

THE FIRST SUBMARINE SQUADRON

BY

ITS OFFICERS

INTRODUCTION

Although this article is for reading by engineering personnel, it is an attempt to provide an account of the Squadron in rather broad terms, with little detail. This is for two reasons : first, that the maintenance angle was well covered by Commander (now Captain) L. F. Ingram, R.N., in his admirable article ' Wartime Experiences in a Submarine Depot Ship ', which appeared in Vol. 3, No. 1 of the *Journal* in April, 1949 : secondly, that the new Officer Structure requires all General List Officers to have an overall interest in, and a good knowledge of, all aspects of the ship. Submariners are asked to be indulgent when reading it ; it is not intended for their eyes.

PART I—GENERAL

COMPOSITION

The First Submarine Squadron, at the time of writing, consists of the following ships :—

H.M.S. <i>Forth</i>	..	Depot Ship
H.M.S. <i>Totem</i>	..	' T ' Class (Conversion) Submarine
H.M.S. <i>Tally Ho !</i>	..	' T ' Class Submarine
H.M.S. <i>Trenchant</i>	..	' T ' Class Submarine
H.M.S. <i>Tudor</i>	..	' T ' Class Submarine
H.M.S. <i>Sanguine</i>	..	' S ' Class Submarine
H.M.S. <i>Sea Devil</i>	..	' S ' Class Submarine
H.M.S. <i>Sentinel</i>	..	' S ' Class Submarine
H.M.S. <i>Miner VI</i>	..	Controlled Minelayer (Fitted out for torpedo recovery)

The number of submarines in the Squadron is normally eight and its composition by classes is normally as shown, but the boats themselves vary for various reasons, though changes are normally only made as the boats become due for refit or on completion of refit. Of these, six are ' runners ' and two are refitting in H.M. Dockyard, Malta, at any one time.

THE SQUADRON'S FUNCTION

Like all other naval forces, the operational function of the First Submarine Squadron in peace, is to prepare for war. In a submarine squadron this is a double task—not only do the submarines themselves require to be worked up to a ' ready for war tomorrow ' basis, but it is also their job to act as targets for the benefit of A/S forces. Mostly, these two tasks can be combined, but not always.

The First Submarine Squadron probably enjoys more opportunities to attack fleet units than any other British submarine force. Not only are the ships of

the Mediterranean Fleet attacked whenever they are formed up for exercises, but also the submarines at Malta form an integral part of the Commander-in-Chief Allied Forces Mediterranean's submarine command, which involves them in a series of major exercises each year.

All types of target training are also carried out, from the basic, buff-towing exercise to acting for the scientist as a toy target ; with cruises, exchange service with submarines of other N.A.T.O. nations, film-making, landing commando raiders, mining, experimental torpedo firing and taking visitors to sea—the whole adds up to the variety of functions described as 'submarining' in peace-time.

COMMAND

The Squadron is commanded by a Post Captain (Captain (S/M)), who is always a one-time submarine commanding officer. He is also the Commanding Officer of H.M.S. *Forth* and normally sails in her, whether accompanied by the submarines or not. He also wears a N.A.T.O. hat as Commander Submarines Mediterranean (Designate) and is the Commander-in-Chief, Mediterranean Fleet's adviser on all submarine matters.

The Captain (S/M) is assisted by the Executive Officer of the *Forth*, and by the Commander (S/M), who is also a qualified submarine C.O. This duality in the 'Executive' line is similar to that which exists in a carrier.

ADMINISTRATION

The Squadron is operated by Flag Officer, Second-in-Command, Mediterranean Fleet, who is also the Administrative Authority for all matters except (a) those special to submarines and their crews and (b) depot ship material matters ; these are the province of the Flag Officer, Submarines, who is the Class Authority for submarines and submarine depot ships.

PART II—THE DEPOT SHIP

GENERAL

H.M.S. *Forth* was designed and built as a submarine depot ship. She was first commissioned in May, 1939, and has served continuously as such, with the additional onus of being the destroyer depot ship for the Mediterranean Fleet from 1948 to 1950. For two months during the Suez crisis she was detached from the Squadron to serve as a maid of all work at Port Said.

Her full load displacement is 11,900 tons. Included in this is 1,140 tons of furnace fuel oil, and 1,240 tons of Diesel fuel, 550 tons of fresh water, 130 tons of submarine lubricating oil and 90 tons of feed water.

Her armament consists of eight 4.5 in. HA/LA in Mark III twin mountings and two 2-Pdr Mark VII 4-barrel pom-poms.

She has two shafts, each of which is driven by two impulse reaction turbines through single-reduction gearing. The total s.h.p. is 7,000 which gives about 16 knots, with a clean bottom, in a flat calm.

The two inner turbines have an astern wheel incorporated. All four turbines have their own underslung condenser, air pump and circulator.

FUNCTION

The *Forth's* function, in spite of her being classified in a recent edition of *Jane's Fighting Ships* as an 'anti-submarine depot ship', is definitely 'pro-submarine'. Her task is threefold : firstly, to command, administer, house, feed, clothe, pay, advise and succour the submariners ; secondly, to assist

them in the maintenance of their submarines between refits and to provide these with stores, torpedoes, ammunition, spare gear, fuel, water, electricity, air and a berth ; thirdly, to assist them in their preparations for ~~refit~~ (defect lists, etc.), advise as necessary during refit and to supervise certain of the post-refit trials.

It is hoped that she fulfils her function adequately but it is becoming more and more difficult for her to do so as she and her charges become older and older and as, therefore, both require more and more effort to keep themselves hale and hearty.

The Engineer, Electrical, Supply, Medical, T.A.S., N.D., Communications and Gunnery Officers of H.M.S. *Forth*, apart from their own ship duties, are also responsible to the Captain (S/M) for assisting the Commanding Officers of submarines in maintaining the efficiency of all aspects of their respective departments in the submarines.

ENGINEERING

Personnel

Engineering personnel (this term, throughout this article, includes shipwright artificers) available for work in the depot ship are of three categories :—

- (a) *Forth's* complement
- (b) Repair staff
- (c) Engineer officers, E.R.A.s, Mechanics and M.(E) branch ratings of the submarine spare crew.

Categories (a) and (b) are drafted to the ship as such but in practice, except for specialists such as moulders and patternmakers, they are employed as is thought fit and as the situation demands ; they are all General Service ratings. Category (c) ratings are mainly a drafting pool for the submarines but certain of them, such as periscope E.R.A.s and spare gear party, are virtually ' stopped draft '.

Submarine M.(E)s are required to obtain ' steam ' A.W.K. certificates in the same way as General Service ratings. They are given the necessary course in H.M.S. *Forth*, being temporarily relieved by a spare crew M.(E) while they are away.

Depot Ship Machinery and Services

Electrical Charging

In order to conserve their battery power when they are alongside, the submarines are, whenever possible, supplied with power from the ship's ring main to meet harbour auxiliary load requirements. This is of the order of 150–250 amps, depending upon the class of submarine.

Normally, submarines charge their own main batteries, using their main engines driving their main motors as dynamos but during self-maintenance periods, or at any time when it is impossible or undesirable for them to run their own machinery, the depot ship provides the necessary power for this. Both of *Forth's* outer main engines can be declutched from the main gearing and clutched instead into the gearing of one of a pair of 800 kW generators which can provide power over a range of 220–310 volts. This is a somewhat cumbersome operation involving the flashing of a second boiler, the use of a main condenser, main air, circulating water and lubricating oil pumps and extra watchkeepers, besides the rigging on the upper deck of very heavy power cables. Because of this and also because of the expense in terms of fuel and machinery maintenance, it is only used when strictly necessary, which works out at an average of once a month.

Air Charging

Four Weir's 4-stage electrically driven compressors, each compressing 12.8 cu. ft of free air per minute up to 4000 lb/sq. in., are fitted. Besides its use in the depot ship in torpedo parting shops, guns, recompression chamber, etc., H.P. air can be supplied to submarines alongside for charging their groups and torpedoes, thus saving wear and tear on these vital pieces of the submarines' equipment.

Fuel

Two steam reciprocating pumps supply dieso to submarines from connections on both sides of the well-deck and quarter-deck.

Fresh Water

An electric centrifugal fresh-water pump, separate from the ship's fresh-water system, supplies water to submarines on either side.

Distilled Water

Battery water is pumped by the distilling plant to two large tanks situated on the 'house-tops'. It is discharged from there by gravity to submarines on either side.

Lubricating Oil

32,000 gallons of OMD 110 are carried in *Forth* in two hull tanks from which it is discharged to either side by means of a small Weir's steam reciprocating pump.

Workshops*Receipt and Issue Room*

Requisitions for work (Forms S.339) are brought to the Senior Engineer of the depot ship by the submarines' Engineer Officer or C.E.R.A. After discussion, the job is given a priority by the Senior Engineer who then sends the S.339 to the receipt and issue room (or in the case of shipwrights' jobs to the shipwrights' office). The job itself is sent to the receipt and issue room by the submarine concerned. A Ch.M.(E) in the receipt and issue room makes out a job card for each job, attaches any necessary sketches and sends it to the shop concerned. This card accompanies the job on its progress round the shop or shops and returns to the receipt and issue room with the completed job. The card is then filed and the submarine informed, if the job is urgent, that the gear is ready for collection. A system of double checking prevents any losses.*

The workshops Engineer Officer, normally an experienced submariner, uses the R. and I. room as his office. Here he keeps an account of all materials used, demanded and received. Here, too, he keeps the more valuable stores on charge to him. His and the Shipwright Officer's staff is disposed as follows :—

Receipt and Issue Room	—1 Ch.M.(E) 1 M.(E)	
Heavy Machine Shop	—2 C.E.R.A.s 1 E.R.A. 1 M.(E)	} (Fitter and turner or fitter)
Light Machine Shop	—1 C.E.R.A. 6 E.R.A.s 1 M.(E)	} (Fitter and turner or fitter)

* Since this article was written, Planned Maintenance Documentation has been introduced into the depot ship when carrying out repairs to submarines but the principle of operating is very similar to that given here.

Tool Room	—1 E.R.A. 1 M.(E)
Store	—1 P.O.M.(E) 1 L.M.(E)
Smiths' and Plate Shop	—1 C.E.R.A. (Boilermaker) 1 E.R.A. (Boilermaker) 1 E.R.A. (Enginesmith) 2 M.(E)s
Foundry and Coppersmith's Shop	—1 C.E.R.A. (Moulder) 2 E.R.A.s (Coppersmith) 2 M.(E)s
Patternmakers' Shop	—1 C.E.R.A. } (Patternmakers) 1 E.R.A. }
Fuel Pump Test Shop	—1 C.E.R.A. (Fitter and turner) 1 M.(E)
Plumbers' Shop	—2 Shipwright Artificers } (Also for 1 M.(E) } 'afloat' work)
Welding Shop	—4 Shipwright Artificers } (Also for 1 M.(E) } 'afloat' work)
Shipwrights' Office	—1 Chief Shipwright Artificer (for Depot Ship) 1 Chief Shipwright Artificer (for S/M work)
Shipwrights' Shop	—12 Shipwright Artificers } (Also for 3 M.(E)s } 'afloat' work)

Spare crew E.R.A.s are employed in the shops according to their trades, or else afloat.

Heavy Machine Shop

FIG. 1 shows a plan view of the heavy machine shop—so called because it is situated in a position whereby it can receive, via three 10 ft by 5 ft 'plumb' hatches, heavy loads from the 2-ton and 6-ton well-deck cranes. Thus, besides containing such heavy machine tools as the ever useful Kearns horizontal boring machine, it is able to take large items such as cylinder heads, cylinder liners and various big sub-assemblies direct from submarines alongside. Owing to the lack of floor and bench space and facilities such as large extractors, presses and hydraulic test rigs in the submarines themselves, the submarines' crews often have to work, with the depot ship's staff, in the heavy machine shop, where such facilities are available; at such times, the space available in the heavy machine shop is often inadequate. The hydraulic testing rig, which is portable, is in constant demand and could well, in a future design, be built into a separate hydraulic test shop. Submariners are considerably more sensitive about hydraulic testing of repaired parts than their surface ship brothers, not only with regard to pressure hull fittings, but also to any water system in the submarine that is subject to a pressure differential.

When a submarine urgently requires a spare gear item to replace a defective component, it takes one by direct lift via a 4 ft. 2 in. by 4 ft. trunk from the spare gear store. If possible, the defective item is repaired on board and

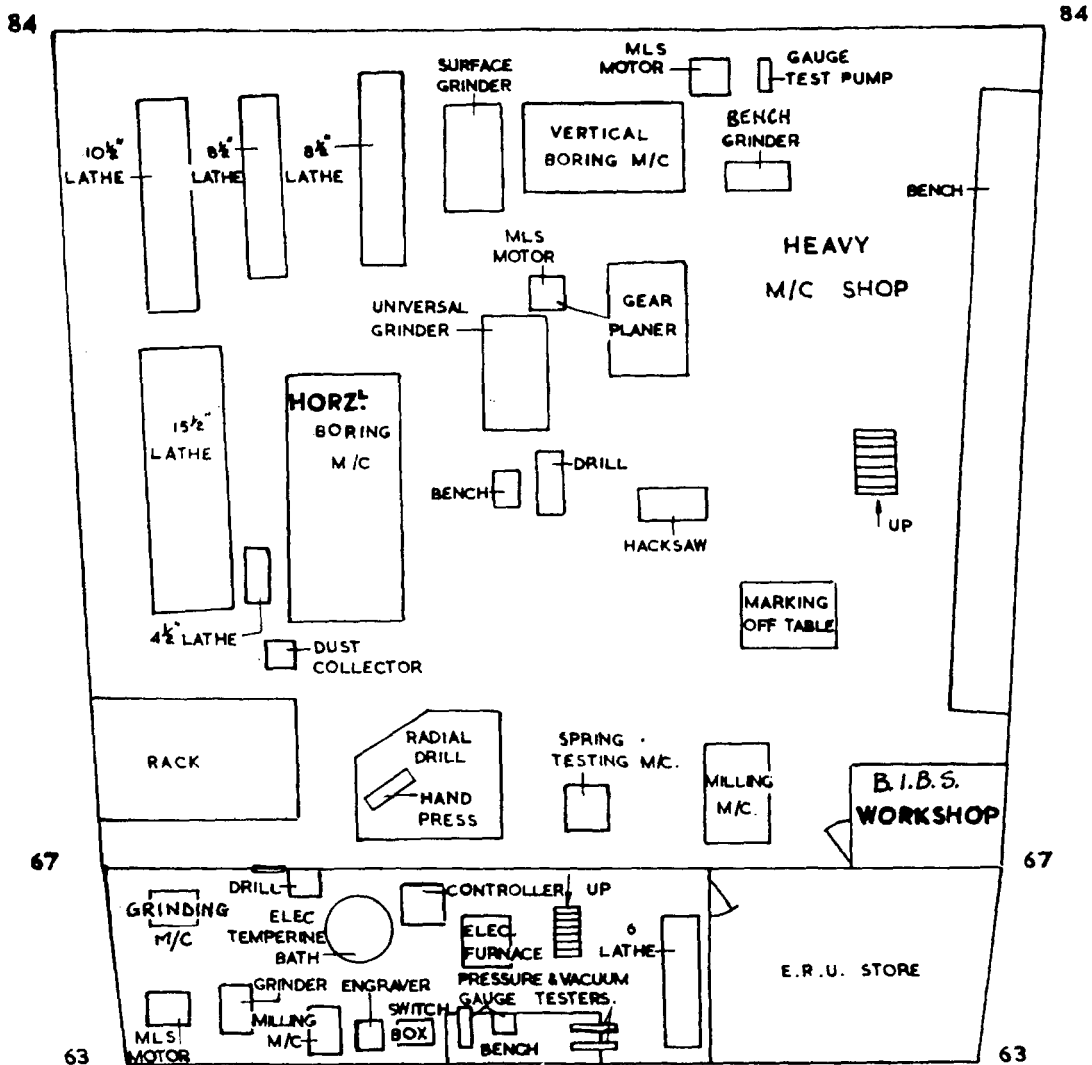


FIG. 1—PLAN OF HEAVY MACHINE SHOP, TOOL ROOM AND ENGINEERS READY USE STORE

lifted on completion via a 10 ft by 4 ft 6 in. hatch in the deckhead of the heavy machine shop to the spare gear store (see FIG. 2).

The heavy machine shop is provided with five 1-ton chain blocks running on suitable 'I'-section girder tracks to assist in moving large weights.

One lathe has recently been fitted up with metal-spraying equipment and has proved extremely useful for the reclamation of worn parts. Unfortunately, the situation of the lathe does not lend itself to a forced trunked exhaust of the 'fish and chip shop' type so a limitation is imposed on spraying with metals like cadmium that produce toxic fumes.

B.I.B.S. Workshop

A small enclosed workshop has been installed in what was the heavy machine shop tool store for the testing and adjustment of the demand valves of Built-in Breathing Sets. The Submarine Escape Coxswain (a submarine coxswain) works here under the technical supervision of the Senior Engineer. This shop was so sited because of the requirement for H.P. air supplies and because the heavy machine shop is reasonably dust-free, and at a time when all other activities of the Escape Coxswain were out in the Manoel Island D.S.E.A. Tank building.

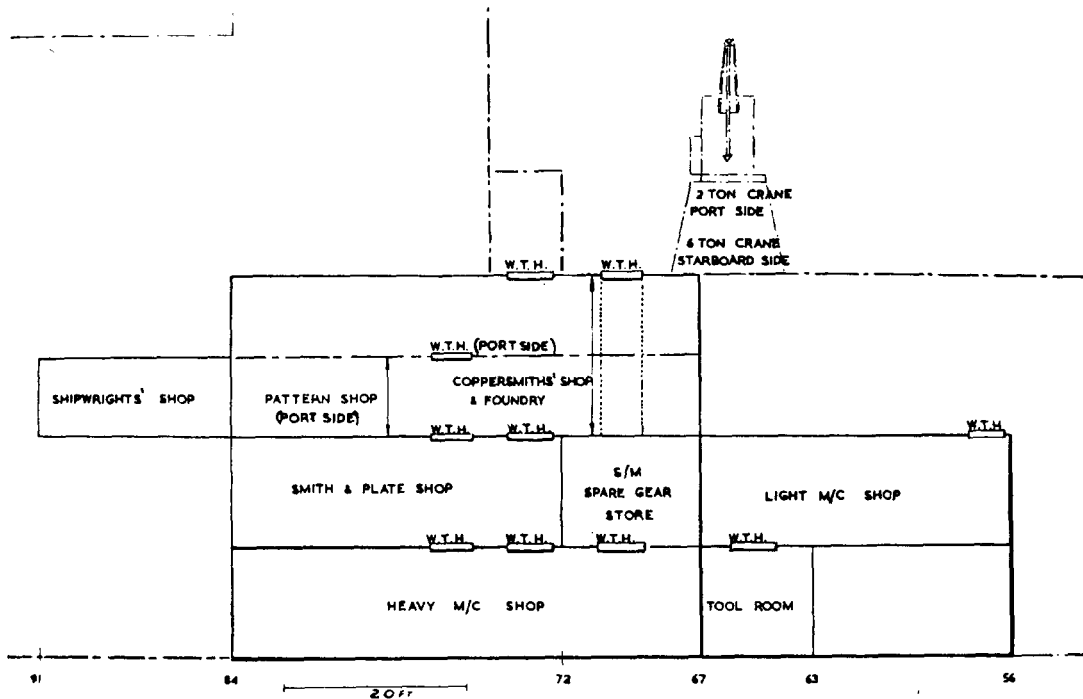


FIG. 2—ELEVATION SHOWING GENERAL ARRANGEMENT OF WORKSHOPS

Escape Workshop

It was decided recently to bring the whole of the Escape Coxswain's erstwhile shore-side maintenance facilities on board and, as the main requirements were for reasonably low temperatures and freedom from oiliness and greasiness, as well as for a fairly large space, it was decided to instal a workshop in the gunroom flat. This has now been done and here he has the means of testing and storing submarine escape immersion suits and D.S.E.A. sets (the latter now being carried, in British submarines, for fire fighting purposes) and of doing the attendant paper work.

Light Machine Shop

A plan view of the light machine shop is shown in FIG. 3. This shop is normally staffed by a C.E.R.A. and six E.R.A.s. The shaping machine is probably the least used machine while, possibly surprisingly, the 7 in. capstan lathe is the most highly prized. The latter not only rapidly turns out batches of such items as fitted bolts, but is also useful for quickly making good deficiencies of certain naval store items and machining large quantities of occasionally sub-standard spare gear items such as copper joints.

Tool Room and Store

Down one ladder from the light machine shop is the tool room and engineers' ready use store. The tool room, seldom used as such, nevertheless contains a useful range of equipment as shown in FIG. 1. Unlike its modern counterpart in a factory, the tool room contains no testing equipment apart from a pressure gauge hydraulic test bench. The adjacent store contains only ready use tools and the less valuable instruments. All materials required in the shops are, because of lack of space in the store, obtained elsewhere; a situation that would be unfavourably commented on if *Forth* were to be subjected to a 'work study' examination.

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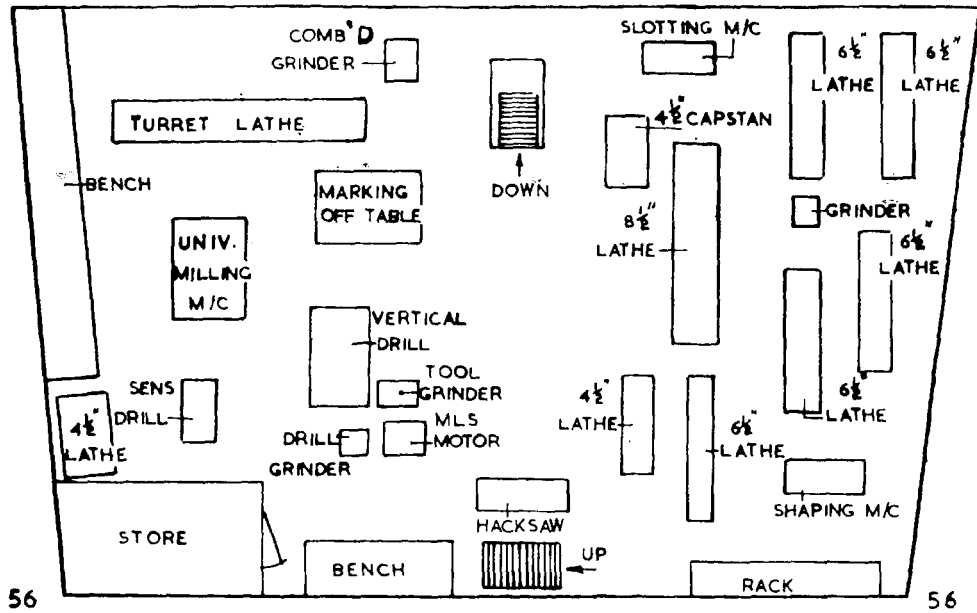


FIG. 3—PLAN OF LIGHT MACHINE SHOP



FIG. 4—VIEW OF THE LIGHT MACHINE SHOP

The Smiths' and Plate Shop

This shop is equipped as shown in FIG. 5 and is staffed by boilermakers and engin smiths but is also available for shipwright artificers and is well fitted for carrying out minor ferrous constructional and repair work. The additional weight involved by having bending rolls at least double their existing 4-foot length would be more than justified. The Bennie punching, shearing and cropping machine is a gem and quite one of the most valuable machines in the

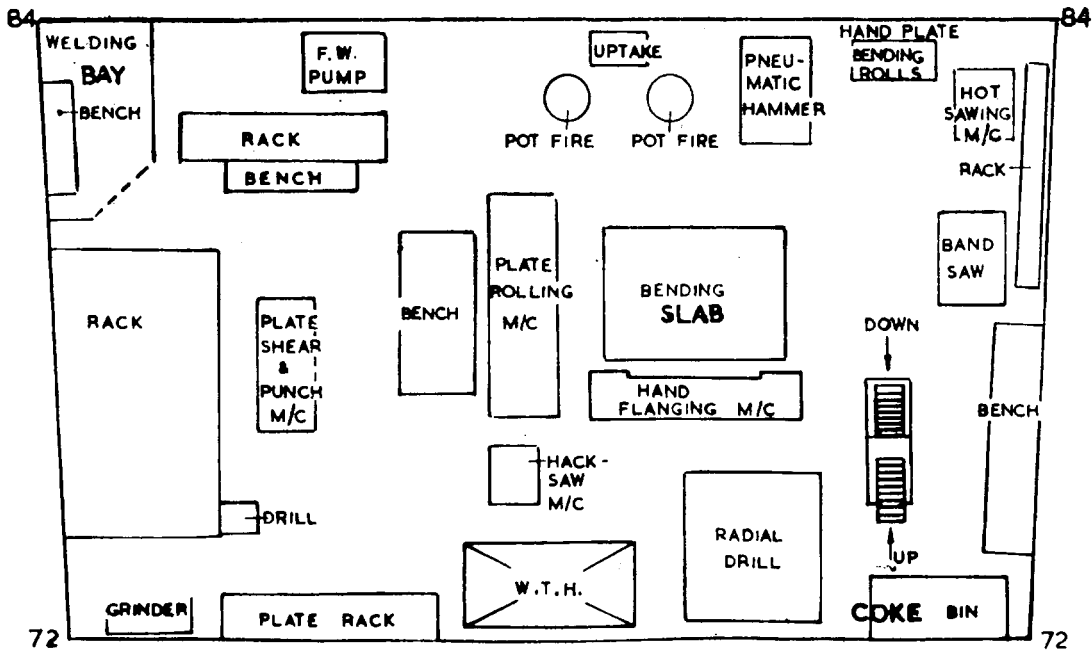


FIG. 5—THE SMITHERY AND PLATE SHOP

ship. The power hammer, used moderately frequently, requires a general warning to be issued before use as, in spite of rigid bracing underneath its bed, vibration is liable to upset a final run during cutting or grinding in the shops in the vicinity. Both gas and electric welding are carried out in this shop, the gas being bottled acetylene. Modern facilities for repairing and fabricating aluminium alloy structures are non-existent but it is hoped that this requirement will shortly be met by A. and A. action.

A large amount of work undertaken for submarines at the present time is spent making good leaks on salt water cooled exhaust manifolds and pipes associated with the main engines. On rare occasions these leaks can be made good by a run of welding, more often a patch is required and sometimes wholesale renewal of the water jacketing. It is not unknown for submarines to meet their commitments with hastily erected cement boxes round some of the worse leaks.

The Foundry and Coppersmiths' Shop

The layout of this shop is shown in FIG. 6. The foundry section contains one 400-lb 2,000 degrees C. tilting furnace and two 120-lb 2,000 degrees C. crucible furnaces with a 2-ton travelling crane overhead. It also contains a 900 degrees F. large core-drying oven which is, fortunately, large enough to receive such items as evaporator coils for descaling and annealing and cylinder heads for normalizing. A sand-blasting room is situated adjacent to the floor and is run by the moulder. It is useful in preparing surfaces for metallizing in addition to cleaning castings.

The coppersmiths have, for most of their tasks, enough space and equipment but a requirement for a modern, portable, pipe-bending machine has arisen several times during the present commission.

Patternmakers' Shop

This shop is shown in FIG. 6. The sander is a recent addition and its associated dust extractor has been rigged up with change-over butterfly valves to extract from either the sander or bandsaw as desired. At the same time that the sander

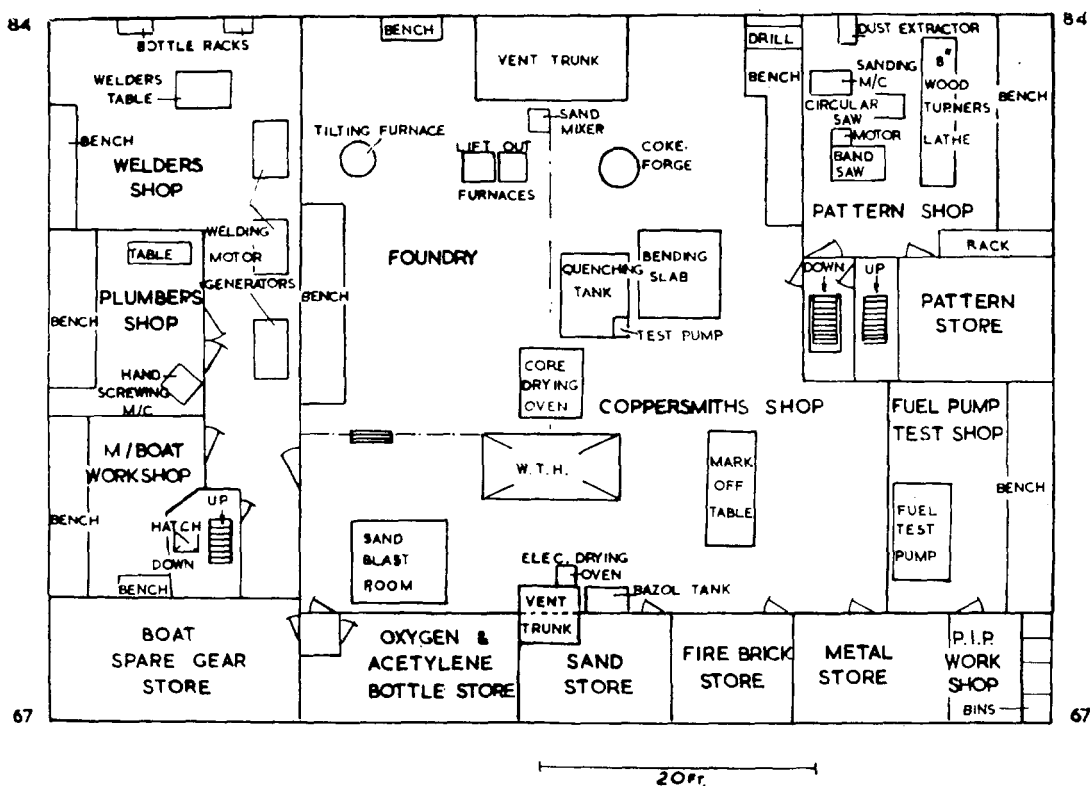


FIG. 6—THE FOUNDRY AND ADJACENT WORKSHOPS

was installed, the overhead shafting in the shop was removed and the machines converted to individual motors thus saving a considerable amount of space and some weight. There is also a small patternmakers' store adjacent to the shop.

Fuel Pump Test Shop

This shop, being situated in the space originally designed for the motor boat workshop, is satisfactory but not ideal, due to the difficulty of keeping it in the state of cleanliness necessary when handling such equipment as fuel pump plungers and barrels. A Hartridge dual-type Diesel pump test bench is fitted which enables motor boat, Diesel generator and submarine fuel pumps to be both phased and calibrated after repair or adjustment. Most types of injectors can be tested in this shop. A specially rigged pump has been fitted for use with PX-4 which is flushed through all refitted equipment before it is returned to the spare gear store or to submarines as carried-on-board spares.

P.I.P. Shop

A small preserving, identification and packaging plant for ferrous spare gear, etc., has been built in an annexe off the fuel pump test shop. The preservation process consists of cleaning in a 'dirty' white spirit tank, followed by washing in a 'clean' white spirit tank. The parts are then dried in a drying tank and, when cool, are dipped in a tank containing molten strippable preservative. Ball-bearings are dipped in a special tank containing PX-11. The parts are finally moved to a labelling and wrapping bench. Four roses, fed by the firemain and remote-controlled from the coppersmiths' shop, have been fitted over the plant. This plant was set up mainly for the benefit of submarine spare gear but is, of course, used for depot ship spares as well.

Plumbers' Shop

This shop is manned by shipwright artificers who, in the depot ship, very broadly have the responsibility for all hot and cold fresh-water services from the outlet side of the gravity tanks. Their major machine tool is a $\frac{1}{2}$ in. to 4 in. hand threading machine but none is more useful than the 'Sanisnake', a 'gadget' which normally makes light work of cleaning choked scupper pipes, soil pipes and drains.

Welding Shop

Adjacent to the plumbers' shop is the shipwrights' welding shop which contains all the ship's electrical welding generators, two $4\frac{1}{2}$ -kW and one 9-kW machines. It is a major disadvantage of the installation that portable leads have to be run from this shop, situated between decks, to all positions in the ship (except certain shops and the well deck) where electric welding is required to be carried out. A much more satisfactory arrangement would be achieved by having a 'welding main' running throughout the length of the ship with permanent tappings taken off to either side of the well deck, among other places, for use in the submarines alongside. The 'main' could be fed by any machine through suitable change-over switches.

A very large amount of the shipwrights' metal work afloat involves gas cutting followed by electric welding. The former has been made much easier by a recently supplied equipment, the P.L.E.C.A. (Portable Light Emergency Cutting Apparatus), which only weighs sixty pounds complete. The use of this set saves considerable manhandling of heavy gas cylinders to submarines alongside.

Shipwrights' Shop

A well fitted shipwrights' woodwork shop running right across the ship is spoilt by its location on No. 4 deck. It is a matter of very considerable inconvenience that all wood used requires cutting to length and needs considerable man-handling to get it into the shop. Unfortunately, too, a ridiculously large percentage of the total shipwright labour force is spent on repairs to ships boats, particularly the hard chine type, and any work study expert would be horrified at the number of long treks made daily by shipwrights between the upper-deck boat stowages and the shop. *Forth's* sister ship, *Maidstone*, is better laid out in this respect, having her shipwrights' shop on the upper deck in the space occupied in *Forth* by the recreation space.

Periscope Shop

This shop, due to extensive alterations in recent years, is now one of the 'showpieces' of this ship. It is capable of storing and housing, for repair, periscopes and radar masts up to 43-ft long and is fitted with fluorescent lighting, steam heating and air conditioning. The staff of the shop consists of one or two submarine E.R.A.s specially trained at Messrs. Barr and Stroud. An O.A. also works in the periscope workshop on minor optical equipment such as binoculars and telescopes in order to make use of the lens and prism balsaming oven. This shop also contains benches, a 4-in. lathe and various minor equipments such as a collimator and a desiccating plant, the latter for thoroughly drying the air inside the periscope on completion of repair.

The periscopes and radar masts are removed from the submarine by either of the 2- or 6-ton cranes. The periscope derricks are unpopular as many hands are required to rig and use them and it is often possible to avoid their use by listing the depot ship and trimming down the submarine, in order to gain a



FIG. 7—THE PERISCOPE WORKSHOP

little more clearance for the crane. The periscope is handed over to two $1\frac{1}{2}$ -ton travelling blocks running on a central 'I'-section girder in the periscope workshop. Turntables move the periscope from the central position in the shop to the sides where six stowage racks are fitted.

Photographic Dark Room

In addition to the more usual photographic apparatus, the dark room contains a large $6\frac{1}{2}$ in. by $4\frac{1}{4}$ in. enlarger, a Johnson glazer, a 10 in. by 8 in. contact printer and a Holden photo-copying machine capable of reproducing prints from tracings of 30 in. width. Photographic work is carried out by a leading airman suitably qualified at the R.N. School of Photography. As a large amount of his work involves liaison with the periscope E.R.A.s, the darkroom is administered by the Engineering Department and the leading airman is incorporated in one of the M.(E)'s divisions.

Spare Gear Organisation

Submarines

This is a highly important part of the Engineering Department, the efficiency of which has a great bearing on the operational availability of the submarines. It is run by an experienced submarine engineer officer appointed for duty in H.M.S. *Forth*. He is assisted by a submarine chief engineering mechanic, who is 'stopped draft', and a party of two L.M.(E)s or M.(E)s, both submarine ratings.

The spare gear organization functions very much like a Sub-S.P.D.C. (no pun intended!). Submarines demand spare gear on, and return it to, the S.G.E.O. who either replenishes by direct demand on S.P.D.C., Malta, or Captain (S/M) Five (H.M.S. *Dolphin*), as appropriate, or else arranges for the repair of defective parts by H.M.S. *Forth*, by H.M. Dockyard, Malta, or by Local Purchase Order to the manufacturer of the part.

Depot Ship

Each section officer is responsible for the safe stowage, preservation, repair, demanding and returning of his own spare gear. Some of it is kept in the depot ship spare gear store but much of it is stored in the section officer's own domain.

T.A.S.

The T.A.S. Department in H.M.S. *Forth* is divided, broadly speaking, into the following three sections :—

- (i) Torpedoes, mines and submarine torpedo tubes
- (ii) Asdics
- (iii) Diving.

The Squadron T.A.S. Officer, a General List lieutenant-commander, is responsible for the general administration of the Department, and he deals with all operational and tactical matters. He is assisted by two Special Duties List lieutenants, one of whom deals with submarine Asdic sets and is also the divisional officer for all the depot ship T.A.S. ratings, the other being the diving officer and officer responsible for all torpedo armament and explosive stores, and associated submarine and depot ship ledger accounts.

The Ordnance Engineer Officer is responsible for the maintenance and trials of submarine torpedo tubes and torpedo control equipment, preparations for firing of practice torpedoes and mines, and routine stripping and overhaul of all the torpedoes held by the Squadron. He is also responsible for the mechanical maintenance of, and repairs to, the hull outfits of the submarine Asdic sets, the diving recompression chamber and the depot ship's and submarines' gunnery and fire control equipment.

The Ordnance Department staff consists of two chief ordnance artificers and fourteen ordnance artificers, whose work is divided up as follows:—

One chief O.A. is in charge of the two torpedo parting shops and he has six O.A.s working under him, who do all the preparation routines and annual or biennial stripping and overhauling of the 120 torpedoes, and their associated heads and pistols, held by the Squadron.

The other chief O.A. who is in charge of the ordnance workshop and spare gear store, is assisted by five O.A.s in the maintenance of the depot ship's and submarines' gunnery and fire control and optical equipment other than periscopes.

Of the remaining three O.A.s, one is employed full time on the maintenance and preparation of torpedo gyroscopes and depth and roll recorders and the other two, who form the torpedo tube party, carry out all the routine calibration and repairs of the submarine torpedo tubes and all such work in connection with submarines in dock and refitting, including post-refit trials.

Some idea of the T.A.S. Department's effort may be given by stating the fact that over 1,000 practice torpedoes have been fired by submarines of the First Submarine Squadron during the last five years.

ELECTRICAL

General

Like all others in the *Forth*, the Electrical Department's job is to look after the Squadron as a whole. It finds itself, probably more than any other department, with the choice of either devoting an undue portion of its effort to looking after the *Forth* or of letting her electrical and electronic state slide. This is due to two factors, namely, inadequate numbers of staff and the age of most of the equipment and wiring in the depot ship.

Personnel

The Squadron (L) Officer is a commander ; his deputy is a lieutenant doing his General Service after some four years in submarines, and there are two S.D. officers, one for submarine repairs and the other for radio maintenance ; the last two have had no previous submarine experience. The total depot ship staff, including artificers, mechanics, electrician and radio electrician rates, is less than 40 ; the repair staff consists of three artificers and four electrical and radio mechanics and the spare crew made available amounts to one artificer and one petty officer ; but these two, forming so small a pool, are often required in billets in the submarines.

Workshops

In the after part of the ship, far from the useful well-deck cranes, is sited the main workshop for ' heavy ' work. This contains a 6-inch lathe, three 4½-inch lathes, three drilling machines, two bench grinders, a universal milling machine and a shaping machine. It is shared with the Ordnance Engineering Department ; an arrangement which has never proved satisfactory to either party. A better scheme would be for the E.A.s to have their own, smaller, shop and for the O.A.s to work with the E.R.A.s in slightly enlarged engineering shops. A still better arrangement might be for all workshop resources to be pooled and for the direction of all technical work to be the responsibility of one General List commander who would be, preferably, an engineering or electrical specialist.

A small ' clean ' shop for light work, such as instrument calibration and repair and coil-winding, is in the same flat as the main workshop.

There is an impregnating plant, sited on the housetops, but this is seldom used for the full treatment ; a home-made baking oven and a dipping bath are, however, most useful.

Electronic maintenance is carried out in two shops on the ' house tops '. One of these is fitted with racks to hold complete submarine radar components as ready-use proved replacements. Maintenance of submarine W/T aeriels is carried out here and takes up a large amount of the radio maintenance personnel's time, particularly in the vulcanizing of joints and junctions.

Spare Gear

The 'L' Department's spare gear organization is handicapped by the lack of large, easily accessible, crane-served and well racked store rooms and by the lack of experienced submarine personnel on a 'stopped draft' basis. All of these the 'E' Department has and is thus able to do the job more easily and more efficiently. The rear organization, co-ordinated by E.-in-C. and Flag Officer, Submarines, and operated by S.P.D.C.s, dockyard technical departments and H.M.S. *Dolphin*, is more satisfactory for the engineers than is its counterpart to the electricians.

COMMUNICATIONS

H.M.S. *Forth* has a communications complement of two officers and twenty-two ratings who serve the depot ship and, to a certain extent, the submarines. The M.S.O. normally handles about fifty signals a day, rising to about eighty during major exercises when the signalmen break down from four to three watches. The W/T Department have a special circuit for communicating with submarines exercising in the vicinity of the depot ship but, during large exercises, *Forth* sends signals to the Admiralty who use the very powerful long wave Rugby or Criggion transmitters to communicate with the submarines when dived at moderate depths. Whenever a submarine dives she transmits a diving signal stating where she is diving and for how long. On surfacing, a surfacing signal is transmitted but occasionally these are delayed and so start many of the Popular Press scares. All signals for submarines in harbour in the vicinity of the depot ship are handled by the M.S.O. and forwarded to the submarine concerned by hand message.

SUPPLY AND SECRETARIAT

General

With minor exceptions in detail, the Supply Department is organized to look after the needs of the Squadron as a whole, i.e. it is not split into parent ship and tenders sections. The complement is roughly what a big ship with 1,100 accounts would have. Some of the cooks and stewards may, by chance, have had submarine experience, but the Department as a whole has to be manned by non-submariners. For this reason it is arranged for as many officers and key ratings as can be spared to spend a few days and nights in submarines at sea. This makes for tolerance on their part and also serves to impress on them their own true function, which is to help to keep the main armament of the depot ship—her submarines—in good shape. Because the submariners do their work out of sight, there is always a danger that their interests will be overlooked in the ordinary hurly-burly of the depot ship's existence. The submariner is an ingenious creature, with a fertile imagination, and an aptitude for stating his case convincingly. For this reason alone it would be sensible to study his habitat at close range, and so gain at least an inkling of matters which he is liable to raise in so disarming a manner.

The monotony and discomfort of a long patrol, and indeed of the 'clockwork mouse' day-running, amply justify the official measures that are taken to give the submariner a better diet than his opposite number on the surface. But the means of producing this diet are inevitably limited by cramped working conditions and by the fact that only one cook can be carried. A great deal depends on this man, who receives no special training, and is usually a local acting leading rate. Ideally there should be two cooks, one experienced and one learning, but lack of space rules out this solution. Other methods, such as giving a 'chef' a really comprehensive course in advanced cookery, are ruled out by finance. In consequence, the trend is now towards providing pre-cooked

deep-frozen food, which only needs re-heating. This method provides meals cooked by a real expert, but it is extravagant of refrigerator space which is scarce. It cannot yet be regarded as the whole answer.

Domestically the design of our submarines has not kept pace with advances on shore or in surface ships. It is only now becoming clear how extravagant the galley is in its appetite for amps, which is often as great as that of the main motors at slow speed. Much could be saved by more elaborate heat insulation and by the re-design of such heat wasters as opaque oven doors which, when opened, release into the submarine most of the heated air of the ovens. More electricity is then used to absorb the heat into the air conditioning plant. Refrigerator doors, too, are all vertically slung, and the refrigerators themselves are usually of a rectangular shape which does not make the best use of the circular space in which they are fitted. Refrigerators built into the lower half of the hull, with access by hatch, would provide more stowage and use less energy to maintain their temperature.

Stores

The system of naval store-keeping used in submarines is peculiar to them. Until comparatively recently their naval store accounts were kept on an inventory system--rather like a permanent loan list. Now they keep their own small ledgers for permanent stores. The submarines are still treated as tenders, however, and when they draw permanent items other than from the depot ship, *Forth* gets a copy of the vouchers and thus can check the accounts periodically. The system works well and ensures that the N.S.K.O. in the submarine has the day-to-day advice of the depot ship stores staff. If the N.S.K.O.s looked upon the stores staff as a ' Gestapo ', or if the depot ship staff behaved like one, the system would break down.

Consumable stores are taken from the depot ship by the submarines using the depot ship counter book. Once they have drawn the stores they do not account for them further.

With the increase in the amount of technical equipment introduced into submarines in the past few years and with the fact that a great deal of it is now considered essential to operational efficiency, a stores stowage problem in the boats has been created, particularly in the smaller ' S ' Class. The British pattern underwater telephone is an example. This set takes up a good deal of space in an already cramped control room and, in addition, space has to be found for the sundry spares for the set so that an item can be immediately replaced as soon as it becomes unserviceable. Then, when a submarine is detached from the depot ship, she also has to carry the portable set so that it can be transferred to any surface vessel with whom she is working to provide surface/underwater communications. Practically every ' E ' list for submarine equipment lays down a minimum complement of spares to be carried in the boat. Perhaps the *Dreadnought* will have a small store room; there's much to recommend it.

In this Squadron, the submarine's N.S.K.O. is sometimes the Engineer Officer and sometimes the First Lieutenant. Both are busy officers and can rarely devote as much time to naval stores matters as they would like. The N.S.K.O. has no rating in the submarine with any stores knowledge and inevitably he finds himself not only doing most of the paper work involved but also a lot of his own errands. The depot ship staff can help in some ways but not to any great extent as it is practically impossible to anticipate a submarine's naval stores requirements. The work involved does not justify the employment of an S.A.(S) in a submarine but most submariners agree that there is sufficient work for a rating who could combine the duties of S.A.(S), S.A.(V) and ship's

writer. An intelligent rating of either the S.A. or Writer Branches could carry out all these duties and obtain his training 'on the job'. He would at all events be a 'professional' in one subject.

A large number of stores items in submarines are of non-service pattern. Of these, some are engineer's spare gear, others electrical spare gear and the remainder are what have come to be known as submarine special stores. The latter are mostly 'special to ship' washers, dexine rings, metal alloy washers and bushes, dexine and rubber seats, etc. Their supply is controlled, very efficiently, by H.M.S. *Dolphin*. Because they cannot be obtained through S.N.S.O., a fifteen months' supply has to be maintained in the Squadron. They are accounted for separately and the submarines are responsible for keeping up to date the *Lists of Special Stores* (D.122). The present system for obtaining special stores does mean that a separate organization exists, as it were, on top of the normal naval stores organization. The Admiralty at present have the whole question of the future of these stores under review and it seems probable that some items will be patternized and the remainder will be transferred to spare gear as has been done, already, for surface ships.

MEDICAL AND DENTAL

H.M.S. *Forth* has a large sick bay consisting of twenty cots, an operating theatre, dispensary, examination room, consulting room, isolation ward and bathroom, most of which are air conditioned.

It is fitted with its own autoclave and so is independent of shore in sterilizing gowns, dressings, etc.

The S.M.O. is also the Surgical Specialist Afloat in the Mediterranean Fleet.

There is a dental surgery with facilities for one dentist.

TRANSPORT

Boats

H.M.S. *Forth* carries the following power boats :—

- 1 in No. 25-ft F.M.B. (Captain's)
- 2 in No. 35-ft F.M.B.s
- 2 in No. 45-ft Launches
- 2 in No. 36-ft Pinnaces
- 1 in No. 32-ft Motor Cutter.

One of the pinnaces is allocated to the Squadron Engineer Officer and is manned by an Engineering Department crew with an L.M.(E) as coxswain. It is available to everybody in the ship but first priority is given to technical departments' requirements. Its running is co-ordinated by the depot ship engineer's writer, the coxswain merely reporting to the O.O.W. on his departure and return. The possession of this boat makes life a great deal easier for the Senior Engineer.

M.F.V. 73 is permanently allocated to the Squadron and is used mainly for noise trials in submarines and also for transporting crews of submarines which are doing periodical dockings and for the carrying of bulky stores.

Motor Transport

H.M.S. *Forth* has a permanent allocation, from S.N.S.O., Malta, of one 3-ton lorry, one 15-cwt truck and one Bedford Utilecon. These are all supplied with S.N.S.O. drivers but they and their drivers are only available during dockyard working hours. Their use is co-ordinated by the Engineering Department.