THE GENERAL LIST ENGINEER OFFICER

EVOLUTION, EMPLOYMENT AND FUTURE

BY

COMMANDER C. B. WILLCOCK, R.N., C.ENG., M.A., A.I.E.E. AND
COMMANDER E. W. WARD, R.N., C.ENG., A.M.I.MECH.E., M.I.MAR.E.

The authors are members of the Officers' Planning Section in D.G.N.P.S. with responsibility for forward planning of the Officers' structure. The views expressed in this article and in particular the speculation as to future trends are the personal opinions of the authors, and do not necessarily represent Ministry of Defence Policy.

INTRODUCTION

No apology is offered for adding to the volume of discussion on this subject, as this is of lively interest in these days of policy changes.

This article is concerned with the present and future employment of General List Engineer Officers. It considers first the Engineer Branch, briefly surveying its history to show how the present structure has evolved. The Ministry of Defence organization for handling this structure is then outlined and some of the principles of career planning listed. The division into sub-specializations is shown and each sub-specialization considered in turn. The need for an officer to return from his sub-specialization is then argued.

HISTORICAL BACKGROUND

The Marine Engineer

The change from sail to steam is now long enough ago for the Marine Engineer sub-specialization, unlike the other Engineer sub-specializations, to have settled into a well-established organization, where training, employment, professional standards and so on are fully worked out, defined and understood.

It should not be assumed, however, that because of this the specialization has been static. Indeed, in the last few years an important change took place when the training of marine engineer officers was altered so as to conform more closely with the National University system and external Engineering Degrees were incorporated in the naval scheme. At this stage, the title of the specialization was changed from 'Marine' to 'Mechanical Engineer'.

However, the other sub-specializations are newer and the major development in these evolutions are outlined below.

The Electrical Branch

The 'Phillips' Report and the 'Middleton' Steering Committee led in 1946 to the setting up of the Electrical Branch. This combined the existing Warrant and Commissioned Electrical Officers with a body of Cadet entry electrical officers professionally qualified to national standards. Underlying this approach was the recognition that hardware would proliferate to a degree where a detailed knowledge of the full range of equipment would not be possible. Instead the principles would be mastered, so that the individuals could then apply these to whatever equipment they might have to deal with. This approach, while varying in its application, has remained the underlying philosophy of the Branch for officers and ratings.

No one, either within the Navy or outside it foresaw just how big and rapid the technological explosion triggered off by the advances in electronics would be. In consequence, demand has exceeded forecasts and entry rates have seldom met the real need.

The rating structure of the Branch is fully constituted, but it takes longer to achieve a steady state of all ranks of officers as they serve for longer.

The Branch was started by transferring officers from other Branches, the R.N.V.R., the Admiralty Engineering Service, entry of civilians, and so on. Officers who entered the Electrical Branch as cadets are only now approaching the zone for promotion to Captain. Clearly it will be some years before stability comparable with the Mechanical Engineers can be achieved.

The Committee on Officer Structure and Training (C.O.S.T.)

The next major development stemmed from the Committee on Officers' Structure and Training, which sat in 1954 and 1955. This led to the splitting of the Seaman List into 'Wet' and 'Dry' Lists on promotion to Commander, and the union of the Seaman 'Dry' list with the 'Engineers' and 'Supply and Secretariat' specializations to form a single General List of officers. This enabled much rationalization of command, employment, entry, training, promotion and so on. To attract a high quality entry a good career factor for promotion to Commander was offered, and demanding entry standards set.

This General List is now a well established fact and undoubtedly contributes to the harmonious development of inter-Branch relationships. Some duties afloat and ashore are now shared, and a number of appointments, more particularly in the senior ranks, are held alternately by officers of any of the three Specializations.

The Treasury maintains a ceiling on the numbers of Commanders, and this with a fixed career factor limits the number of 'Lieutenants' (trained Lieutenants and Lieutenant-Commanders) that may be borne.

This does not provide enough 'Lieutenants' to do the work needed at that rank, so the Supplementary List was set up. This comprises a mainly short service list of professionally qualified officers, interchangeable in engineering appointments with the General List, (G.L.).

The recruiting rate does not meet the requirements for either the General or Supplementary Lists. We seek officers capable of attaining recognized professional standards, believing that quality is more important than quantity. There is a national shortage of this sort of candidate.

At the same time the status of the Warrant Officers, then known as the Branch List, was improved. This was done by promoting the Commissioned Officers, Senior Commissioned Officers, and Lieutenants to Sub-Lieutenant, Lieutenant, and Lieutenant-Commander respectively, and introducing the present title of the Special Duties (S.D.) List. Promotion to Commander on the S.D. List was forecast.

The Axe

Changing Defence needs forced a reduction in numbers in 1957/58. Many seaman officers were axed, a small number of mechanical engineers but very few electrical engineers.

The Murray Training Scheme

The present training sequence for General List Engineer Officers dates to 1958 and is known as the Murray Scheme. The pattern for the majority of officers is two years general naval training before degree studies at the Royal Naval Engineering College, Manadon, while a small number read the Mechanical Sciences Tripos at Cambridge University.

This is followed by Application Training in specific technologies appropriate to the naval task and equipment training. The main fields now covered in this phase of training are for electrical specialists: Radio and Radar, Control Engineering, Gyro Dynamics, Computation, Materials Technology, Weapon Assessment, Economics and Management. The fields for Mechanical specialists are: Marine Engineering, including Nuclear Technology, Aeronautical Sciences and Engineering, Computation, Production Engineering, Materials, Economics and Management.

The Carlill Committee

In 1959/1960 the Carlill Committee looked into engineer officer problems and recognized that whatever technology was being pursued, the essential art of engineering had a common basis. Accordingly, the Mechanicals and the Electricals were combined in a common Engineer Branch, containing within it officers trained in both the mechanical and electrical disciplines.

Considerable progress has been made in implementing the merger. The re-titling as one Branch is almost complete. There are nearly 200 posts now complemented alternatively for an engineer officer of mechanical or electrical background.

All G.L. engineer officers will compete for promotion to Captain in a common list starting with promotions to be effective in June, 1969. This may later be extended to the promotion to Commander. Steady progress has been made in rationalizing practice, both in the technical and administrative fields. Common maintenance documentation has been accepted, and extended to the other departments.

There is acceptance of common professional engineering standards in training, though syllabuses for the academic courses for General List Mechanical and Electrical Officers diverge.

Sub-specializations were more closely defined both in employment to Commander rank, and in training. While this has reduced cross employment within the Engineer Branch, it has not been long enough for us to run out of officers with experience in more than one sub-specialization.

At the same time the Ordnance Engineer sub-specialization, which had long been working very closely with the Electrical Branch, combined with it to form the Weapons and Radio side of the Engineer Branch. This merger is almost complete. Nearly all O.E. officers have been cross-trained in electrical subjects, whilst most electrical officers have been cross-trained in ordnance.

The Committee also sought to rationalize control of the ship systems, and in particular the generation and distribution of electrical power, under the Marine Engineer Officer, thus freeing his electrical colleague to concentrate upon the Weapons and Radio, whose proliferation was presenting formidable problems. This, however, ran into difficulties and is now in abeyance.

Clearly, the single Engineer Branch is going to work, and the benefits, already considerable, will be great. As in any personnel change it will take many years for the full effects to become manifest.

The Officer Structure Survey Committee (O.S.C.C.)

This Committee sat in 1965. It considered a Navy of Vote A strength of 100,000 and recognized that within this the proportion of engineer officers would need to rise, to take account of the increasing complexity of equipment. This has been called the 'Technical Trend', and to give it effect the entry targets were adjusted to seek more engineer officers, and correspondingly fewer seamen and supply and secretariat officers. General List career factors were given some flexibility.

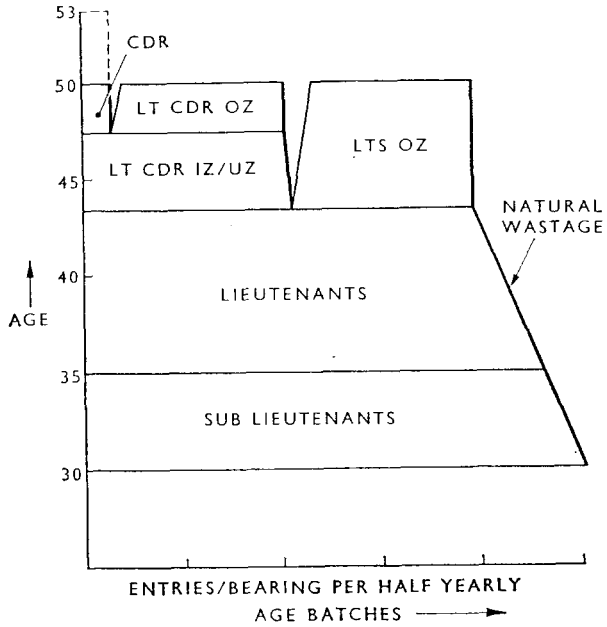


FIG. 1—S.D. ENGINEER OFFICER STRUCTURE

The full effects of these changes will not be felt for many years. A change in entry rate would take 25 years to affect the bearing of Commanders significantly, and in any case, the increased target for entry of engineer officers has not been matched by enough candidates of the required quality. The change in career factors for the General List will start to become effective in 1984.

The proportion of 'Lieutenants' (that is, trained officers of Lieutenant-Commander's rank and below) to be provided by the Special Duties List was set for the Engineer Branch to be up to 44 per cent. It has now risen to 49 per cent to compensate for G.L. shortfall, and may go higher yet. This is much higher than the other Services intend and compares very favourably with commerce and industry where 'from shopfloor' promotion is becoming yearly more difficult. At the same time the conditions of service of the Special Duties List were improved by increasing the career factor for promotion to Lieutenant-Commander, to about one in two, instead of about one in three. Promotions at this increased rate have started, but will take about five years yet before the full effect on the bearing is achieved. Also then started was the planned promotion to Commander on the S.D. List.

The Steady State Special Duties List structure that we are working towards is illustrated in FIG. 1. Ages shown are planned average age on promotion, while the dotted section indicates the planned extension of retirement age due in 1973.

The increasing proportion of S.D. officers at higher rank will continue to broaden the S.D. List contribution, both in posts held and in nature of work. At the more senior level, the administrative or managerial content increases in comparison with the more technical aspect, and the more senior S.D. List officers can expect to become increasingly involved in a managerial capacity with the affairs of Engineer Branch sub-specializations other than their own, without the necessity for deep knowledge or training in those sub-specializations.

Defence Review 1966/68

While the political and economic debate continues, certain clear directives have emerged. Firstly the Navy is stopping operational fixed-wing flying, now planned to end in 1971/72. This will cut back the manpower needs of naval aviation to the helicopter force, whose planned size gives a good idea of the final officer strength needed.

These reduced needs of naval aviation are already reflected in the reduced numbers of G.L. and S.L. officers selected for the A.E. sub-specializations. Extraction of S.D. officers into the A.E. categories of A.L., A.R. and A.O. will similarly be reduced. Measures for redeploying officers surplus to the A.E. task in other service engineering roles are the subject of a series of D.C.I.s. Redundancies of surplus officers for whom there are no re-deployment opportunities are being calculated.

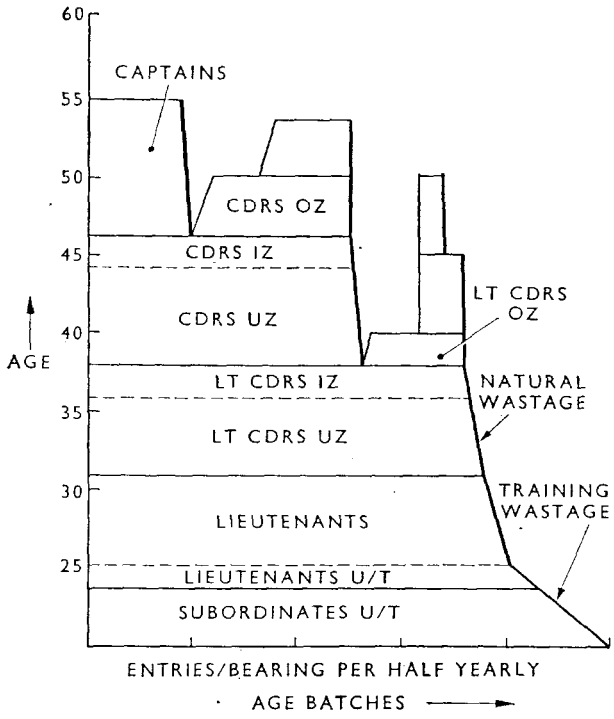


FIG. 2—G.L. ENGINEER OFFICER STRUCTURE

Secondly, the high priority of the Polaris and nuclear Fleet submarines has been re-affirmed, as is already shown by the increasing number of G.L. (and S.L.) officers selected for submarine training.

Thirdly, the Navy's overall manpower needs will be less. A figure for the Vote A strength of the order of 80,000 by 1973 is planned, and this will in turn need fewer officers than the preceding 97,000 Vote A Navy. This has the overall effect of about cancelling out the present shortage of engineer officers, although the mix is not correct for the new Fleet, hence the need for redeployment and some redundancies.

Beyond this it needs no crystal ball to foresee that there will be more changes. The economic state of the country, the European as opposed to global role of Great Britain, and the rapidly changing armament technologies all warn that the future will not be static. To cope with a dynamic future we may well need to develop more flexible approaches than were appropriate in the past, particularly in the training and employment of engineer officers, who in a normal career will see both foreign policies and technologies come and go. We cannot look forward to a 'return to normal', as the normal state in the future will probably be one of continuous and rapid change. This means that there is always something new, which is the sort of challenge a professional engineer officer should relish.

THE PRESENT STRUCTURE

The present structure is based on the idea of a blend of experience and the academic approach. The S.D. officers contribute much 'on-the-job' experience, while the G.L. and S.L. bring the academic approach. Like all generalizations this does not reveal the full story, as S.D. officers increasingly bring considerable theoretical understanding to their work, whilst G.L. and S.L. officers amass experience, if of a wider field. The overall effect sought is of a mix of diverse backgrounds which, working together, make a team of great power, effective over a wide range of activities.

The S.D. List structure is shown in FIG. 1 and was described above. The corresponding G.L. structure is shown in FIG. 2.

As before the planned average ages are shown, while dotted lines have been added to show promotion zone entry points. The structure has been drawn to show the state after 1st April, 1973, when the retirement age for Commanders is to be raised to 53.

As we saw above, numbers are controlled by a Treasury limit on the number of Commanders (and above). As the slope of the pyramid is fixed by the career factor, the number of Lieutenants on the G.L. is limited. It is this that gives scope for the large extraction of S.D. officers from rating and the opportunities for short service commissions on the S.L. for those who would like some naval service as engineer officers but who do not necessarily want to stay for their working life.

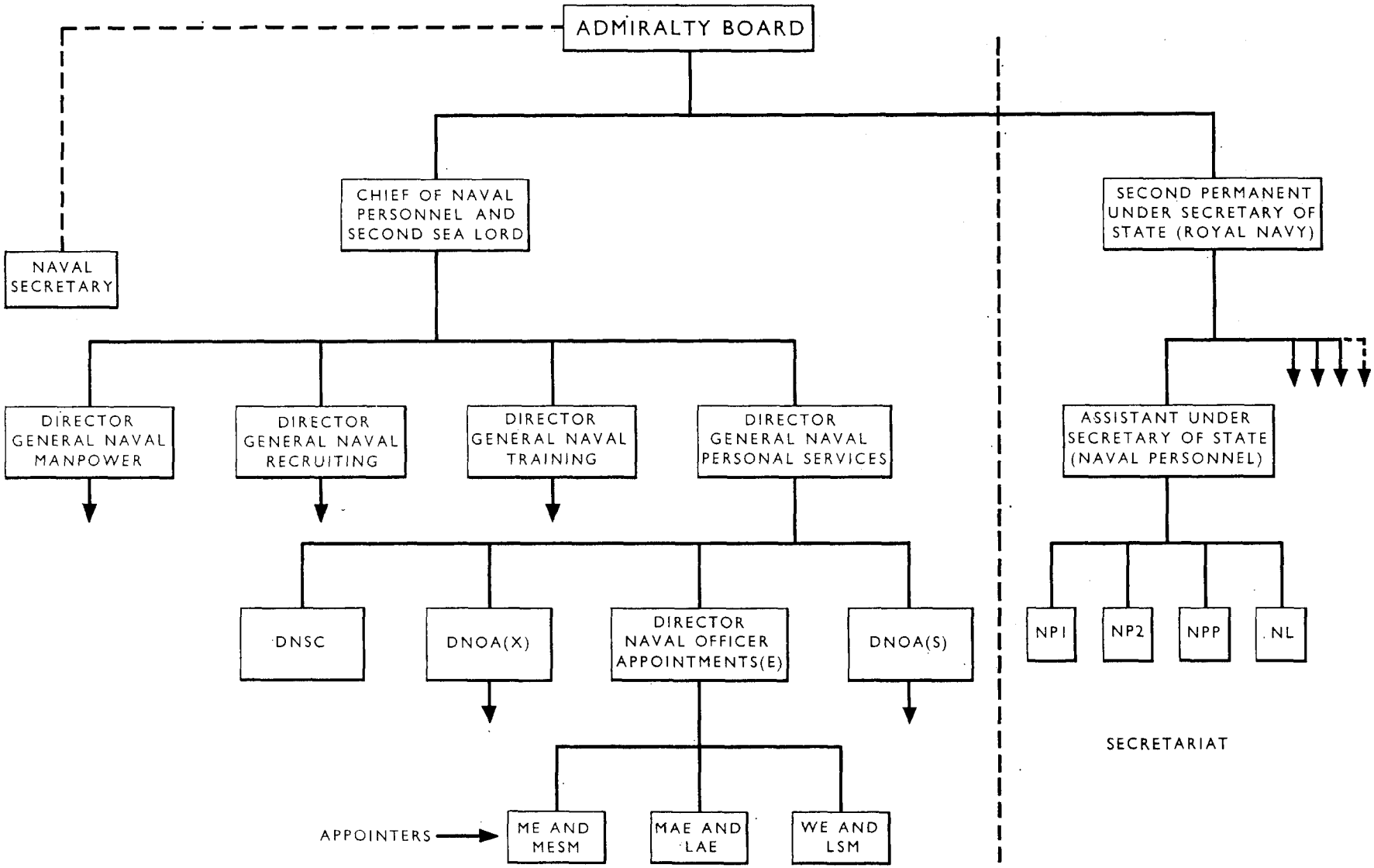


FIG. 3—MINISTRY OF DEFENCE ORGANIZATION FOR NAVAL OFFICERS

At the same time the G.L. is clearly the nursery of the future higher management, and rightly so as they are picked on a basis of pure merit from the widest possible section of the community and are started young enough to develop the breadth of experience needed. Such favoured treatment carries a corresponding responsibility. This is the duty of the officer to make himself fit for the higher roles. Such fitness is not the consequence of the initial training, but can only come from a continuous process of self-development.

Having brought the structures up to the present day, we will look at the Ministry of Defence organization responsible for implementing the plan.

MINISTRY OF DEFENCE ORGANIZATION FOR OFFICERS

Officers are looked after by the Chief of Naval Personnel and Second Sea Lord, Admiral Sir Frank Twiss, K.C.B., D.S.C. He exercises this responsibility through a group of naval departments headed by Directors-General who work closely in parallel with the Secretariat as shown in FIG. 3.

Considering the Secretariat first, these are the permanent Civil Service divisions who carry out the various actions, maintain continuity, handle proposals, sort out departmental views, prepare Board submissions, negotiate with other Government departments such as the Treasury and so on. It will be seen that their activities are administrative and executive as well as secretarial. They are complementary to the naval departments.

Responsible to the Second Permanent Under Secretary of State (Royal Navy) is the Assistant Under-Secretary of State (Naval Personnel)—short title AUS(NP)—who has four Heads of Divisions under him. Naval Personnel Division 1 (NP1) work mostly with D.G.N.M. and D.G.N.T., Naval Personnel Division 2 (NP2) with D.G.N.P.S., and the two remaining Divisions are Naval Law (N.L.) dealing with discipline and legal aspects and Naval Personnel (Pay), (N.P.P.).

While other naval departments look after the Royal Marines, Medical, Dental Officers, W.R.N.S. and so on, these are beyond the scope of this article. Engineer officers are the concern of the following.

First is the Director General of Naval Manpower (D.G.N.M.), who works out the requirements, that is, how many of what sort of officers will be needed. He is responsible for schemes of complement. Next is the Director-General of Naval Recruiting (D.G.N.R.), who recruits officers from civil life. The Director General of Naval Training (D.G.N.T.) is responsible for the actual process of training these officers, and also of extracting Special Duties List officers from ratings already serving.

The Director General of Naval Personal Services (D.G.N.P.S.) appoints officers of Commander's rank and below—the Naval Secretary does this for Flag Officers and Captains—and deals with their personal problems, acting as their Headquarters Divisional Officer from their entry date.

After they finish training he is completely responsible for them, selecting employment suitable to their abilities and taking care that their talents are properly developed by a graded and varied series of appointments. To assist him in these tasks he has four Captains. One, the Director of Naval Service Conditions (D.N.S.C.), is responsible for Service Conditions in their broadest sense. The other three are the Directors of Naval Officer Appointments, the D.N.O.A.s. There is one for each specialization, Seaman, Engineer and Supply and Secretariat, the D.N.O.A.s (X), (E) and (S) respectively. These have teams of Commanders and Lieutenant-Commanders who are the actual appointers. General List, Supplementary List and Special Duties List officers are all appointed from the same offices. The appointing process is summarized in FIG. 4. It is based on two sets of data, i.e., that about the officers themselves, and that for the appointments or jobs available. The jobs are defined in the approved Schemes of

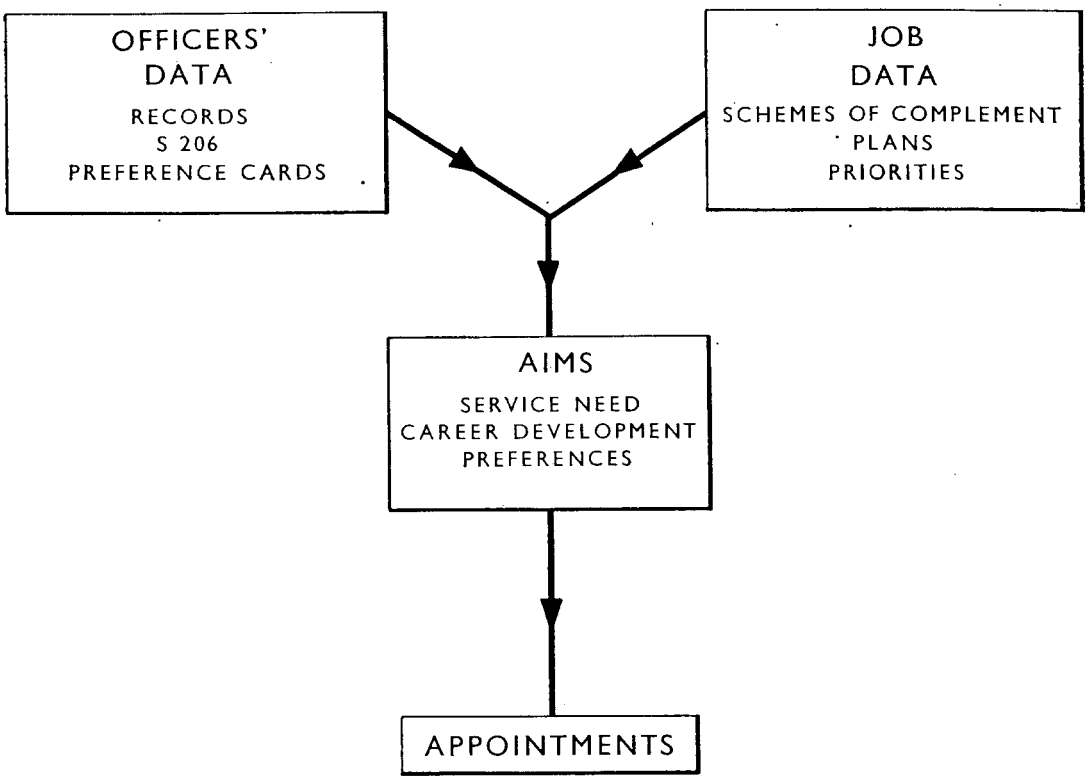


FIG. 4—THE APPOINTING PROCESS

Complement and the Plans, i.e., what ship will be in commission during which period, etc. These together provide a complete list of the jobs to be filled, and a description of the job, i.e., the job profile.

Data about the officers is contained in the records, which beside details of age, rank, qualifications and so on include copies of all the Confidential Reports which have been raised on the officer. Besides showing how an officer has been employed, and how he performed, these reports include a section for recommendations as to future employment. Officers' wishes are also obtained on Preference Cards.

While it is open to officers to go and talk to their appointer about their future, the officer concerned should always check first with his Commanding Officer—who may well have already taken action on his behalf—and secondly, try to give as much notice as possible before presenting himself for interview.

The Appointing Aims are threefold, and in order of priority are:

(*a*) First to meet the needs of the Service
(*b*) Second to develop the officer's potential
(*c*) Third to meet the officer's wishes.

These aims are pursued with the aid of the concept of career pattern.

CAREER PATTERNS

Career patterns are not fixed. They vary from individual to individual, from sub-specialization to sub-specialization, and from time to time. There is, however, a deliberate plan which runs throughout the career patterns of officers. This is to alternate employment in varied fields to fully develop and exploit each officer's potentialities. The Navy goes to a great deal of trouble with the career development of its officers and compares most favourably with commerce and industry in this respect.

The main fields of employment through which officers of all sub-specializations are rotated are as follows:

(*a*) *Sea* (*including for Air Engineers the Front Line Air Squadrons*) This is self-explanatory, and includes all officers so appointed whether the ship be running, refitting, working up, and air squadrons whether or not they be embarked. The officer is here in daily contact with both his equipment and his men. This sea role is of course basic to the concept of the naval engineer officer following the profession of arms. Considerable competence is required before taking up such a complement post (hence the long initial training) as the ships are complex and are operated at high usage rates. There is no room for anyone who doesn't know what he is doing. At the same time, sea complement experience provides the marine background which is the naval engineer officer's stock-in-trade in his shore employment. His 'training by doing the job at sea' is what enables him to make his unique contribution in the other employment areas.

(*b*) *Training and Support Work* This includes the giving of training to both officers and ratings, and the multifarious activities in support of the ships and aircraft. There are shore-based Fleet Maintenance Units which work on the ships during their brief turn-round periods, Fleet and Squadron Staffs, Work Up Teams, and the Royal Dockyards and Aircraft Repair Yards where the deep repair is carried out. All these activities have in common a close contact with the operating ships, their present hardware and their men.

(*c*) *Project Work* This is the task of developing tomorrow's Fleet. It involves attachment to the various Research and Development Establishments, Ministry of Technology, Material Headquarters Departments, Ship and Weapon Overseeing in the commercial shipyards, Testing and Tuning Teams, Trials parties and so on. The naval task is in the early stages of design to provide advice on the naval environment, as design progresses to advise on its suitability for naval service, to participate in development trials, to conduct acceptance trials, and take an increasing role on the various processes of introducing the equipment to the Fleet. In some areas, such as the Marine Engineer sub-specialization, naval officers also take a major managerial role in the actual design process, while they make varying design contributions in other areas. In the more purely design fields both continuity and post-graduate training tend to be required.

(*d*) *General Management* With increasing rank, particularly from Commander onwards, more of the posts are removed from direct engineering tasks. These include the 'General List' posts, open to E, X and S officers. There are the various shore and training establishments to run and command, the naval departments to staff and later direct, with the ultimate target of a seat on the Board of Admiralty.

To fit an officer for higher management in one of these areas, previous experience of that area is often most desirable. Thus to aspire to a Manager's appointment in a dockyard, previous experience in a dockyard is sought, as while the technical task is well within the compass of the naval engineer, some of the management aspects, such as Trade Union negotiation, are not. Similarly to perform a directorate role effectively in the Second Sea Lord's Department, it is very helpful to have worked in the personnel field before.

Running contrary to this requirement is the need for sub-specialists.

ENGINEER GENERAL LIST SUB-SPECIALIZATIONS

While S.D. List officers basically follow their rating category, G.L. (and S.L.) engineer officers have rather fewer sub-specializations. These are shown in FIG. 5.

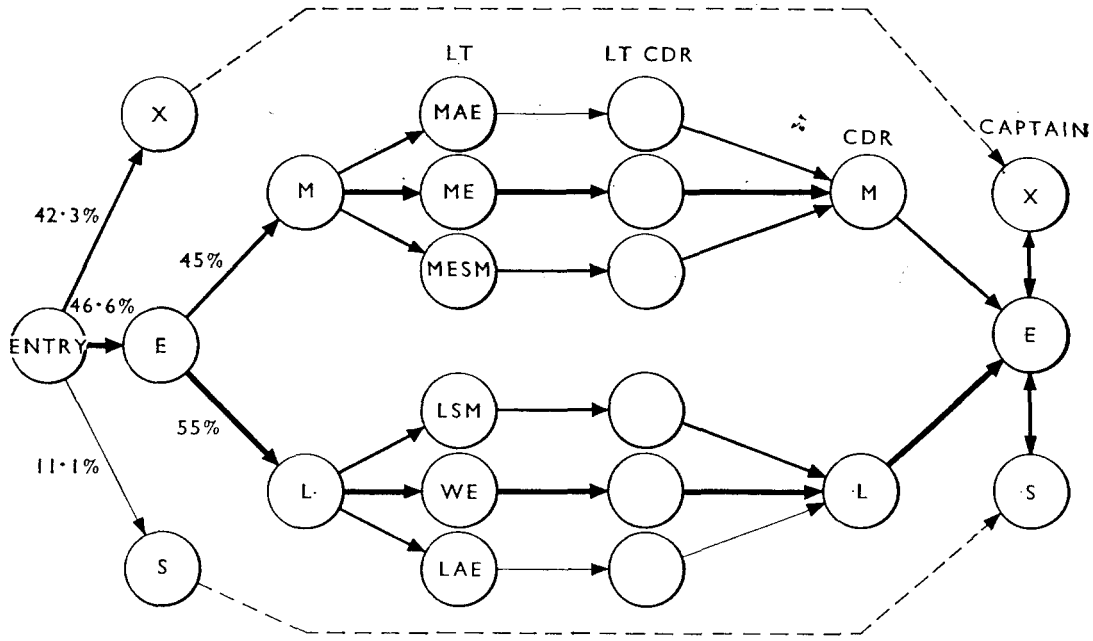


FIG. 5—ENGINEER BRANCH—G.L. SUB-SPECIALIZATION NETWORK

The percentage split of the entry shown between X (Seaman), E (Engineer) and S (Supply and Secretariat) are the present targets. Because of shortages in numbers of candidates qualified to undergo the engineer training, these have not been achieved. X and S have tended to be fully subscribed, but there have been many vacancies in E. One consolation is that there is more scope for promotion in an underborne branch.

The split between M (Mechanical) and L (Electrical) disciplines, and into the six sub-specializations is dictated by the service need for such officers as worked out by D.G.N.M. The sub-specialist employment is in the immediate future when the needs are well established. Basically the Weapons world is expanding, while the propulsion field is not. The nuclear submarines must be manned, while the number in Naval Aviation is reducing. The numbers streamed in the various sub-specializations are indicated by the thickness of the lines in FIG. 5. These are and will be adjusted from time to time as needs alter (more submarines and less aviation and so on).

In both M and L the surface ship requirement (M.E. or Marine Engineers) and W.E., or Weapons Electrical) is the largest, as is indicated by the thickness of the lines.

We will now consider each sub-specialization in turn.

M.AE (Air Mechanical Engineer)

These officers will be responsible for the maintenance of a rotary wing force, practising gas turbine technology. It may also maintain the Navy's hovercraft and will of course also deal with the closing stages of operational fixed-wing flying.

It is quite probable that even after this date, we shall retain some essential fixed-wing Communication aircraft.

It is envisaged that the requirement will remain for some naval engineer officers to participate actively in the design and development of the Navy's future aircraft, and to enable these officers to fulfil these duties, post-graduate training is given at Cranfield for up to two years in various aeronautical subjects including propulsion, aerodynamics, control, production and economics.

There should be plenty of interest but obviously the requirement will be for more limited numbers than hitherto.

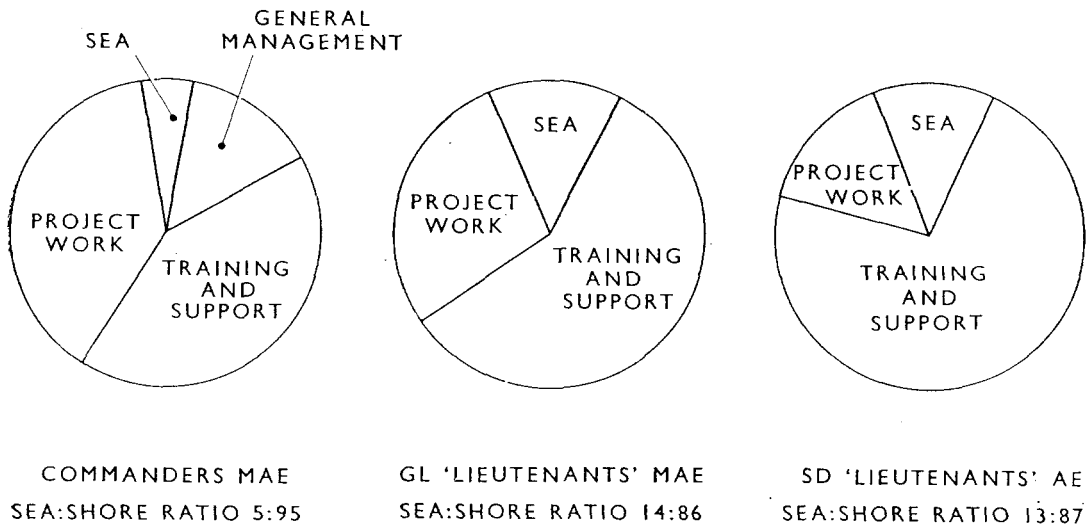


FIG. 6—THE EMPLOYMENT PATTERN

The present employment pattern of M.AE officers is illustrated in FIG. 6.

M.E. (Marine Engineer)

Historically the senior of the six sub-specializations, that of the Marine Engineer might be thought to be the least susceptible to change. In fact it is undergoing a major revolution, and this is being brought about in a number of ways.

Firstly, changes in propulsion machinery and its maintenance and operation. After well over a century of predominance in the field of surface-ship propulsion, steam is making way for gas turbines and Diesel engines and their combinations. This of course applies only to 'conventional' or 'fossil-fuelled' plants since in the present and indeed forseeable state of the art, nuclear power will undoubtedly be tied to steam.

Coupled to these major changes the policy of increased repair by replacement will have a marked effect on the pattern of shipboard maintenance, and the ever-wider application of automatic controls and data processing equipment will revolutionize the watchkeeping task.

Secondly, the rapidly-changing shape of the Fleet, with a resulting predominance of small ships, will have far-reaching effects on the pattern of employment of junior officers at sea. In ten years' time there will be very few watchkeeping billets available at sea, and indeed for most officers their watchkeeping experience will be confined to that obtained during their initial sea training. In a number of important ways the loss of this valuable experience is to be strongly regretted, but it is inevitable, and throws an even greater onus on those responsible for an officer's early professional training.

So much for the Marine Engineer's role at sea. As a professional mechanical engineer, he has an important role to play in the design and development of new machinery, and in certain fields of research and development. To this end, a proportion of officers undergo a post-graduate or 'Dagger' course in engineering design lasting four terms.

M.SM (Submarine Mechanical Engineer)

All officers now joining this sub-specialization must pass the nuclear propulsion courses at Greenwich and Dounreay, lasting about a year, after completing their academic and application training, as their main task is in the nuclear submarines. Apart from the actual nuclear reactor watchkeeping they

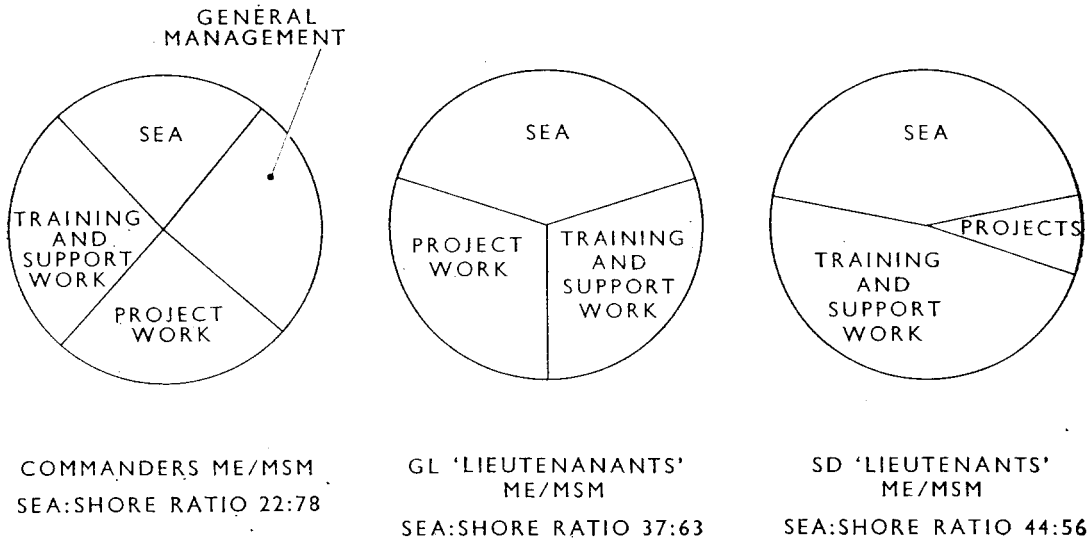


FIG. 7—THE EMPLOYMENT PATTERN

are also responsible for the other ship systems, but they are basically nuclear engineers.

A proportion of M.SMs, and some M.E.s, are selected for the advanced nuclear course which is for design, and carries the C.N.A.A. M.Sc. Degree. This prepares for employment in certain nuclear design posts in the Ship Department.

M.SM officers can expect to spend the majority of their time as Lieutenants and Lieutenant-Commanders in the Submarine Service, but because the number of posts for this sub-specialization in the higher ranks is restricted, it will be the policy to give each officer a General Service appointment in a surface ship before promotion to Commander so as to fit them for wider fields of employment.

The employment pattern for M.E. and M.E.SM officers is shown in FIG. 7.

L.SM (Submarine Electrical Engineer)

All officers now joining this sub-specialization must pass the same nuclear propulsion courses as the ME.SM officers, as they share with them the nuclear reactor watchkeeping role. They are also responsible for the submarines' tactical weapons systems, that is, her communication equipment, sonars, torpedoes, torpedo fire control and launch systems, all of which now amount to a sophisticated complex and include digital computers. They thus have the taxing role of combining nuclear and weapon technologies. As a rule they will not also handle the Polaris weapons system.

It is intended to give L.SM officers a sea job in a surface ship, so when they reach more senior ranks they are fitted for a wider range of employment.

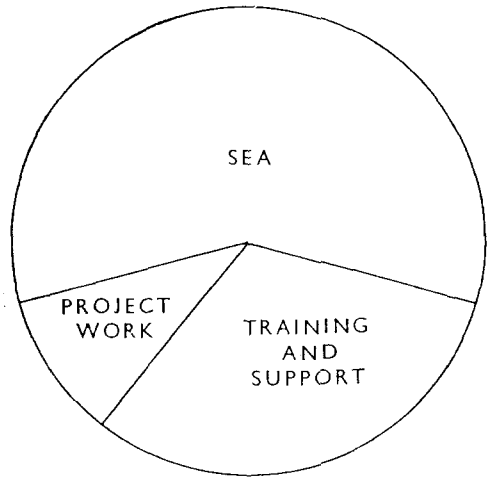
A few may be selected for the advanced nuclear (design) course, but the more normal channel for those suited to further training would be the same as for the W.E. officers, described below.

The employment pattern for General List L.SM 'Lieutenants' is shown in FIG. 8.

W.E. (Weapon and Electrical Engineer)

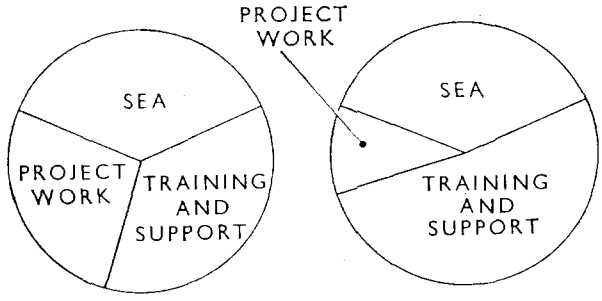
W.E. officers cover the full range of surface ship fitted weapons and electrical equipment. This includes heavy power equipment, ordnance, such as gun mountings and launchers, weapon control and all aspects of electronics, including radio and radar. The technologies are multiplying, and there is at present some *de facto* deep sub-specialization as follows:

(*a*) *Guided Weapons* The present systems include Sea Slug, and Sea Cat, with Sea Dart on the way. Officers may additionally do a spell as the Polaris Systems Officer, which involves a year's pre-commissioning



SEA:SHORE RATIO 58:42

FIG. 8—EMPLOYMENT PATTERN FOR G.L. 'LIEUTENANTS' LSM



GL 'LIEUTENANTS' WE
SEA:SHORE RATIO
37:63

SD(L) 'LIEUTENANTS'
((L), (O), (OE), (RE)
AND (CE) INC. LSM)
SEA:SHORE RATIO
37:63

FIG. 9—THE EMPLOYMENT PATTERN

training. Alternatively, while remaining primarily a surface ship officer, a W.E. sub-specialist may undertake all his specifically guided weapons experience with the Polaris system. Advanced training at the Royal Military College of Science, Shrivenham, is given to selected officers. This lasts one university year and usually precedes work in the R and D field.

(*b*) *Action Data Automation (A.D.A.)* These are on line digital computer systems for handling tactical data. It starts with a one-year naval pre-commissioning course. The area is small, but expanding.

Both these equipment areas are in their early days, and hence the need for some officers to become particularly adept in them. In the longer term it may be expected that they will become part of the normal stock-in-trade of any W.E. officer, as has been the case with other once novel developments like Radar, analogue fire control systems, etc.

(*c*) *Shore Telecommunications* There is a small but continuing requirement for officers with deep knowledge of the Navy's communication networks, to man and develop the wireless stations and their equipment and so on. This could include satellite communication systems.

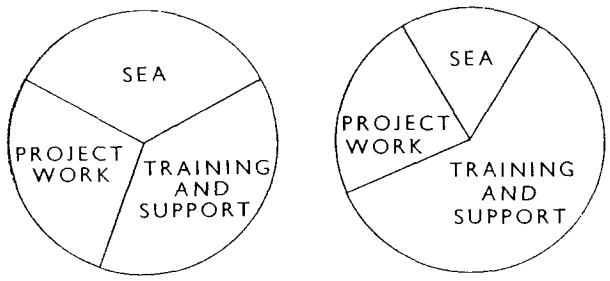
The higher training of suitable W.E. officers recognizes the diverse and rapidly changing technologies involved. Officers accordingly are allowed to take up higher training on an opportunity basis at whatever educational establishment offers suitable instruction.

Thus apart from the purely naval courses (such as the A.D.A. training referred to above), and the other Service establishments (such as Shrivenham), officers have been sent back to Cambridge University and Imperial College, London University for advanced studies. It is hoped to explore other sources in the developing technological fields.

The present employment pattern for General List 'Lieutenants' W.E. is shown in FIG. 9, contrasted with that for the General Service and L.SM S.D. Officers.

L.AE (Air Electrical Engineer)

As with the M.AEs, these officers will look after the closing stages of the



GL 'LIEUTENANTS' LAE
SEA:SHORE RATIO
34:66

SD 'LIEUTENANTS' LAE
(INCLUDES AL, AR AND AO)
SEA:SHORE RATIO
17:83

FIG. 10—THE EMPLOYMENT PATTERN

operational fixed-wing flying and may be involved in hovercraft. The main task in the future will be the electrical, radio and weapon systems of the Navy's helicopter force. The future trend should be to greater load-carrying capability which, matched with the increasing micro-miniturization of equipment, should lead to a progressive sophistication of the weapons package. This should provide technical interest for the small number of G.L. and S.L. officers selected for this sub-specialization.

As with the L.SM, it is intended to give some L.AE officers surface ship experience, so that they will be suited to a wider range of employment on promotion to more senior rank.

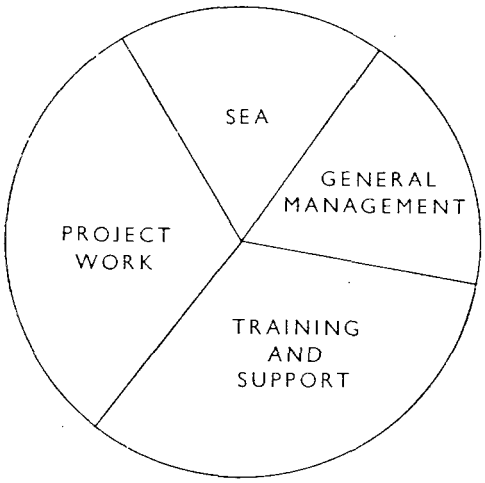
Further training is similar to the M.AE sub-specialization.

The present employment pattern for G.L. 'Lieutenants' L.AE is shown in FIG. 10, contrasted with that for S.D. L.AEs.

THE RETURN

To make an impact upon a technical field one must become an expert. For this it is necessary to go deeply into a narrow field, hence the above six formal sub-specializations, and the *de facto* sub sub-specializations always lurking below the formal structure. However, General List officers are the embryo higher management of the Branch, and also of the Navy, and to become effective managers they must cultivate a breadth of experience and understanding outside deep sub-specialization.

This is a well-attested paradox. As far back as 1919, Fayol in his classic work described the increasingly administrative nature of work as an individual rises in the organization hierarchy, and the consequent diminution in the technical nature of the work. At the same time higher rank brings an influence over fields in which it is impossible for the individual to have deep experience. Many engineers in industry are frustrated through the lack of a means of moving from the engineering function into the firm's general management. The Navy has chosen that its General List engineers should be part of the management stream, and by the institution of the General List has provided just that bridge which industry so often lacks. The implications of this are considerable. Firstly to take advantage of this bridge an officer must progressively extract himself from the sub-specialization in which he has acquired deep knowledge, and in which he is comfortable, not to say cosy. Secondly, he must grapple with the affairs of, to him, strange sub-specializations, and thirdly he must consider the naval interest before that of the naval engineer. Keeping abreast of developments is harder, as he spends less time in his own original trade, and has a wider field of interest to follow. In the higher ranks there is little place for the 'technical only' man, though there is of course plenty of engineering management and administration, as well as the more purely naval administration and management referred to above. Nevertheless, those wishing a lifetime in the undisturbed practice of professional engineering or applied science should seek it in the Navy's civilian engineering services, the Royal Naval Engineering Service



SEA:SHORE RATIO 18:82

FIG. 11—EMPLOYMENT PATTERN FOR ELECTRICAL SPECIALIST COMMANDERS

(R.N.E.S.), the Royal Naval Scientific Service (R.N.S.S.), the Royal Corps of Naval Constructors and the Production Pool.

The return from deep sub-specialization is illustrated in FIG. 5. All mechanical engineers take part in a common competition for promotion to Commander, with no quota of promotions reserved for any one sub-specialization. Similarly all electrical specialists compete in a common pool for promotion to Commander. With these are now being included the old ordnance engineers, now W.E.(M), in process of cross training into the Weapons and Electrical field.

Employment as Commander is in part in the original sub-specialization, in part covering the M or L field, in part covering the E field, and in part outside the engineering field. This is illustrated for the Electrical Specialist of Commanders' rank in FIG. 11.

Subsequent promotion to Captain is in a common competition for all engineer officers, with no quota reserved for M or L, or for any of the sub-specializations. The latter part of this competition, the 'Pool' promotion, is also in competition with officers of the Seaman and Supply and Secretariat Branches, as subsequent employment is increasingly common throughout the General List.

In summary, it is a fine thing to dig deep into a sub-specialization in a narrow enough field to become a real expert, and to make a personal contribution to that field. It is an equally fine thing to emerge from that narrow field and fit yourself for a wider ranging role, both in engineering management, and in the higher administration of the Navy.

CONCLUSION

This article has tried to show the present structure of the Engineer specialization of the General List and the steps that have led up to it and some of the future trends. One clear lesson which emerges is that we must look to a changing future, a condition of flux. Our models of the future operation must be dynamic.

The second lesson is that while technologies change, the underlying basis of engineering, the application of the scientific method and the practice of measurement, do not.

Thirdly naval engineer officers must consciously fit themselves for the dual role, of the technologists of today and the administrators of tomorrow.

It is one Branch embracing many backgrounds and disciplines. It is vital to the future of the Navy and should provide an exciting challenge to the all-round man.