their Boiler Room Watchkeeping Certificate.

Summary of Syllabus

There are four sections broadly described as Basic, Transmission, Electrics applicable to I.C.E.s, and Workshop, each of approximately 4 weeks duration. Study time is interspersed with workshop demonstration, an analysis of time spent on practical work in each of the first three sections being 25, 16 and 13½ hours respectively, which works out at 40 per cent. overall.

All lecture material was re-written with new sketches and bound in one volume in 1952, to include the new equipment and procedure to that date. This book contains the minimum of maker's instructions for particular engines. Instruction books are kept with the maintenance schedules and task schedules on the engines in the workshop.

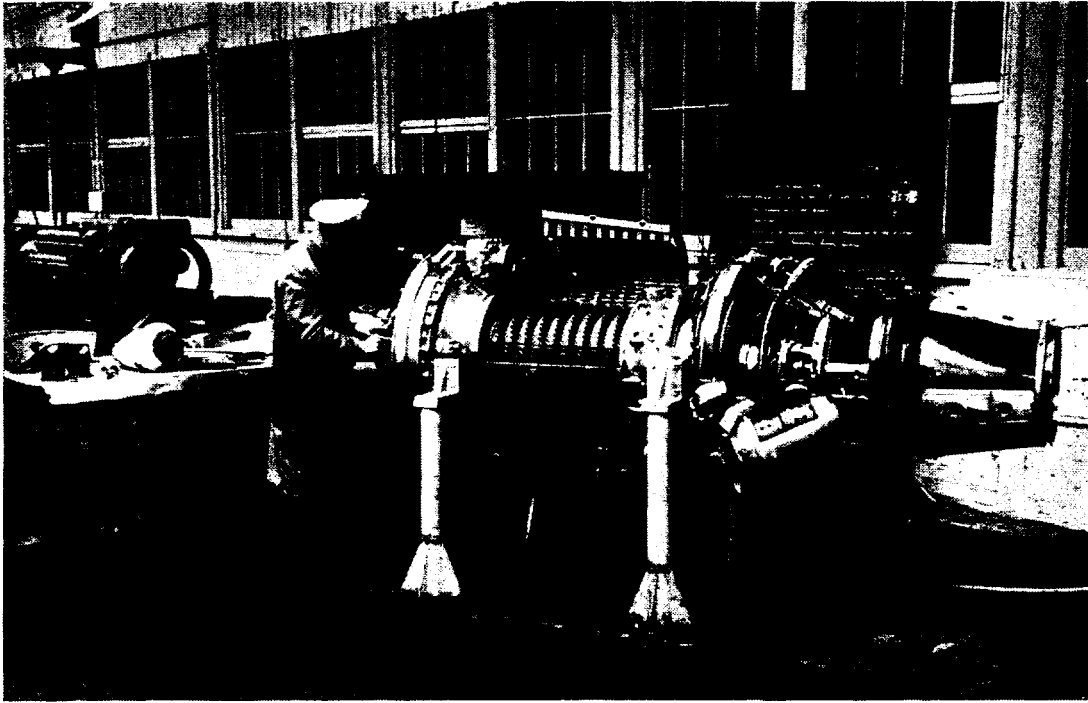
1st Month.—Basic section lectures—Construction, theory, shell bearing technique, cooling, lubrication, fuel systems, carburation, combustion, nozzles and chambers, timing, governors, superchargers, wear and tear, pistons and rings, care and maintenance and operating in hot and cold climates. Instructions gleaned from A.F.O.s and references to history sheets and forms are written in as ordinary instructional matter, in appropriate places.

Trainees are issued with a bound sketch book during this month, from which they are required to copy sketches in their own time, to augment notes taken in lecture periods.

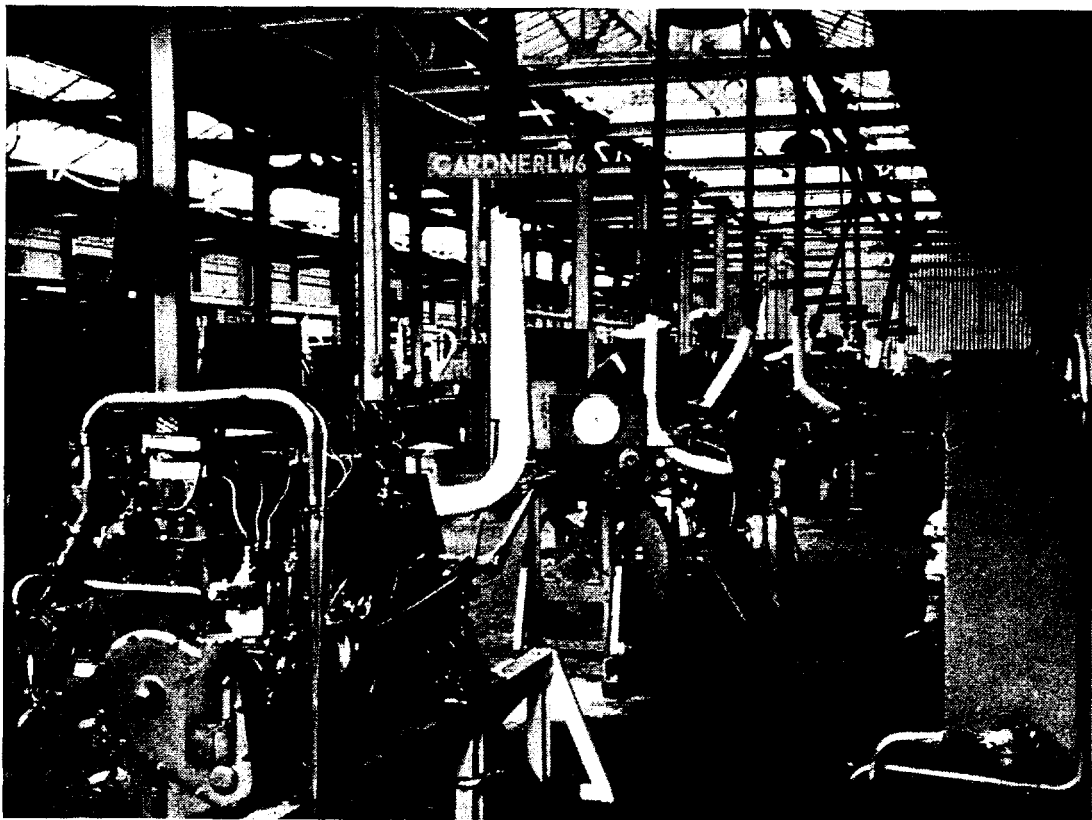
2nd Month.—Transmission (this section includes fuel pumps). Lectures :—Fuel, feed and injection pumps, calibrating C.A.V. and other types, injection valves, anti-dribble, pilot injection, gasoline pumps, other pumps such as mono, megator, etc., clutches, reverse gears, including Gardner, Lister, 'MR' series of oil operated reverse gears made by Self-Changing Gears, Ltd., 'S.L.M.' gears made by Modern Wheel Drive, Ltd., the single lever control system, Bibby coupling, V.P. propeller.

3rd Month.—Electrics applicable to I.C.E.s—Lectures :—units and symbols, circuits, magnetism, generators, cells, regulators, ignition circuits, magnetos, spark and heater plugs, starter motors. Then gas turbines.

As gas turbines are more in evidence, and more material is to hand, this subject is now given three days. Drawings, instruction books and/or engine



ROLLS-ROYCE CLYDE PROPELLER TURBINE



PRACTICAL INSTRUCTION—FOURTH MONTH

parts are available from Gatric, Metropolitan-Vickers G.2, Allen, and Rolls-Royce R.M.60, on which to build instruction, and a Clyde two shaft propeller turbine aero engine has been completely sectioned in the school. Lectures on this section are again being re-written under the headings :—basic cycles, materials, construction, fuel, lubrication and control systems for marine type sets.

4th Month.—Tasks on the engines—Classes are split into small groups with a leader, and tasks are performed on pistons, liners, timing, pumps, injectors, testing, starting equipment, connecting rods, carburettors and magnetos. Special tools and torque spanners are supplied.

Engines available are :—

British Anzani.	Dorman 2 and 4.	Brown Boveri Turbo Super-charger.
Coventry K.F.4.	Lister EPVMG, 3 JPM.	
Perkins P6M.	Paxman TPM, RQ, RPH.	Rolls-Royce Clyde gas turbine (sectioned).
Foden FD6.	Hall-Scott.	
Packard.	Gardner 8L3, 6LW, 4L2.	To be installed :—
Gray Marine.	Morris Hyland.	A.S.R.1., 6 L.T.S.
Ford V8.	Scammell.	Foden F.D.4.
Cub.	Deutz.	Deltic.
	Napier Turbo Super-charger.	Paxman YHA.12. Enfield 2.

The ideal instructional engine lay-out is a group of one running, one stripping and one fully sectioned model. At present this is available in Perkins, Paxman and Ford. Of the three, the running model is by far the most important and the sectioned one the least, except for the uninitiated, who need to identify parts by sight. For trainees in this phase, it is an asset if the sections also work, and in this category there is a Paxman RPH and Ford V8 driven by electric motor, and the gas turbine which drives its own compressors by an external compressed air supply led to one nozzle group.

At the end of the 15th week of the course, a final examination is held and the last three days before discharge to home depots is devoted to 'Preservation, Identification and Packaging', which includes how to inhibit an engine.

Visits to other Establishments

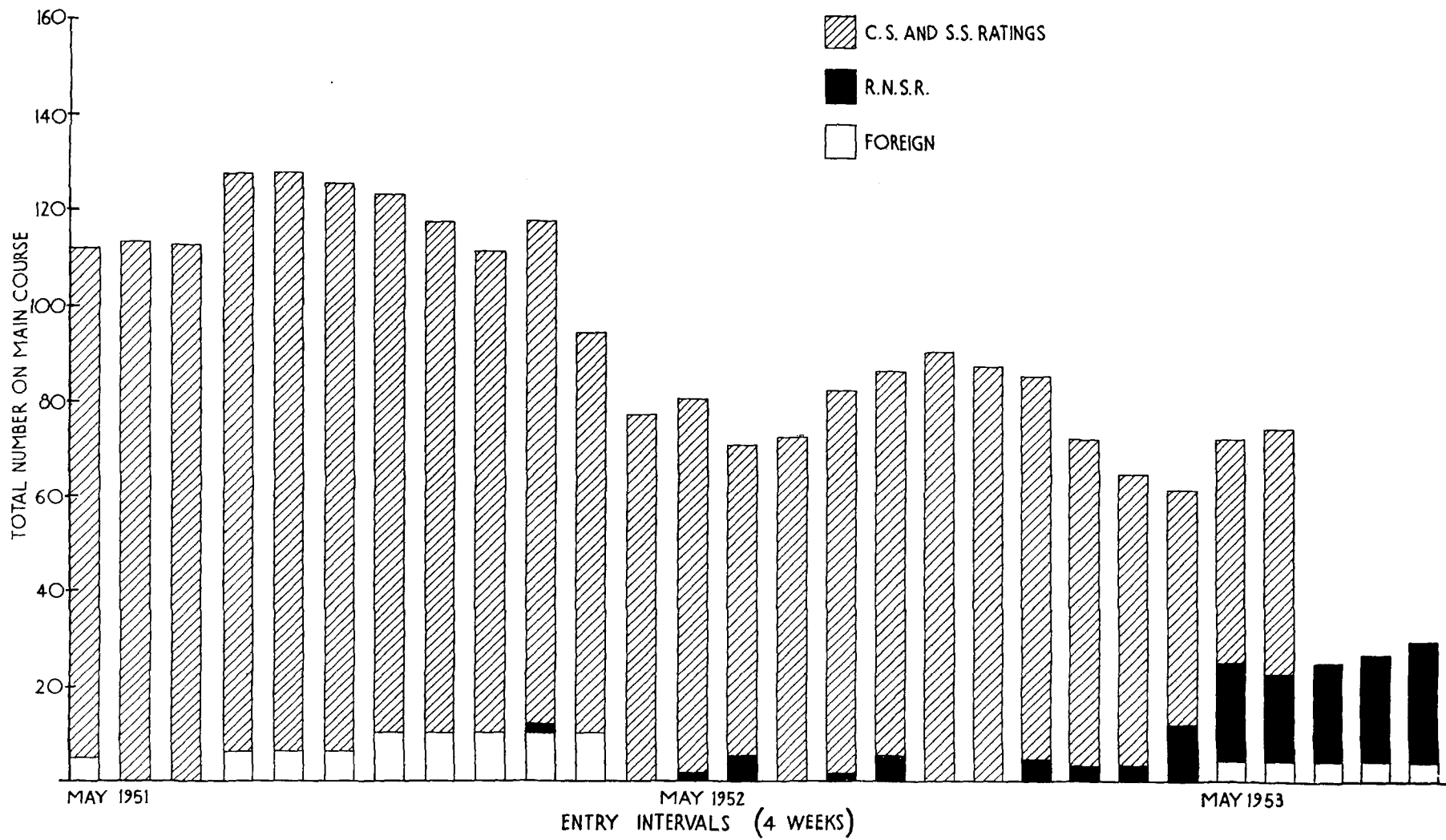
By permission of M.E.D., H.M. Dockyard Chatham, the workshop class now makes the following visits :—

A.S.R. engine test bed	2 hours.
Hartridge injection testing machine	$\frac{1}{2}$ hour.
Wouldham—major overhaul depot for Perkins and Coventry		$\frac{1}{2}$ day.
P.I.P. shop	1 hour.

On the last afternoon of the course they go to the Ford Motor works, Dagenham, primarily to see diesel engine production. This visit is arranged through the Chief Designer who commands a Sea Cadet unit, and supervises engineering trade training for the boys in his spare time.

Examinations

Half-day examinations are held at the end of each of the first three sections, with a full day for the final which covers the whole course. Most questions



involve sketching and ask for observations not covered by the dictation of notes. The required standard is 50 per cent. Those failing to qualify in the basic section are individually considered and may either be allowed to continue, to be put back a class, or taken off course.

The method of setting examinations may be of interest in view of the number held. Questions covering every aspect of the subject are prepared, carefully vetted and numbered. The numbers alone, 1–120 in this case, are typed on a single page. From this, each examination paper is selected and marked by different symbols, e.g. circles or squares. Symbols have different colours. By this means, 30 different papers are planned in advance ; so that by selecting a series of symbols in one colour, papers may be set for a given class, without fear of repetition later, and without looking up what was given before. Five examination papers are set in as many minutes, but no easy solution is offered for marking the results !

Multiple answer tests which have been referred to elsewhere as the gambler's quiz, are not now necessary. They were formerly used for certain short intensive courses on particular engines. No doubt an easy marking scheme, if needed, could be devised for these.

Recreation

The 16 weeks allotted for the course in 1946 was for a syllabus considerably smaller than that at present covered. There is now no latitude, and no time can be allowed for recreation during working hours.

Instruction is given $5\frac{1}{2}$ days per week and only one long week-end is granted at mid-term. Prayers are held one morning each week and one class attends a current affairs lecture once a week.

Apart from this, there is the M.T.E. sports club which organizes cricket matches with local clubs for evenings and week-ends ; football and rugby teams are raised in the winter. The club supplies first class sports gear ; even tennis rackets and balls. The school adjoins the playing fields, and no difficulty is experienced in obtaining facilities. The mess is equipped with television and billiards for those who do not elect to go on ration allowance and bring their wives to Chatham. Final classes usually organize a farewell party in London or Margate, as they usually make many friends in the school environment.

Instructors

Potential instructors are selected whilst on course, and are recommended as such on leaving. Staff reliefs are sent to the Instructional Technique course before they start duty. The normal method of working is for two instructors to take each main course right through, so there is nobody available for special subject lectures, except occasionally an officer.

Previously there has been one stand-off instructor or, at times, two. This asset has been used to send instructors in turn for further training in :—

Turbo Blower maintenance . . . 5 days at D. Napier & Sons (Acton),
 Injection equipment 5 days at C.A.V. Ltd. (Rochester),
 and individual visits to other establishments.

In the school itself, the spare instructor in rotation has been encouraged to assume charge of a task such as maintenance, making models, sections, aids, drawings and in general in being the key to the vital function of infusing new life into the course. Training classes, although probably possessing much talent, cannot be used for progressive work. They do well, indeed, if they cause no undue damage or wastage.

Instructors live in a separate part of the school mess ; most of them have duties as officials for the various mess and sports activities.

Conclusion

The accompanying table gives a summary of the numbers in main courses over the past two years. The decline in C.S. & S.S. ratings and the rise in R.N.S.R. are both considered to be temporary and therefore misleading for forecasting, except that it shows the recent important growth of a R.N.S.R. commitment.

The numbers of 1800 C.S. & S.S. ratings trained in the school to date is relatively small but the potential is large. I.C.E. trained general service ratings will therefore be thinly dispersed, but they are usually very interested, and they take away good notebooks, which considering the effort that is put into them, cannot be treated with anything but respect by their owners. Trainees should be capable of instructing junior ratings, as they are called upon to take a turn in front of their own class on course.

The two months functional training originally laid down for Combined Operations and Coastal Forces is not now applicable and ratings may be drafted on completion of the 16 weeks course as I.C.E. trained under A.F.O. 1019/52. Present main courses, however, consist of senior ratings who have some experience before they start and, moreover, since the 16 weeks course is the prime function of the school, every effort has been made to keep it up to date.

Practical work has been given priority, but a trainee may be faced in service with an engine he has never seen before. Even with the engines listed above the application of each man on course works out at no more than five hours for each engine.

They should, nevertheless, know the right way to handle any engine and appreciate that when defective, some parts, such as injection pumps, hydraulic mechanisms and electrical accessories, must not be tampered with. They are all fully aware that essential information in the form of instruction books, maintenance schedules and history sheets, exist for each engine. It is considered that the majority of trainees will have the desire to seek such information themselves ; the capacity to understand precisely what is intended ; and the habit of doing this at the proper time, which is on first acquaintance with the engine—not after something goes wrong.
