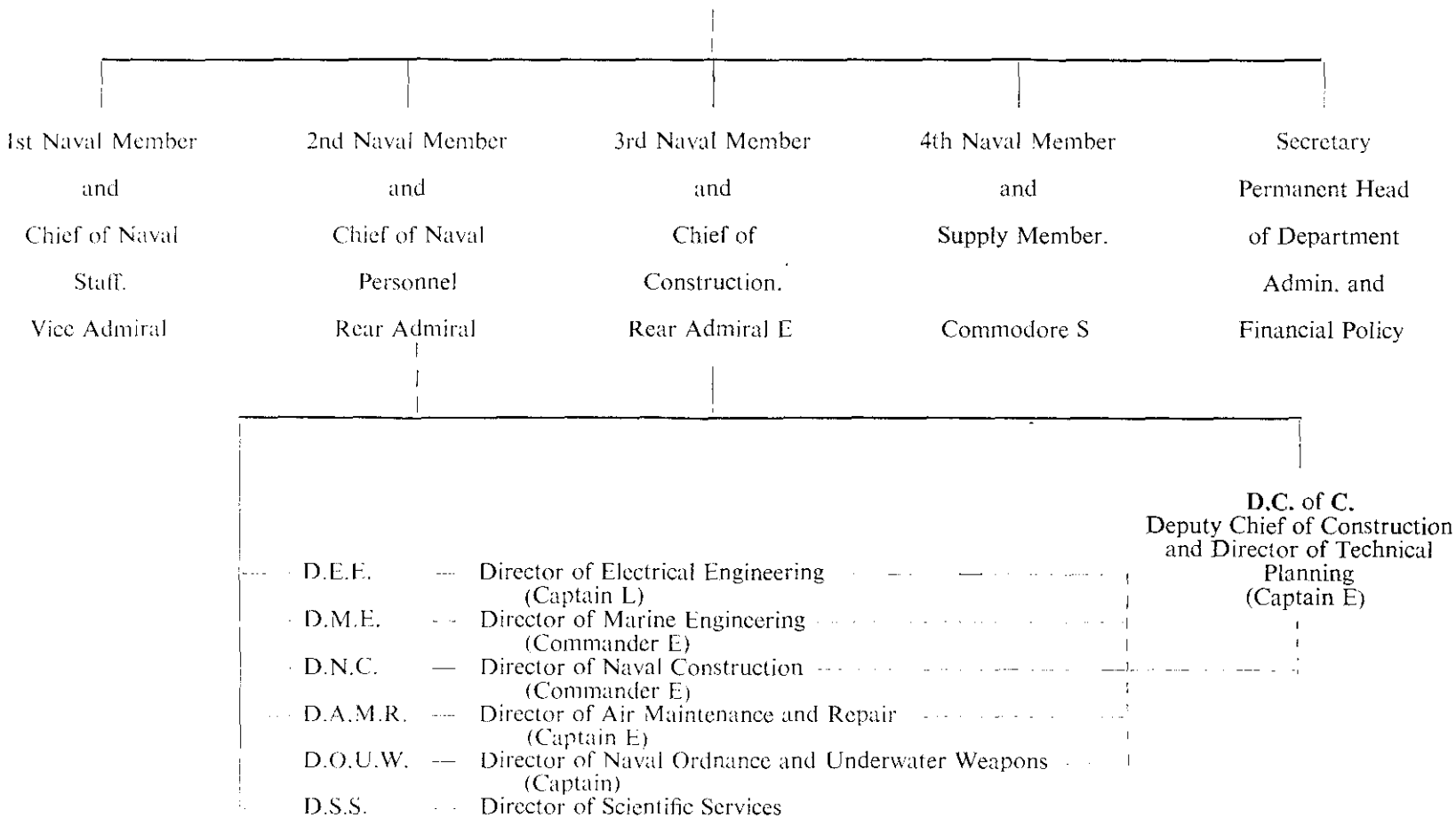
TABLE I

PART OF THE ORGANIZATION APPERTAINING TO THE AUSTRALIAN COMMONWEALTH NAVAL BOARD



ENGINEERING IN THE ROYAL AUSTRALIAN NAVY

PART I

BY

COMMANDER A. C. W. WILSON, R.N.

This article has been compiled from a series of briefs written by R.A.N. officers and is an attempt to present a compact and easily read survey of the engineering activities going on in the R.A.N. today.

Since many of the items are subject to continuous change, the article should be used for general information only, details being checked before being used for official purposes. At the time of going to press this applies particularly to the organization of the Department of the Third Naval Member within Navy Office and to the overseeing organization.

The article is presented by permission of the Australian Naval Board. Their generosity in making this material available, and the co-operation of the many R.A.N. officers who have helped in assembling it, is much appreciated.

THIRD NAVAL MEMBER, AND CHIEF OF CONSTRUCTION'S DEPARTMENT

General Organization

The Third Naval Member is responsible for all technical matters in the R.A.N.; new construction, fleet maintenance, dockyards, overseeing and the procurement of technical equipment are the generally accepted divisions of such responsibility. The procurement responsibility, however, is now being transferred, in whole or part at least, to the Fourth Naval Member (Supply Member) of the Australian Naval Board. The Third Naval Member is also the Board Member responsible for Research and Development.

The technical directors shown on the accompanying chart are all directly responsible to the Third Naval Member but their work is co-ordinated by the Deputy Chief of Construction. They also owe responsibility to the Second Naval Member for personnel matters relating to their own specialization branches.

The Deputy Chief of Construction is primarily concerned with the planning of shipyard work, utilization aspects such as estimates and control of expenditure. Hitherto he has also been responsible for the procurement of engineering and electrical equipment and spare gear for new construction and the Fleet and for machinery and plant for fleet and civil establishments and Vote 8 III equipment. These procurement functions are being transferred to the stores branch in the near future.

Overseeing

It is the responsibility of the naval dockyards to ensure the proper oversight and inspection of all work carried out within these dockyards. The task of overseeing the new construction and repair of ships and craft at private shipyards, together with the inspection of stores and equipment manufactured and repaired by private contractors is, however, the responsibilty of the Naval

Overseeing Organization. Two divisions of this organization are established ; one in the East Australian Area, and the other in the South-East Australian Area, the areas where the majority of shipyards and the industry essential to shipbuilding and repair are located.

The General Overseer, East Australian Area is a captain of either the (E) or (L) specialization who is functionally responsible to the Chief of Construction for the overseeing and inspection within the area, which contains not only the general secondary industry of New South Wales and Queensland, but particularly the major shipyards at Sydney and Newcastle and the iron and steel industry at Newcastle and Port Kembla.

From the area headquarters in Sydney the Deputy General Overseer, a commander (E) or (L), co-ordinates the activities of the civilian overseeing and inspecting staff through the staff officers. These officers, in the case of the hull, mechanical and electrical sections, are civilian professional officers. The staff officer of the ordnance engineering section is a lieutenant-commander O/E, and a lieutenant-commander (E) controls the oversight of all work carried out on small craft.

The supervision of the building and refitting of Naval ships at Cockatoo Island, Sydney, forms a considerable part of the work undertaken by the General Overseer, East Australian Area, and necessitates the permanent assignment of a number of overseers to this shipyard. The Commander (E) who holds the appointment of Principal Naval Overseer, is responsible to the General Overseer for the co-ordination of all the overseeing activities in this yard.

The South-Eastern Area comprises industries in Victoria and South Australia. The shipbuilding activities within the Naval Dockyard are not subject to the oversight of this organization. The overseeing organization is primarily concerned with production at the ordnance factories at Bendigo and Maribyrnong and all work contracted to private industry. The majority of this work is at present centred in Victoria.

The General Overseer, in this area, co-ordinates the overseeing of all contract work throughout the State while production within the ordnance factories is under the supervision of the Resident Naval Overseer, an O/E officer of lieutenant-commander rank. There is also a small civilian staff at each of these factories.

Ships

Ships in H.M.A. Fleet are normally made available for refit and docking at approximately six-monthly intervals – this programme consists of an annual main refit and a self-refit period. Dockyard assistance is usually necessary for at least a portion of the work undertaken during a self-refit and their assistance is also involved to assist with some of the Planned Maintenance scheduled to be carried out during this period. Consideration is being given to an eighteen-month period between main refits.

All ships are allowed approximately a week for pre-refit testing, etc., before commencing main refits, and a post-refit period depending on the type of ship.

Aircraft carriers fly off aircraft and disembark air group personnel at Jervis Bay before proceeding to Sydney for refit. Refits are usually followed by a short work-up period before embarking air group personnel, followed by a programme of flying by Squadron aircraft, 'touch and goes', etc., before embarking aircraft.

Refitting is normally carried out at H.M.A. Naval Dockyards, Garden Island, Sydney, and Williamstown, Melbourne. Ships serving as part of the

Strategic Reserve on the Far East Station undertake self refits at either Singapore or Hong Kong.

Administrative Personnel

The administrative engineering staff consists of a captain (E) appointed as Fleet Engineer Officer and he is the Chief Technical Adviser to the Flag Officer Commanding Her Majesty's Australian Fleet. He is normally borne in the Flagship.

His First Assistant, a lieutenant-commander (E), is borne ashore at Garden Island Dockyard, Sydney. A second assistant, an engineer sub-lieutenant, M.E., is also borne in the Flagship and so is a part-time assistant (O/E), who is also watchkeeping engineer officer.

The organization also consists of the following Staff Ratings :—

(*a*) *Borne in the Flagship*
Chief Engine Room Artificer (Boilermaker)
Chief Engineering Mechanic, E.O.W.
Leading Engineering Mechanic, E.O.W.

(*b*) *Borne ashore*
Chief E.R.A. or E.R.A. (Boilermaker)
E.R.A. (any trade) trained in Flight Deck Machinery
Petty Officer M. (E), E.O.W.
Leading Engineering Mechanic (Bricklayer)
Four M.(E) 1 Bricklayers.

The Fleet Electrical Officer, a captain (L) is also borne in the Flagship. As the principal technical authority on general electrical, electronic and radio matters he acts as adviser to F.O.C.A.F. on all material and personnel matters under the responsibility of the electrical officers within, or attached to, the Command.

Also allowed for Staff duties in the Flagship are :—

One Electrical Lieutenant-Commander/Lieutenant, as Assistant Fleet Electrical Officer

One Chief or Petty Officer Electrician (P) or (E), for duty as L.O.W. to F.L.O.

TRAINING ESTABLISHMENTS

H.M.A.S. 'Cerberus'—Flinders Naval Depot

H.M.A.S. *Cerberus* is situated on Westernport Bay some 50 miles south of Melbourne and is the principal training establishment of the R.A.N. The establishment is commanded by the Commodore Superintendent of Training and consists of various schools namely the Recruit (New Entry), Engineering, Electrical, Signal, Supply and Secretariat, Cookery, Gunnery, Seamanship, Music, Medical and Petty Officers' Leadership Schools. The site covers some 4,032 acres, of which the buildings cover 180 acres, and with its numerous gardens, trees, playing fields and zoo must be one of the most pleasant naval establishments in the world in which to serve.

The facilities for sport and recreation are excellent and include an indoor and outdoor swimming pool, a 9-hole golf course, athletics track, rifle range and numerous rugby, soccer (Australian rules) and hockey grounds, tennis courts and cricket pitches. Sailing and boat pulling are provided for and a modern cinema seating 900 has just been completed.

The Engineering School has 12 standard courses and additional courses are arranged as required. The principal courses are :—

Advanced Engineering Course (C.E.R.A. and Ch. Mech. Qualifying)	23 weeks
Mechanicians' Training Course	2 years
Preliminary Engineering Course (Direct Entry Acting E.R.A. IV)	16 weeks
Mechanical Training Course (L.M. (E))	16 weeks
Engine Room Watchkeeping Course (Confirmed P.O.M. (E) for unit W/K duties)	10 weeks
Engineer Officers' Writers Course	
Welding	
Bricklaying and Lagging	
Internal Combustion Engine	
Motor Transport Drivers and Maintenance.	

Trade testing of direct entry E.R.A.s is carried out in the workshop and full use is made of the Psychologist's reports and recommendations in accepting new entries of both Mechanic and Artificer grades into the Branch.

The syllabuses in school subjects in the Mechanicians and C.E.R.A. 'Q' course are designed to bring these ratings up to H.E.T. standard in maths. and mechanics and they are encouraged to qualify educationally for the Special Duties Officer list while on course.

Generally, engineering school courses run parallel to those of the R.N. at H.M.S. *Sultan*, with such differences as are necessary to suit Australian conditions. The marine engineering instruction is based on B.R.s and wall diagrams from D.M.E., Admiralty, and of local manufacture; along with Admiralty strip and movie films they are used extensively in the school.

The concentration of industry in a comparatively small area in this country does enable many instructional and recreational visits to be made to a wide range of industrial concerns in and around Melbourne. These include oil refineries, power stations, industrial gas production and welding tool factories, motor car production lines, aircraft engine factories and mechanical engineering research laboratories, in which ratings under instruction are given an insight into modern engineering practices, thereby stimulating an interest in the many fields of engineering endeavour on which the future of this country depends.

Facilities at the Royal Melbourne Technical College are made available to the School. Williamstown Naval Dockyard, where one *Daring* has been completed and a Y.100 frigate is soon to be finished, is close at hand and visited regularly for instructional purposes.

The Electrical School has facilities to provide all technical instructions and skill of hand training for electrical artificers and ratings of the Power (P), Electronic (E), Radio (R), Air Radio (A.R.) and Air Electrical (A.L.) sub-specialization.

The principal courses provided are :—

(*a*) Short Service Commission Electrical Officers

(*b*) Electrical Artificers Qualifying for Acting 4th Class

(*c*) Recruit Technical (for all sub-specialization)

(*d*) Part I Technical (for all sub-specialization)

(*e*) Course for Advancement to Petty Officer rate (for all sub-specialization).

Subsidiary courses are also provided for :—

E.A. III qualifying
Chief E.A. qualifying

Shore wireless
Teletype maintenance
Electrical Officer's Writer
Pre-commissioning and conversion courses as necessary.

To avoid repetitive training and to gain increased utilization of ratings, Leading Rates Courses were abolished in July, 1958. Advancement to this rate is now gained by award of a Certificate of Competency and subsequent examination by Fleet Board. To offset the consequent reduction in formal instruction, basic courses were increased in duration and the standards raised. As this is a departure from established practice, experience will be necessary before the effectiveness of this method of advancement can be assessed.

Weapon control training is provided for by a comprehensive installation of 4·5 in. twin Mk. VI turret, Mk. VI Director and F.E.P. II. In the near future this training will be further amplified by the later types of equipments available at the West Head Gunnery Range. All the available types of A/S sets and mountings are installed and these are being currently brought up to date as the new equipments come forward.

The highly specialized training required for Air rates is provided for in well-equipped classrooms containing working installations of the equipments these ratings will be required to operate and/or maintain. A 'written off' aircraft is available to instruct on general lay-out.

Although R.N. equipments and books of reference are used almost exclusively, the pattern of electrical training has of necessity been designed to suit the requirements of the R.A.N. and this has required some deviation from R.N. methods.

The sub-specialization of E.A.s into Air, Air Radio and Radio has been tried, but the small numbers required for each category led to difficulties in advancement and drafting. All such specializations have now been abolished and the R.A.N. E.A. is given a comprehensive training to fit him for any required draft. If necessary, pre-commissioning courses before drafting to special billets are available.

West Head Gunnery range has been established on the coast some fifteen miles from Flinders Naval Depot and is planned to provide both user and maintainer training on M.R.S. 8, M.R.S. 3, F.P.S. 3, G.D.S. 2 and G.D.S. 5 systems. 4·5 in. Mark 6*, 4 in. and Twin Bofors mountings are used for live firing against both surface and air targets.

H.M.A.S. 'Nirimba'

Naval artificer apprentice training in the Royal Australian Navy commenced in July, 1956, when H.M.A.S. *Nirimba* was commissioned for this purpose. An entry of 50 apprentices takes place in July and January each year, and the training pattern conforms generally to that in the Royal Navy, except that for E.R.A.s it takes place solely in the one establishment. Electrical apprentices and Air apprentices undergo part of their training at *Cerberus* and *Albatross* respectively, and the ordnance apprentices will do a certain time at *Watson* (T.A.S. school in Sydney) and the West Head Gunnery Range.

Officer outlet is catered for as follows :—

(*a*) Matriculation Entry to the Royal Australian Naval College
(*b*) Upper Yardman Scheme
(*c*) Special Duties List.

A detailed article on H.M.A.S. *Nirimba* was included in Vol. 11, No. 3 of the *Journal of Naval Engineering*.

R.A.N. Engineer Officers—Entry and Training

The training of officers of the Royal Australian Navy is, traditionally, patterned on that of officers of the Royal Navy, so that the changes wrought in recent years in the entry and training of young officers in the United Kingdom are reflected in similar changes introduced in Australia. The entry of thirteen-year-olds has given way to the entry of youths aged between 15½ and 16½ years, known as the 'normal' entry, supplemented by the 'matriculation' entry of youths between the ages of 16½ and 19 years.

Applicants for the normal entry are required to sit for a qualifying educational examination about equal to Intermediate Certificate standard, while matriculation entry candidates must have passed the Matriculation Examination for an Australian University, or intend sitting for it during the year in which they appear before the Interviewing Committee.

Phase I training for both entries is undertaken at the Royal Australian Naval College situated at Jervis Bay, on the coast of New South Wales, one hundred miles south of Sydney. There the normal entry cadet midshipmen undergo a three-year training course concluding in December of the third year while cadet midshipmen of the Matriculation Entry undergo a twelve-month training period, passing out in December of the same year. Thereafter, the training of both entries is identical.

Every facility for participation in most types of games is available at Jervis Bay. The major sports are sailing, football (three codes), boxing, cricket, hockey, swimming, tennis, sailing and athletics. For spare time recreation there is a nine-hole golf course within the College grounds, while cadets may participate in the activities of the R.A.N. Ski Club, the Big Game Fishing Club, and the Gliding Club at the nearby R.A.N. Air Station, Nowra.

Phase II sea training is carried out in the training frigate H.M.A.S. *Swan*. Cadets live and work under the same conditions as the ratings so that they will be able more readily to appreciate the conditions on the lower deck. A short Air course is also undertaken at this period. It is on completion of Phase II training that cadet midshipmen are allocated to the various specializations, individual preferences and aptitudes being taken into consideration.

After one term in the training frigate, midshipmen proceed to the Britannia Royal Naval College, Dartmouth, for Phase III training. On completion, midshipmen are promoted to Acting Sub-Lieutenant and return to Australia to undergo sea training in order to qualify for the award of Certificates of Competence and Engine Room Watchkeeping Certificates.

On successful completion of this period of training officers proceed to the Royal Naval Engineering College, Manadon, for the Basic Engineering Course, Lieutenants' War Course and Sub-Specialization Course. On return to Australia, having been promoted to Lieutenant during their training in the United Kingdom, officers are appointed to sea billets for a period of some two years and thereafter they follow the normal pattern of sea/shore appointments.

Permanent and 5-year short service commissions are available to applicants possessing a degree or acceptable equivalent in mechanical or aeronautical engineering or naval architecture. Undergraduates studying for a degree in mechanical or aeronautical engineering are eligible to apply for a short service commission or a permanent commission at any time during their three final years. Undergraduates studying for a degree in naval architecture are eligible to apply for a permanent commission during their final year.

First appointment for these officers after entry or graduation is to Flinders Naval Depot in Victoria, for a short indoctrination course in service procedure and customs. They are then appointed to sea for about twelve to eighteen months for training and to obtain an Engine Room Watchkeeping Certificate. During this period officers may apply to specialize in aeronautical or ordnance engineering.

Electrical Officers

The embryo electrical officer follows a pattern of training identical with that described above for the engineer officer in the early stages of his career. It is not until Phase III training has been completed that the paths diverge.

Junior electrical officers join H.M.A. Fleet in the September following completion of Phase III and remain at sea until the academic year of Australian Universities commences in the following March. In this sea period the junior electrical officer has to obtain his Certificate of Competence.

University training is normally undertaken at the University of Melbourne and covers a four-year period leading to a Bachelor's Degree in electrical engineering. Officers reside in one of the University Colleges, being supervised from Navy Office, Melbourne.

On graduation officers proceed to U.K. for Post Graduate courses, joining up with the current *Collingwood* Long Course operating. Heavy and light industrial experience is also gained in this period, the total duration of post-graduate training being approximately two years.

On completion of this training officers return to Australia to take up first appointments.

A Direct Entry scheme is also operative with entry possible at either the undergraduate or graduate levels for either permanent or short service commissions (five years from first appointment for graduates, five years after graduation for undergraduate entries).

With the changes proposed in officer training in the R.N. the changes necessary in the system of entry and training of officers for the R.A.N. are at present being considered.

Engine Room Department Ratings

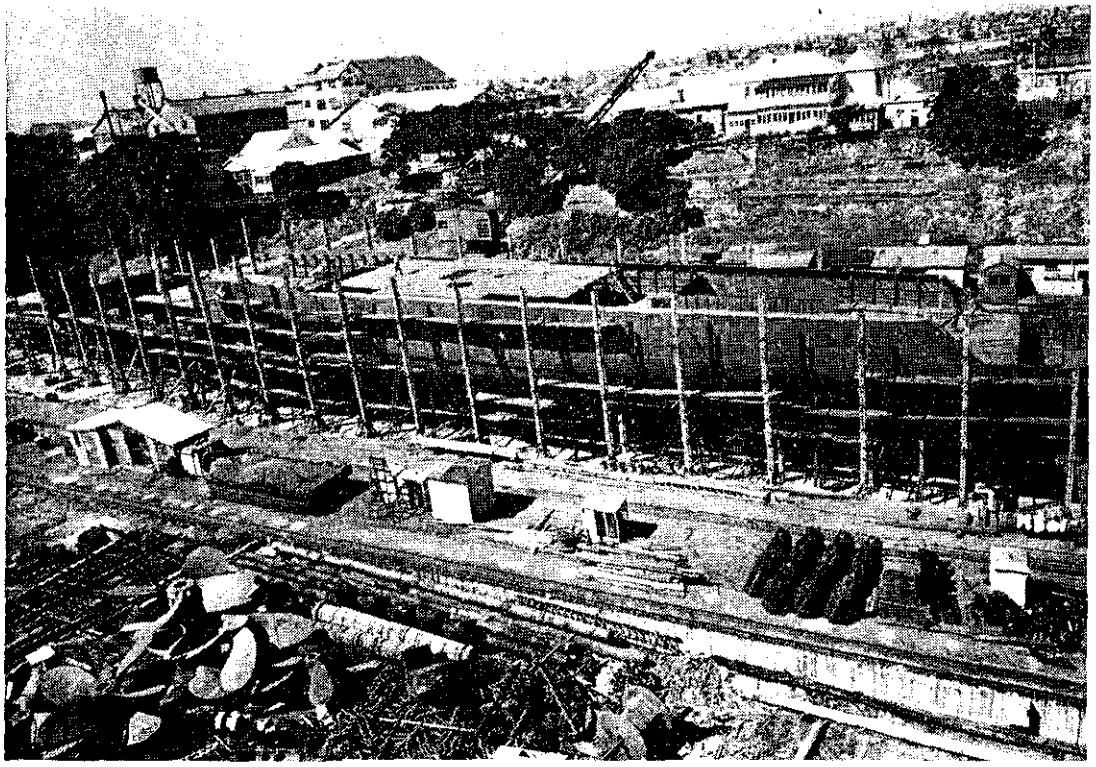
Ratings recruited into the R.A.N. as engineering mechanics are approximately 17 years old and usually without previous training in the engineering field.

These ratings are recruited to provide the labour force for the Engineering Department and to provide the material from which key ratings in the Department are chosen as a result of suitably graded courses and watchkeeping experience. The training scheme followed by the engineering mechanic rating has been designed to provide the knowledge necessary for ordinary advancement. It also provides means of selection for C.W. and Mechanician Candidates and gives them a graded build-up to the intensive instruction they receive later on.

Electrical Branch Ratings

Recruits are entered into the R.A.N. as Recruits (Electrical Branch) (Short title R/LB). Applicants are normally between the ages of 17 and 19 years and no previous training or experience in the electrical trades is required.

As the production of an Electrical Branch rating requires long and arduous courses the recruit entry must exhibit :—



TYPE 12 FRIGATE BUILDING AT COCKATOO

(*a*) A good educational standard (arithmetic and English to sub-intermediate standard)
(*b*) A genuine interest in undertaking an electrical career
(*c*) The ability to persevere with the academic training.

The aptitude and educational tests, to ensure that these standards are met, are made at the various recruiting centres. The successful applicants are subsequently drafted to Flinders Naval Depot for kitting up, indoctrination and Branch training.

PRINCIPAL SHIPBUILDING AND REPAIRING FACILITIES IN AUSTRALIA

Cockatoo Docks and Engineering Company

Cockatoo Dockyard is owned by the Commonwealth but is leased to Vickers Limited. It is one of the oldest and largest shipbuilding yards in Australia but in recent years has been fully occupied on naval construction.

The more important modern ships built include three *Tribals*, one improved *Battle* and two *Darings*, while two Type 12 frigates are under construction.

The shipyard is well equipped to deal with welded construction and special methods of pre-fabrication have been devised to reduce welding stresses and to obviate the necessity of welding unnecessary dogs and fitments to the hulls for temporarily securing the various sections.

In the Engineering Department the whole of the main machinery and boilers have been built, not only for these ships, but also for similar ones constructed at Williamstown Naval Dockyard.

The Australian *Darings* are fitted with Foster Wheeler boilers and English Electric turbines while the frigates have Babcock and Wilcox boilers and English Electric turbines. In addition to this the propeller shafting is machined from rough forgings and the propellers are manufactured completely together with a large number of other parts and fittings. Recently, a licence has been

obtained from Stones for the manufacture of Novoston propellers.

A very well equipped tool room, together with a standards room and metrology section is available and an inspection system based on the Admiralty one of Delegated Inspection is in operation. The turbine manufacture includes the manufacture of the whole of the blades, nozzles and diaphragms.

In recent years many modern machine tools have been installed in the workshops, and these are capable of producing work to the high standard of accuracy and interchangeability now required for naval construction.

The total employment at present is about 2,100 workmen and a staff of 250. In addition to the shipbuilding activities a large amount of merchant ship repair and commercial engineering work is carried out at Cockatoo. There are three dry docks, the largest of which can take a 27,000 gross ton merchant ship.

During the war the ship repair facilities were of particular value to ships operating in the Pacific. At present the R.N. submarines based in Sydney carry out their normal short refits at Cockatoo.

Williamstown Naval Dockyard

Since the acquisition of the Dockyard at Williamstown by the Department of the Navy in 1942, the activities of the Dockyard have been developed and expanded to enable them to meet the shipbuilding and ship repairing requirements of the Naval Board.

In an area of approximately twenty-two acres the Naval Dockyard possesses a graving dock, four building berths and various workshops. It has successfully fabricated hulls and installed machinery and equipment for naval destroyers and merchant ships of approximately 9,000 tons.

The Alfred Graving Dock, built of bluestone and completed in 1874, has a maximum length of 479 feet. The length of the floor is 450 feet and the width of the dock at keel level is 61 feet 6 inches.

Two of the four building berths are 400 feet in length and can be serviced by three 10-ton electric travelling cranes and one 7-ton fixed crane. The other two berths are each 460 feet in length and are serviced by three 5-ton fixed electric cranes.

The General Manager of the Dockyard (a captain), who is responsible direct to the Naval Board for the efficient management of the establishment, controls an organization consisting of two main sections—the works section and secretarial accounting section, which are further segregated into appropriate sub-sections.

The Dockyard staff consists, at present, of 1,150 persons, but during World War II a maximum figure of 1,500 was reached.

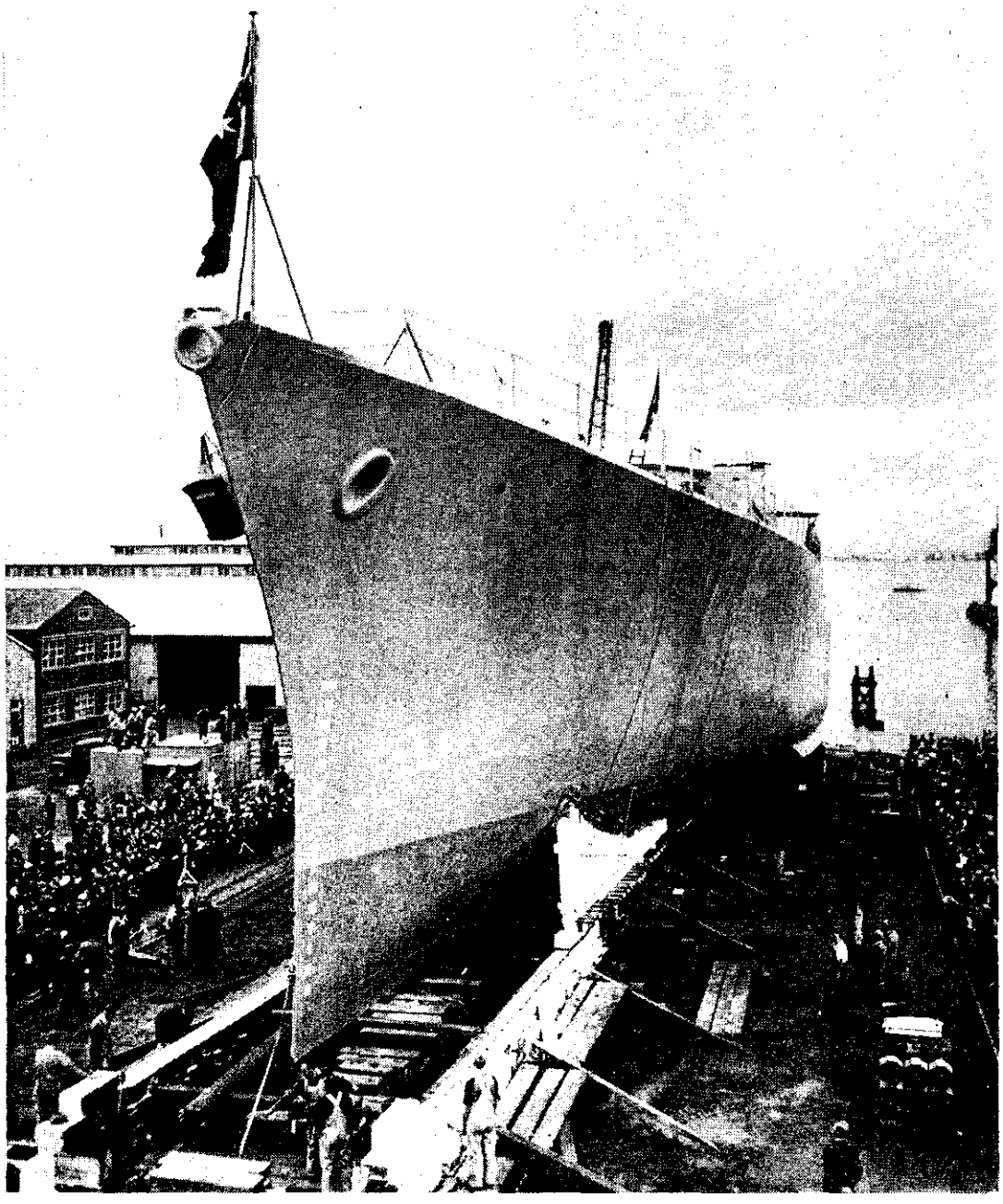
The activities of the Dockyard are at present concentrated on the building of two A/S frigates.

The recent acquisition of an additional area of land will enable workshop facilities to be reorganized and extended in the immediate future. This should materially assist the development of the Naval Dockyard, Williamstown, into a more modern and efficient shipbuilding establishment.

Whyalla Shipyard

Whyalla is situated in an area far removed from Australia's main engineering centres. It is, in fact, on the western shore of Spencer's Gulf approximately opposite Port Pirie.

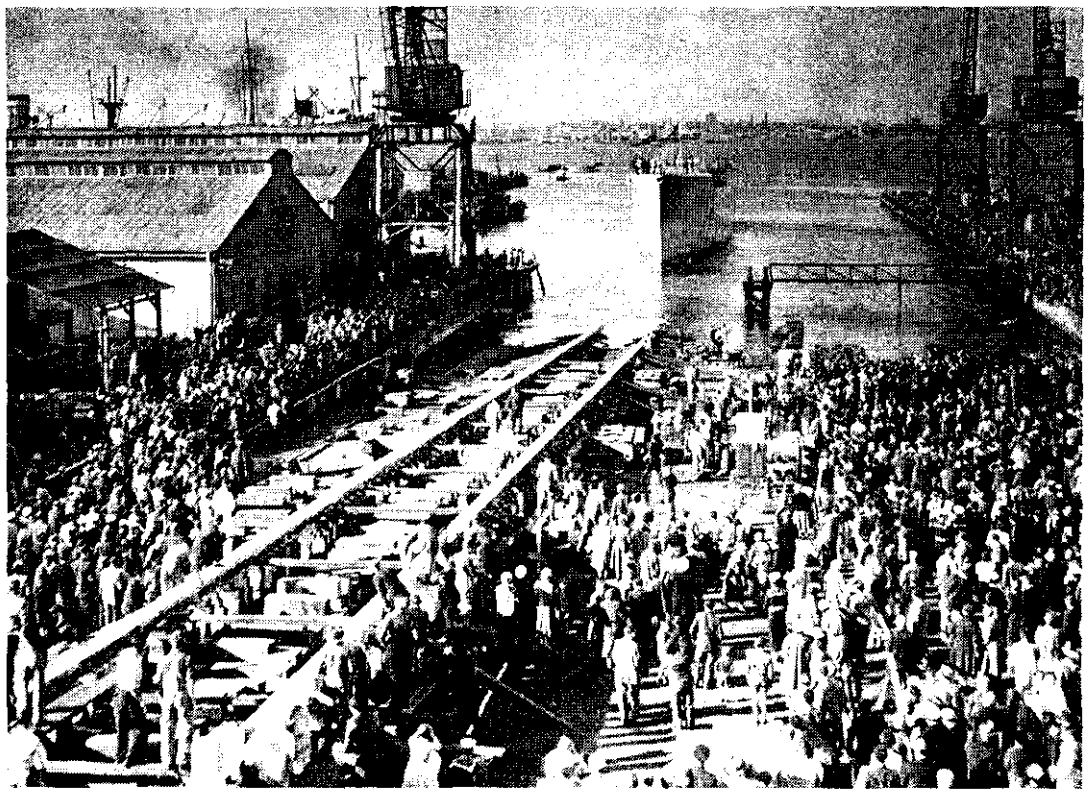
The main interest in Whyalla has always been the shipment of iron ore from the nearby mining areas to the steel producing centres on the N.S.W. coast.



LAUNCH OF H.M.A.S. 'VENDETTA', DARING CLASS DESTROYER, AT WILLIAMSTOWN DOCKYARD

However, by the end of 1939 it was already a thriving centre, since in 1937 it had been decided to build a blast furnace there, and in 1938 a suction dredger commenced the work of dredging a harbour 1,800 ft by 800 ft.

Work commenced in 1940 on the construction of a shipyard at Whyalla, this being brought about by the emergency resulting from the outbreak of World War II. The construction programme was designed to enable production to commence as early as possible and the initial shipbuilding programme comprised four minesweeping vessels for the R.A.N., the keel of the first of the vessels (H.M.A.S. *Whyalla*) being laid down in July, 1940. This ship was launched in May, 1941, and completed in January, 1942.



LAUNCH OF H.M.A.S. 'YARRA' AT WILLIAMSTOWN

In equipping the yard, the necessity for self-sufficiency had to be kept in mind because of Whyalla's remoteness from manufacturers. The greatest difficulty of all was the recruitment of an adequate skilled labour force.

However, it was found possible to recruit a small number of men with shipbuilding training but who had drifted into other industries when yards closed down in the early 20's and this group formed the nucleus of the yard's labour force in its initial stages. The balance comprised men from a wide variety of industries and the majority of them were witnessing ships being built for the first time in their lives. With the launching of the *Lake Illawarra* in September, 1957, 29 ships had been launched from Whyalla with an aggregate of 207,000 deadweight tons. The Yard's current construction programme comprises one 10,000-ton D/W motor driven bulk carrier and two 14,000-ton D/W ore carriers for the Commonwealth Government, two 19,000-ton D/W ore carriers for B.H.P.'s own fleet and one 32,000-ton tanker for the Ampol Petroleum Company.

Whyalla shipyard is part of the B.H.P. concern in Australia (Broken Hill Proprietary Co. Ltd.) and is wholly owned and operated by them. It is now a model shipyard in all respects and well equipped in all departments, including an excellent gear cutting shop, where the bull wheels for the first Australian-built *Daring* gear boxes were cut.

Miscellaneous

Other main shipbuilding and repairing facilities in Australia are undertaken by the State Dockyard, Newcastle, Evans Deakin in Brisbane, by Walkers in Maryborough and until recently by Morts Docks in Sydney.

Considerable boat building facilities exist all around the populated areas of the Australian coastline and particularly in Tasmania.

AERIAL VIEW OF GARDEN ISLAND DOCKYARD WITH SYDNEY IN THE BACKGROUND

REPAIR OF R.A.N. SHIPS IN PEACE TIME

Garden Island Dockyard

Garden Island is the major refitting yard of the Royal Australian Navy, carrying out the majority of the routine refits and servicings of Fleet Units and other Auxiliary vessels. It now incorporates the large Captain Cook graving dock, capable of docking the largest vessels afloat. This was opened in 1945 in time to enable all the major units of the British Pacific Fleet to be serviced during the replenishment periods before the final Allied drive on Japan. A very large modern workshop was also added with the dock, as well as a 250-ton crane.

The machine shops and workshops generally, were modernized during and after the war and the Dockyard is now well equipped to compete with modern Fleet requirements. New drawing offices have been completed recently, and a new electronics workshop is now in use. A weapons workshop building is also planned for construction in the near future, of which the rolling platform is already in operation. Garden Island has a modern dockyard laboratory which, in addition to the routine tests of materials, carries out research in underwater paints, etc., in connection with the Naval Corrosion Committee. It also has a very well equipped boatbuilding shed and the majority of the Australian Navy's pulling and power boats are constructed there.

Garden Island plays a major role in the development work in the Royal Australian Navy, and undertakes the construction and modification of targets, experimental small craft and special equipment for trials in H.M.A. ships.

The labour force is approximately 2,500 men (wages staff)- all civilians, with a naval and civilian management. There has been a recent reorganization in the management structure which brings it fairly closely in line with industry generally. The General Manager is a captain (E) with a commander (E) as Deputy General Manager, who is O.I.C. Planning Division. The production division is under the Civilian Works Manager with civilian superintendents

in charge of Engine, Hull and Electrical Departments. The Weapons Division, comprising O/E, A/S, mortars and torpedoes with the associated fire control systems, is under a commander (L) assisted by a lieutenant-commander (E) (O/E). The old First Assistant (commander (E)) who previously carried out what were virtually the duties of the Works Manager, has now become the Refit Superintendent and is responsible to the Works Manager for the general co-ordination of all work carried out on board H.M.A. ships. He is assisted by about six 'refit officers', lieutenant-commanders and lieutenants (E) and (L), who are each responsible for the overall control of the refit of particular ships allocated to them.

Williamstown Naval Dockyard

The Naval Dockyard, Williamstown, is primarily a shipbuilding yard as previously stated, but a limited amount of refitting work is undertaken. This work provides an effective medium by means of which a balance of work can be maintained, and the services of skilled employees, who may be temporarily idle on occasions if this work were not available, can be retained in continuous employment.

The annual refitting programme is, therefore, arranged after consideration has been given to the available manpower and the demands placed on the establishment for shipbuilding. It normally provides for a complete refit of two destroyers and the maintenance of numerous small craft, which are attached to the various establishments in the South-East Australian Area.

The plant and equipment in the various workshops is capable of executing all repairs which may be necessary, with the exception of major repairs to main turbines and the manufacture of castings. It has been found more convenient to request the assistance of outside contractors to undertake such work as the lagging of pipes and boilers, renewing brickwork in boilers and repairing refrigeration machinery.

The workshops include a radiographic laboratory and radar and gyro compass workshops, in which work of a specialized nature is carried out.

Machinery and Spares

For the supply of engineering equipment, mechanical and electrical, the functions of the A.M.D.s and S.P.D.C.s of the R.N. are combined in a Central Machinery and Spares Depot having storehouses at Randwick (Sydney) for fast moving spare gear items, and at Rydalmere (Sydney) for heavier items of parent equipment.

Repair of stock, purchase of stock to establishment levels, and disposal of surplus stock within prescribed delegations, are carried out by the M.S.D., an autonomous supply organization under the administration of the F.O.I.C.E.A.

Two sub-depots exist within the premier dockyard (Garden Island) but in national emergency further sub-depots could quickly be established at Williamstown Naval Dockyard and at strategic base ports.

Central Office procurement in respect of machinery for new construction, and machinery and plant items for dockyards, air station, Fleet shore and civil establishments is carried on from Navy Office, Melbourne, by the Engineering and Construction Departments.

Planned Maintenance

Planned Maintenance was introduced progressively into H.M.A.S. *Melbourne* after commissioning at the end of 1955. It was fully operative in H.M.A.S. *Voyager* when she commissioned early in 1957, and has since been introduced

into the ' Q ' Class frigates. This will be followed shortly by introduction into the *Battle* Class and in addition, all new construction will operate on Planned Maintenance as from first commissioning.

In view of the limited size of the Australian Fleet it was decided to dispense with Class Authorities, the work of these authorities being divided between Navy Office and the ship's Administrative Authority. Thus schedules are prepared and systems set up by Navy Office, after which the Administrative Authority supervises the operation of Planned Maintenance, progress of which is reported quarterly. In conjunction with this a method of reporting defects is used which ensures that the Administrative Authority always holds, for each ship in the command, an up-to-date file of outstanding dockyard and ships staff defects.

The introduction of Planned Maintenance has initially thrown an increased burden on both ships staffs and dockyards, but the planning of work is facilitated. This, coupled with the decrease in the incidence of defects already noted will do much to alleviate this position.

Experience to date indicates that the organization is working well on the whole, and that an increase in serviceability can be expected from ships on Planned Maintenance provided that a reasonable percentage of the maintenance task can be completed.

Part II of this article, which deals with the current new construction programme, the manufacture and testing facilities of armament and electrical equipment, the Fleet Air Arm and Research and Development, will be published in the next issue of the *Journal*. (EDITOR)