THE Navy

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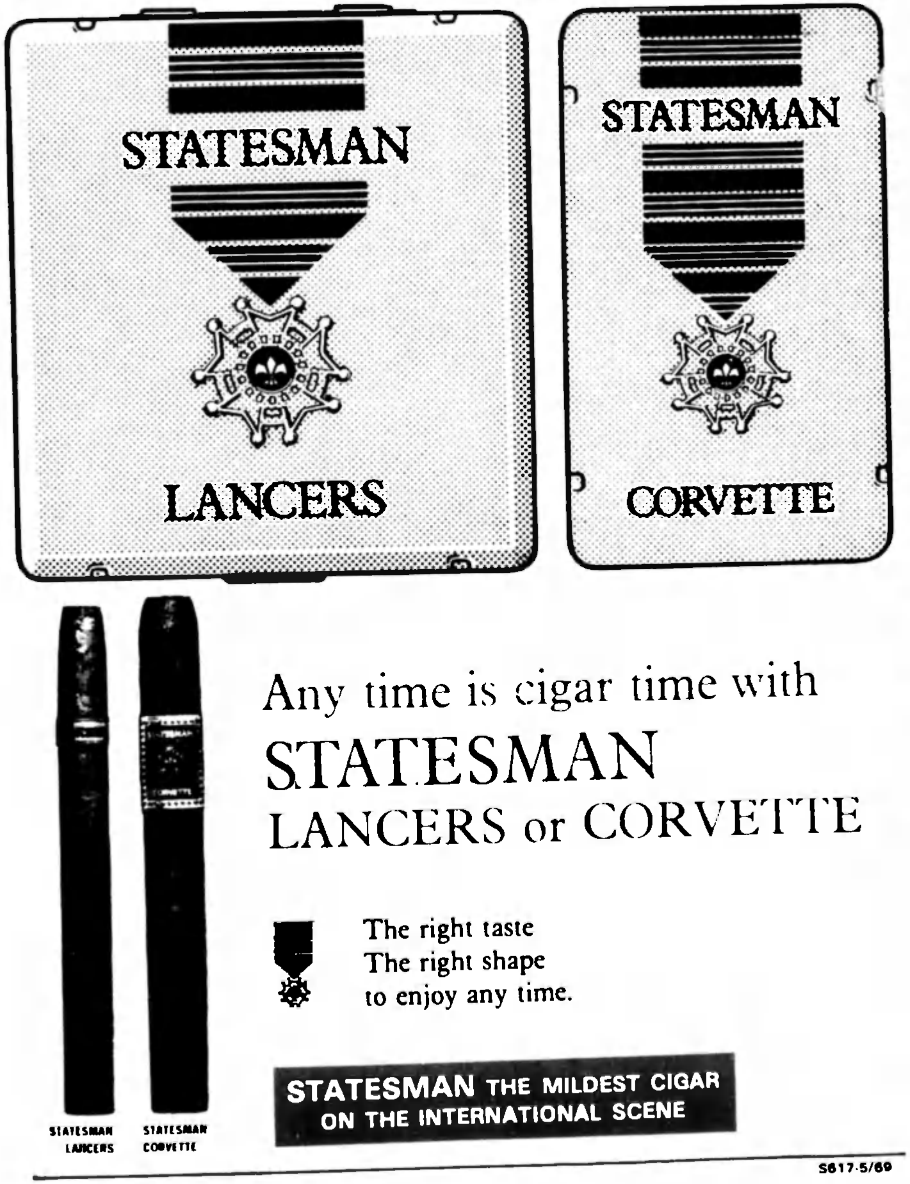

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All Correspondence should be directed to the Editor

EDITOR: Dennis P. Trickett, Esq., Box C17B, Clarence Street Post Office, Sydney, N.S.W., 2000, Australia

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Periscope on Australia

by Grommet

INDUSTRIAL MOBILISATION COURSE ON DEFENCE PREPAREDNESS

Thirty-seven senior representatives of Victorian industry, the universities, the armed services and government departments and instrumentalities, began a final symposium lasting six days on Sunday, 5 October, at the Armoured Centre, Puckapunyal.

This last period of study brought to a close a nine month part-time course which had examined some of the difficulties and problems associated with industrial support for Australia's defence preparedness.

The course commenced last February at the R.A.A.F. base, Laverton. Throughout 1970, the course consisted of evening lectures and discussions on a comprehensive range of subjects at Victoria Barracks, Melbourne and weekly visits to selected industrial establishments of national importance throughout Australia.

The Australian Government attached considerable importance to the courses, because they have maintained close co-operation between Australian industry and the armed forces and at the same time have indicated the capacity of Australian industry to contribute to the nation's defence preparedness.

SEATO MILITARY ADVISERS' 33rd CONFERENCE

The 33rd Conference of the military advisers of the South-East Asia Treaty Organisation was held at Honolulu, Hawaii on 15 and 16 October, 1970.

General Sir John Wilton, Military Adviser for Australia and Chairman of the Australian Chiefs of Staff Committee was the chairman of the Conference.

The Military Advisers meet in formal session twice a year for consultation on the defence of the Treaty Area against the Communist threat. Their meetings also provide an opportunity to review and update the work of the SEATO Military Planning Office.

AUSTRALIAN SUBMARINE COMMANDER

The Royal Australian Navy has another Australian born submarine commanding officer, Lieutenant Commander Terry Roach, who has assumed command of H.M.A.S. Otway.

Lieutenant Commander Terry Roach, R.A.N. (left) has taken command of the submarine Otway, succeeding Lieutenant Commander Tim Duchesne, R.A.N. (right), who transferred from the Royal Navy to the R.A.N. in 1967.

REAR ADMIRAL A. M. SYNNOT

Captain A. M. Synnot, has been promoted to the rank of Rear Admiral and has been appointed Second Naval Member of the Commonwealth Naval Board and Chief of Naval Personnel.

His promotion follows the appointment of Vice Admiral Sir Victor Smith as Chairman, Chiefs of Staff Committee and Rear Admiral Peek as Chief of Naval Staff.

R.A.N. OFFICERS TO TRAIN WITH R.N.Z.N.

Six Royal Australian Navy junior officers began a year's training with the Royal New Zealand Navy last October.

All acting sub-lieutenants, they had attended professional courses in the United Kingdom prior to joining their New Zealand ships.

In New Zealand, the officers are being given extensive practical experience and are expected to acquire requisite formal naval qualifications.

DEFENCE FORCES RETIREMENT BENEFITS

The Chairman of the recently appointed Joint Committee on Defence

Forces Retirement Benefits legislation, Mr. J. D. Jess, M.P., announced on 3 September, that the Committee had held its first meeting.

The terms of reference of the Committee are to inquire into and report upon the legislation in relation to—

a. its aims and objectives

b. the complexities of the legislation and any means by which the legislation might be simplified and improved

c. the rates of contribution by members

d. any differences, as between members, in the benefits provided

e. any anomalies and inequities that might exist

f. the frequency of and delays in actuarial investigations on the state and sufficiency of the Defence Forces Retirement Benefits Fund, and

g. administration of the Fund.

The Committee is keen to receive written submissions from organisations and individuals concerned with the operation of the Defence Forces Retirement Benefit Act.

Communications should be directed to Mr. Donald Nairn, Clerk to the Committee, House of Representatives, Canberra, A.C.T., 2600, Australia.

EXERCISE SWAN LAKE

The exercise began from Sydney on 26 October, with the deployment phase and ended in Fremantle on 15 November.

The following vessels participated in the exercise—

H.M.A. Ships *Melbourne*, *Brisbane*, *Swan*, *Oxley*, *Otway*, *Hawk*, *Ibis*, *Curlew* and *Acute*. H.M. Ships *Charybdis*, *Minerva*, *Lynx*, *Ashanti* and *Finwhale*.

They were supported by H.M.A. Ships *Supply* and *Stalwart*; H.M.S. *Forth* and the Royal fleet auxiliaries *Olmeda*, *Resource* and *Typhoon*.

Orion anti-submarine aircraft of the R.A.A.F. and R.N.Z.A.F. also participated.

The exercise was directed by the Flag Officer Commanding the Australian Fleet, Rear Admiral H. D. Stevenson.

The Australian guided missile destroyer H.M.A.S. *Brisbane* leads the British frigates H.M.S. *Minerva* and H.M.S. *Charybdis* out of Sydney Harbour, bound for Western Australia and the first major maritime exercise to be held in the Indian Ocean in peacetime.

DEFENCE PROCUREMENT LIAISON TALKS

The United States Department of Defense representatives arrived in Canberra on Saturday, 24 October, for defence procurement liaison talks.

The Honourable Barry J. Shillito, Assistant Secretary of Defense (Installations and Logistics) led the U.S. team which included Armed Forces representatives.

Ways and means were examined of increasing opportunities for Australian industry to compete for Department of Defence (U.S.) procurements.

The underlying purpose of the talks was to strengthen Australia's technological base and defence production capability as well as developing more procurement reciprocity on the part of the United States in view of Australia's large volume of military orders in the States.

OUR COVER

Harrier V/STOL Fighter in United States Marine Corps Markings

Delivery of Hawker Siddeley Harrier V/STOL Fighters to the United States Marine Corps begins in the new year with the aircraft scheduled to go into service during 1971. Already in operation with the Royal Air Force in England and Germany, keynote of this unique fighter is flexibility, mobility and quick reaction.

The Harrier pictured is seen in Marine Corps markings and is flying with an 8,000 lb bomb load in a configuration of bombs, 30 mm Aden cannon and cluster bombs.

Able to operate with an ultra-short take-off or vertically, the Harrier presents an even more formidable weapon that is very difficult to detect when dispersed. Worldwide interest has been shown in the Harrier for multi-service operation on land and sea.

A licencing agreement between Hawker Siddeley Aviation Limited and the McDonnell Douglas Corporation of St. Louis Mo., provides for co-operative production of Harriers ordered under U.S. Government contracts.

The Royal Navy's Trend-Setter

by REGINALD LONGSTAFF

The frigate H.M.S. *Exmouth*, the western world's first major warship entirely powered by gas turbines, is the fore-runner of a new breed of ships for the Royal Navy. All future new construction will use combinations of gas turbines, and the *Exmouth* is a working test-bed for the next generation of major warships.

A "Blackwood" Class frigate of 1,500 tons, the *Exmouth* was completed in December 1957. She is 310 feet long, has a beam of 33 feet and is served by a crew of 140.

MODERN REFIT

Exmouth was dry-docked at Chatham Dockyard, England, for a major refit which was completed in 1968. Part of the work involved the removal of the existing steam machinery and replacement with Rolls-Royce gas turbines. A combined gas turbine arrangement has been installed consisting of an Olympus TM 1 unit of 15,000 horsepower for full power, and two Proteus engines of 3,600 horse power for cruising.

Both engines are "marinised" versions of those used in a wide variety of commercial applications and well proved for reliability.

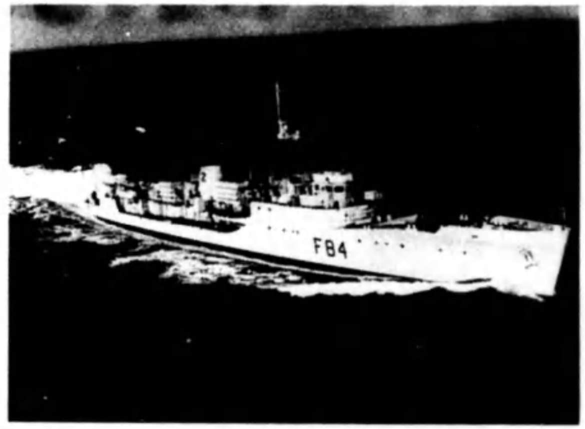
As the engines have been fitted into an existing vessel, the power of the Olympus unit has been reduced from its normal 24,000 horse power to match the vessel's structural capabilities.

The installation was designed to fit into the existing machinery spaces. The Proteus engines and gearing are situated aft in the old steam turbine room while the Olympus is forward in the old boiler room.

All three engines drive into a central main reduction gear, and all have been fitted with synchro self shifting clutches. A single shaft fitted with a controllable pitch propellor is driven via the reduction gearing.

REMOTE CONTROL

The gas turbines can be remotely controlled from the bridge or from the machinery control room, in the forward engine room, by means of a single power pitch control lever.



The frigate *Exmouth*, pride of the British Royal Navy, and the western world's first major warship powered entirely by gas turbines. The *Exmouth*, an undoubted trend-setter for modern navies, has three engines, two for general cruising and one for extra boost power. It all adds up to one of the world's most sophisticated vessels.

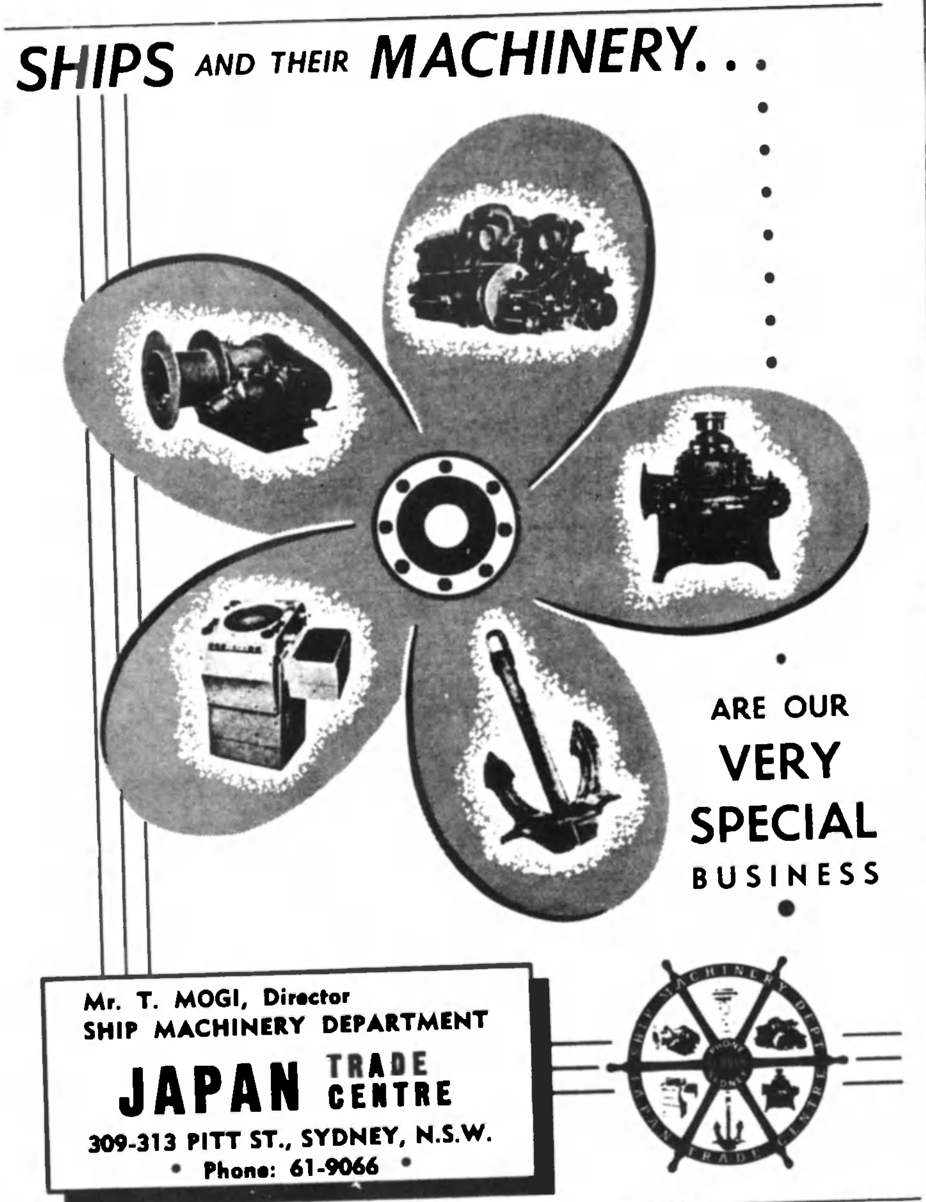
Like the Proteus, the Olympus has a background of extensive development as an aero engine. It is one of the world's most powerful jets and has established a first class reputation for reliability since its introduction to the Royal Air Force in 1956.

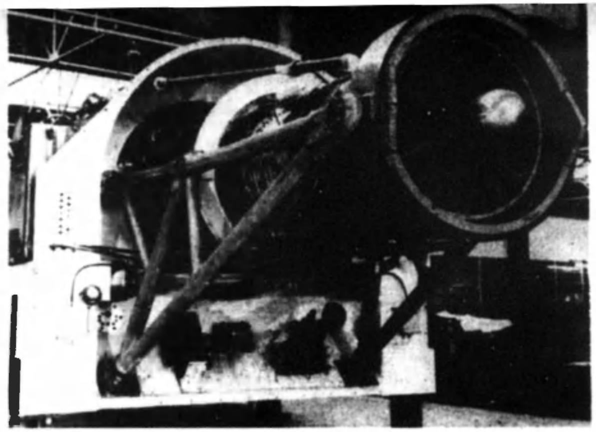
The Olympus is 22 feet 1 inch long, 10 feet 11 inches wide, with a height of 9 feet 6 inches and weighs 24.8 tons. The maximum output shaft speed is 5,660 revolutions per minute.

The Proteus is short, compact, light in weight for its high output (1.32 pounds per horsepower), and has a well established reputation for exceptional reliability and performance.

Simplicity is the basic merit. There are only two rotating assemblies, the turbine and the compressor, and no reciprocating parts. Full power is available within one minute of starting the engine and no preliminary warming up is necessary.

The use of the free turbine principle





The Rolls-Royce Olympus marine engine, used with the two Proteus engines on the *Exmouth* to provide extra boost power. The Olympus is a 15,000 horsepower unit. Like the Proteus it has an extensive background of development as an aero engine. It is one of the world's most powerful jets and has established a first class reputation since its introduction to the Royal Air Force in 1956.

in which the turbine driving the output shaft is independent of the compressor system allows the engine to deliver extremely high power at low and medium propeller speeds.

Other new features in the *Exmouth* include the use of a gas turbine for driving the main electricity generator, incorporating a waste heat boiler to produce steam for auxiliary and domestic purposes. Equipment includes advanced sonar and anti-submarine weapons.

Rolls-Royce experience with marine gas turbines dates back to 1958 when the Royal Navy pioneered the use of Proteus engines of 4,250 h.p. for the Brave Class fast patrol boats, and the combined steam and gas turbine plants in the Tribal Class frigates and the County Class guided missile destroyers.

Since this installation, 12 other navies have ordered engines with power destroyers, corvettes, fast patrol and torpedo boats, hydrofoils and hovercraft. Some 300 engines are on order or in service and engine hours at sea now exceed 120,000.

By getting the Olympus to sea as a main propulsion unit in the vessel, the Royal Navy has gained further valuable experience of the operational characteristics and benefits in the rigours of naval service.

Exmouth is air-conditioned throughout and the living quarters are of high standards. The various visits already undertaken or planned for the future, are designed to test the machinery under varying climatic conditions.

The advantages of switching to gas turbine machinery modules as a general policy is that they are simple to install, easier to maintain, need less valuable technical manpower, and increase the availablity of the ship.

The installation is shockproof to underwater explosions and can be changed through the big air intake trunking by running it out on rollers and rails. A complete main engine change might be possible in 48-hours.

There is no low frequency noise which can travel a long way underwater, as there is with conventional machinery. Instead there is a high frequency noise which is far easier to insulate against.

Allowing for the same machinery-fuel weight ratio, the lower weight and size of the gas turbines allows more fuel to be carried.

A standard range of gas turbines is envisaged consisting of one high-powered, a medium-sized one, and a smaller one for cruise conditions. These will be used in varying combinations depending on the size of the ship. This standardisation will make logistic support simpler.

Gas turbine installations are very sensitive to ambient air temperatures, which mean reduced power in the tropics. But with excess power to use, the running under power should lead to improved life cycles, greater reliability, and greater mean time between overhauls.

In the fast patrol boats, for instance, despite the tremendous buffeting at high speeds, the original time between overhauls was increased from 500 to 2,000 hours, and this is the kind of improvement being looked for by the Royal Navy in the *Exmouth*.

SIGNIFICANT LEAD

There is no doubt that the British lead is significant. The navies of Argentina, Malaysia, Iran, Libya, Finland and the Netherlands have already ordered Olympus units. Over 70 engines are on order or in service and engine hours at sea exceed 3,700. The latest Olympus, the TM3B, is rated at 27,200 horse power, and is three feet narrower and 2½-tons lighter than the TM1.

Neither steam nor diesel offered much scope for improvement either in efficiency or costs, and *Exmouth* is without doubt the ship of the future.

The simplicity of installation and the reduction in technical manpower of up to 25%, make it an attractive proposition for any modern navy.

CONTRIBUTIONS INVITED

The editor invites persons to submit articles, photographs and drawings (black ink) for inclusion in the magazine, but regrets that no payment can be made for contributions submitted. Contributions should be addressed: The Editor, "The Navy", Box C178, Clarence Street Post Office, Sydney, N.S.W. 2000, Australia.

The Editor, does not hold himself responsible for manuscripts, though every effort will be made to return those with which a stamped and addressed envelope is enclosed.

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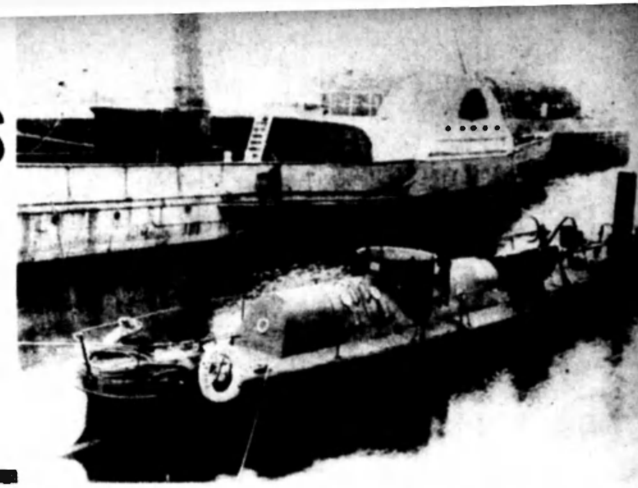
Tasmania's Only Warship

By JACK MILLAR



A view of Tasmania's one and only fighting ship, an un-named second-class torpedo boat, which saw service on the Derwent from 1884 to 1900. The photo, taken at the old Princes Wharf, also shows the paddle steamer Monarch, once a popular trader between Hobart and New Norfolk.

Russian invasion scares from the time of the Crimean War until the 1880's — two unannounced Russian warships dropped anchor in the Derwent in 1873 — gave Tasmanians the jitters and lead to the building of Bellerive's Bluff Battery.

They resulted also in the creation of a Tasmanian Navy — a navy which consisted of a torpedo boat, manned by the army.

The sole seagoing unit of the colony's navy — or was it the army? — was an unnamed craft of 12 tons, and her crew was made up of volunteer soldiers in gay uniforms.

Both Houses of the colony's Parliament recommended the purchase of a gunboat for harbour defence in 1859, and three years later the Under-Secretary (Mr B. T. Solly) advocated that Tasmania should have a steam ram with two cupolas, each mounting two 10-inch guns.

This idea stemmed probably from those used successfully in the early days of the American Civil War. Weird, awesome-looking craft, they were nothing more than floating gun platforms, useful only in calm, sheltered waters.

Nothing came of the idea, but with the departure of British garrison troops the Government not only formed a volunteer corps, but ordered a torpedo boat from the British firm of Thornycrofts.

The "warship" was unloaded from the steamer **Abington** on 1 May, 1884, watched by crowds which flocked to the waterfront, and was towed to the Battery Point shipyards of John Lucas for the machinery and propeller to be fitted.

It was moored off the shipyard until the completion of a special boatshed to house it on the Domain foreshore.

This sea-going "dreadnought" was 63ft long, with only a 7ft 6in beam. Draught forward was only about 1ft 1in, and aft, 3ft 2in.

The keel, stem and stern posts, transverse frames, outside plating, deck beams, and deck plating were all of galvanised steel, the plating of which was only 1/16th of an inch thick.

Engines were of the inverted direct acting compound system, fitted with one high pressure cylinder, with surface condenser, air pump (worked off the low pressure engine), and two feed pumps and a bilge pump worked off the crank shaft by means of worm and wheel.

Water was circulated through the condenser by a centrifugal pump worked by a separate engine, and there was also a fan engine for supplying air to the boiler. The bilge service consisted of six ejectors, one of 45 tons, and five of 20 tons capacity.

A locomotive type boiler had a working pressure of 130lb.

Nothing was forgotten. The boiler was even provided with Thornycrofts' patent apparatus for preventing injury to the stokers from the bursting of a tube.

17 KNOTS

Speed was stated to be more than 17 knots. Barring accidents, steering was from the conning tower, with telegraphic communication between steersman and engineer.

The torpedo gear consisted of a steel spar run in and out by a winch in the conning tower, to which a McEvoy spar torpedo was fitted. By means of this dropping gear the torpedo was lowered into the water and fired on ahead bearings.

Total cost was around 3,300 Pounds.

Why the terror of the Derwent was not given the dignity of a name is not known. When not in use it was hauled into the boatshed by means of a cradle. An old Hobart identity says it took the best part of half a day to raise steam, launch the boat, and get ready for action.

A special Torpedo Corps of about 40 army volunteers, was composed of engineers and others in the community. They also had in their charge a number of mines, to be strung across the Derwent and exploded electrically in an emergency.

A former Royal Engineer, Captain

TIGHT BINDING

James Mathieson, was appointed Torpedo Director. "Walch's Almanac" tells us that Lieut. J. J. McDonald was officer commanding in 1887. James Mallard Clarke in 1888-9. Lieut. (later Captain) Robert Henry in 1890-8, and Lieut. (later Captain) H. E. Parker in 1898-1900, when the torpedo boat disappeared from the records.

The reluctance of some Tasmanian Governments to allocate sufficient money for defence needs caused a falling off at times in the number of volunteers, who received little or no pay. This rubbed off on the Torpedo Corps, and on occasions the vessel was inoperative for want of a crew.

Another cause of frustration was the inability of the corps to get permission to fire a practice torpedo. The Government concerned at the high cost, was loth to give this. When at last permission was given, the boat chugged off down the Derwent, the crew in high glee.

Torpedoes, then in their infancy, sometimes took erratic courses for no explainable reason. It was not unknown for a ship to have to dodge its own torpedo.

Other colonies had similar defence problems to Tasmania's, and, with the exception of Western Australia, also bought torpedo boats, in addition to much larger gunboats.

South Australia had one second-class torpedo boat, and New South Wales, Queensland and Victoria two. Victoria also had two first-class torpedo boats, larger, more powerful, and speedier craft.

South Australia and Queensland organised their own naval militia forces, and Victoria, with by far the biggest flotilla, had its own naval force.

In the 1890's following a visit to Hobart of the Australian Defence Committee, composed of the commandants of the other Australian colonies, a coastal defence gunboat equipped with two 4.7in guns, to cost 20,000 Pounds, a second torpedo boat, the strengthening of many river ferries to take a three-pounder quick-firing gun, and additional guns for the Derwent batteries were recommended.

The Government, probably baulking at the cost, did not act on this.

Within a few years came Federation, and Tasmania, along with the other States, thankfully dumped its defence problems into the lap of the Commonwealth Government. Stop-gap measures for a naval force were evolved until the formation of the Royal Australian Navy in 1911.

IN THE NEXT EDITION

The next issue of "The Navy" will be published during February/March, 1971, and it is hoped to include special articles on the Navies of the United States, France, the Philippines and Holland.

An article on Hovercraft, together with the usual features will also be included.

EDITOR.

DEFENCE REPORT 1970

The Royal Australian Navy

Text of the Annual Report presented to Parliament by the Minister for Defence, The Honourable Malcolm Fraser, M.P.

THE NAVY

The Royal Australian Navy has the largest peacetime fleet in its history. Fifty-five ships of various types were in service on 30 June 1970, shaping the Navy towards a balanced fleet, possessing versatility and flexibility and a capacity for rapid deployment in a wide range of situations.

The R.A.N. is being developed to be increasingly self-reliant, with a high degree of strategic and tactical mobility.

The roles of the R.A.N. are:

To organise, train and equip naval forces, including naval aircraft, for timely and sustained combat operations at sea:

to detect and destroy enemy naval forces and sea commerce;

to establish and maintain superiority in areas as necessary for naval operations, including the protection of sea lines of communication;

to conduct naval offensive operations against enemy forces and installations;

to conduct naval reconnaissance and surveillance, anti-submarine warfare, the protection of shipping, and hydrographic and oceanographic survey.

To provide naval support for land operations.

To provide military sea transport support for the Australian services; and

To provide seaward defence of ports and anchorages.

Australia's new, powerful submarine force gets together for the first time. The four Oberon-class submarines of the 1st Australian Submarine Squadron, Royal Australian Navy, are moored at the Navy's submarine base, H.M.A.S. *Platypus*, in Sydney. H.M.A.S. *Onslow* is inboard with H.M.A.S. *Ovens* astern and H.M.A.S. *Oxley* is outboard with H.M.A.S. *Otway* astern. Approval has been given for the purchase of two more Oberons, regarded as among the most effective conventional submarines in the world.

NEW SHIPS AND PROJECTS

During 1969-70 the destroyer escort H.M.A.S. **Swan** joined the fleet and the fourth Australian Oberon-class submarine H.M.A.S. **Onslow** was delivered from Scotland after trials and workup in UK waters. A sister ship to **Swan**, H.M.A.S. **Torrens**, will commission early in 1971.

The extended refit of the Daring-class destroyer H.M.A.S. **Vampire** has begun, and will be followed by H.M.A.S. **Vendetta's** extended refit in 1971. These refits will include the updating of several weapon systems.

The conversion of H.M.A.S. **Snipe** to a coastal minehunter will be completed this year.

The preliminary design study for a destroyer has begun and approval has been given for the detailed design of this class of ship.

Other future projects for which approval was given in 1969-70 include: —

A fast combat support ship to supply to combatant ships either at sea or in harbour a variety of fuels, ammunition, victuals and other stores.

A specialised oceanographics ship which will replace the ageing H.M.A.S. **Diamantina**. The new ship, to be named H.M.A.S. **Cook**, is expected to be completed in 1974.

A small hydrographic ship which will replace H.M.A.S. **Paluma**.

Two Oberon-class submarines to increase Australia's submarine strength to six vessels.

Ten Skyhawk fighter-bomber aircraft which will double the number of this type of aircraft in service with the Fleet Air Arm and increase the strike capacity of the carrier H.M.A.S. **Melbourne**.

Two twin-engined support and training aircraft which will be used for aircrew training, communications duties, Fleet requirements and trials.

Overhaul and modernisation of gun mounts for the guided missile destroyers. This will increase the fire power of the Fleet and its offensive capability.

New receiving facilities for the Naval communications station at Darwin. This will enhance communications facilities necessary for the control of operations in areas to the north.

THE FLEET

1 Aircraft Carrier, H.M.A.S. **Melbourne** (Flagship).

3 Guided missile destroyers: H.M.A. Ships **Perth**, **Hobart** and **Brisbane**.

3 Daring-class destroyers: H.M.A. Ships **Vampire**, **Vendetta** and **Duchess**.

6 River-class destroyer escorts: H.M.A. Ships **Yarra**, **Parramatta**, **Stuart**, **Derwent**, **Swan** and **Torrens**.
1 Coastal Minesweeper: H.M.A.S. **Hawk**.
2 Minehunters: H.M.A. Ships **Curlew** and **Snipe**.
4 Submarines: H.M.A. Submarines **Oxley**, **Otway**, **Ovens** and **Onslow**.
15 Patrol Boats: H.M.A. Ships **Attack**, **Advance**, **Assail**, **Samarai**, **Aitape**, **Lae**, **Madang**, **Ladava**, **Aware**, **Ardent**, **Barbette**, **Barricade**, **Buccaneer**, **Bayonet** and **Bombard**.

TRAINING SHIPS

1 Battle-class destroyer: H.M.A.S. **Anzac**.
1 Queenborough-class destroyer escort: H.M.A.S. **Queenborough**.

OPERATIONAL RESERVE (AS AT 30/6/70)

3 Coastal Minesweepers: H.M.A. Ships **Teal**, **Gull** and **Ibis**.
1 Patrol Boat: H.M.A.S. **Bandolier**.

SUPPORT SHIPS

1 Transport: H.M.A.S. **Sydney** (also used for training).
1 Destroyer tender: H.M.A.S. **Stalwart**.
1 Oiler: H.M.A.S. **Supply**.
1 Surveying ship: H.M.A.S. **Moresby**.
1 Coastal surveying ship: H.M.A.S. **Paluma**.
1 Oceanographic research ship: H.M.A.S. **Diamantina**.
1 Trials and oceanographic ship: H.M.A.S. **Kimbla**.
2 Reserve training ships (auxiliaries): H.M.A. Ships **Bass** and **Banks**.
4 Reserve training (patrol boats): H.M.A. Ships **Acute**, **Adroit**, **Arrow** and **Archer**.
1 Cargo ship: H.M.A.S. **Jeparit** (temporarily in commission for Vietnam service).

THE FLEET AIR ARM

SQUADRONS

HT 723: Helicopter pilot training and search and rescue duties. Iroquois and Scout helicopters.

VC 724: Fixed-winged fighter pilot training, communications and Fleet requirement flying and trials. Aircraft types are Sea Venom, Vampire trainers, TA4G Skyhawk trainers and A4G Skyhawk aircraft.

HT 725: Anti-submarine helicopter operational training and Fleet requirement duties. Wessex 31B helicopters.

VF805: Front-line fighter squadron of A4G Skyhawk aircraft.

VS 816: Front-line fixed wing anti-submarine squadron of S2E Tracker Aircraft.

HS 817: Front-line helicopter anti-submarine squadron of Wessex 31B helicopters.

VC 851: Training squadron for pilots, observers and aircrewmen. Twin-engine conversion, communication and Fleet requirement flying. Aircraft types are S2E Tracker and Dakota aircraft.

OPERATIONAL ACTIVITIES

VIETNAM

The Royal Australian Navy continues to maintain one fleet unit in the Vietnam area as an integral part of the United States Navy's Seventh Fleet. Since 1967 this commitment has been undertaken by the guided missile destroyers H.M.A. Ships **Perth**, **Hobart** and **Brisbane** and the Daring-class destroyer H.M.A.S. **Vendetta**.

The R.A.N. continues to maintain its commitment of eight helicopter pilots, four observers, four aircrewmen and 30 maintainers to an integrated R.A.N.-U.S. Army assault helicopter company which was established in South Vietnam in October, 1967.

The company provides helicopter support to Allied ground forces and has operated with considerable success. Some pilots have flown up to 140 combat hours a month.

A clearance diving team has been attached to U.S. Naval forces in South Vietnam since March 1967.

By 30 June 1970 the troop transport H.M.A.S. **Sydney** had made 16 return passages to Vietnam since mid-1965 transporting troops, vehicles and equipment.

During the year under review H.M.A.S. **Perth** was awarded the United States Navy Meritorious Unit Commendation for "exceptionally meritorious service" in the planning and execution of combat missions while operating as a unit of the U.S. 7th Fleet.

In September 1969 team No. 3 of the Clearance Diver unit was awarded the comparatively new United States Meritorious Unit Commendation for its service in Vietnam during the period February until June 1967.

Individual awards were made to other personnel who were serving in Vietnam, including pilots in the assault helicopter company.

STRATEGIC RESERVE

The deployment of two ships to the British Commonwealth Strategic Reserve has continued. H.M.A. Ships **Vampire**, **Derwent**, **Parrammatta**, **Stuart**, **Duchess** and **Yarra** served in the area during 1969/70.

EXERCISES

H.M.A. Ships took part in a number of international maritime exercises during the year.

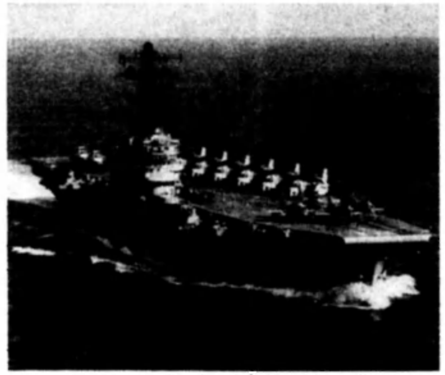
The major exercises were the SEATO Maritime Exercise, "Sea Rover" in which five of H.M.A. Ships co-operated with ships of the Royal Navy, United States Navy, Royal New Zealand Navy, the Philippines Navy and the Royal Thai Navy, and the Five-Power exercise called "Bersatu Padu" in the West Malaysian areas, in which 10 H.M.A. ships took part with units of the three Services of the United Kingdom, New Zealand, Singapore and Malaysia.

ROYAL VISIT

H.M.A.S. **Stuart** acted as the escort for Her Majesty the Queen embarked in H.M.Y. **Britannia** on the Australian

An A4G Skyhawk fighter-bomber is catapulted from the Carrier, H.M.A.S. *Melbourne*, for a strike mission during SEATO exercise, Sea Rover.

station, and R.A.N. ships and establishments arranged and hosted, on behalf of the Commonwealth, all foreign ship visits to Australian ports and attendance at the Captain Cook Bi-Centenary ceremonies. In all, 85 individual port visits were made by foreign ships in connection with the celebrations.



H.M.A.S. *Melbourne*, flagship of the Royal Australian Navy.

SURVEYING AND OCEANOGRAPHIC RESEARCH

The Hydrographic Service continues to play an increasingly important role in the rapid development of the nation's mineral resources. The need for new ports, development of existing ports, new harbour approach routes, new shipping routes, and the resurveying of some existing routes for the safe passage of deep-draught bulk-carriers, provides a challenge requiring the maximum effort of the Service.

H.M.A.S. **Moresby** has completed two survey seasons in the Gulf of Carpentaria to provide shipping routes to the new ports of Gove and Weipa, and in this task was assisted by the Patrol Boats H.M.A. Ships Barbette, Barricade, Buccaneer and Bombard which acted as consorts for the survey. Moresby has a continuing task to survey shipping routes for bulk-ore carriers off North West Australia.

H.M.A.S. Paluma has continued to survey the inner shipping route in the northern part of the Barrier Reef to provide an up-dated survey of this important route which has been based on surveys mostly carried out last century. H.M.A.S. **Bass**, with the assistance of Tasmanian Reserve personnel, has continued with the survey of the approaches to the new port of Spring Bay in Tasmania.

H.M.A. Ships Hawk and Gull and the Division of National Mapping have made progress with the Aerodist Programme, fixing the position of detached reefs in the Coral Sea seaward of the Continental Shelf.

The requirement for new charts to meet the increased demand of the bulk shipping trade comes at a time when metrication of all existing navigation charts is being carried out. This large task is well in hand. A number of metric charts have already been published, and it is planned to have all harbour and harbour approach charts re-published in metric form before the end of 1972.

Oceanographic research has become of increasing value to defence by helping to strengthen the R.A.N.'s anti-submarine capability through greater knowledge of the ocean environment. The information obtained also has scientific importance.

During 1969-70 H.M.A.S. **Diamantina** carried out seven oceanographic cruises in the Indian and Southern Oceans. At these times she carried scientists from the C.S.I.R.O., Columbia University and various Australian universities engaged on different aspects of oceanographic research.

In 1974 H.M.A.S. **Diamantina** will be replaced by H.M.A.S. Cook, a vessel specially designed for oceanographic research, fitted with bow propulsion, and embodying such modern equipment as satellite navigation, data-logging systems, and narrow beam sounding devices.

FLEET AIR ARM

Over the next two years the strength of the Fleet Air Arm will be increased through the addition of 10 Skyhawks, 10 Macchi jet trainers, two HS-748 training and support aircraft and nine light training helicopters.

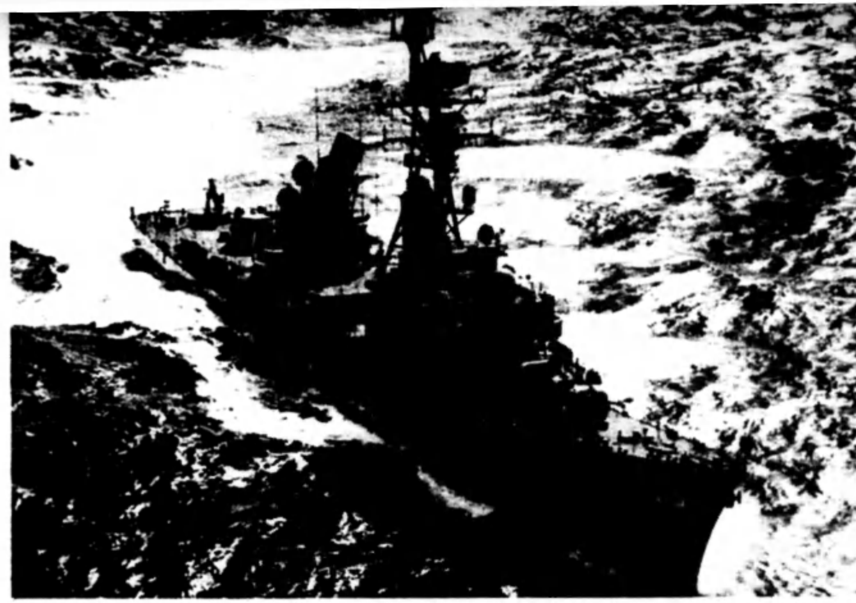
The additional Skyhawks will enable the versatility of H.M.A.S. Melbourne to be increased and at the same time will provide a significant strike force and a substantial increase in the deterrent and offensive capability of the R.A.N.

The Naval Air Station at Nowra now conducts much of the aircrew training which was formerly undertaken overseas, and to increase its capacity for pilot training the first of 10 Macchi jet trainers will be delivered towards the end of 1970 with the programme completing by mid-1971.

The requirement for training and support aircraft includes fleet training and trials over a wide field of operations peculiar to the Navy. In particular the HS-748 aircraft will be used for exercising ships of the Fleet in electronic warfare.

Shore base facilities at H.M.A.S. **Albatross**, the Naval air station at Nowra, have been developed and a programme of modernisation is continuing. In 1970/71 this will involve the construction of two accommodation blocks for officers and one for sailors to replace World War II structures. Additional flying aids and the Tracker weapon system trainer have become operational during the last six months and a new avionics workshop will be in full operation before the end of 1970.

Ships of the R.A.N. Mine Countermeasures Squadron leave Sydney Harbour for overseas.



HMAS HOBART, a guided missile destroyer, makes a fast turn on the gunline off South Vietnam.

PERSONNEL

MANPOWER

A total of 17,304 officers, sailors, W.R.A.N.S. and members of the Royal Australian Naval Nursing Service was serving in the permanent Naval Force on 30 June 1970. The estimated strength on 30 June 1971, is 17,820. The officer strength on 30 June 1970, was 2,016 and will rise to an estimated 2,113 in the next year.

The build-up of junior recruits progressed during the year. At 30 June, 1970, the intake had reached 747 of the "target" of 800. Most of this build up occurred during the latter part of the financial year.

OPTIONAL DISCHARGE

In January, 1970, a scheme was introduced to enable recruits of all kinds to withdraw from the R.A.N. if, within a prescribed time, they found they did not care for naval life.

The basis of the scheme is that adult male recruits may give notice of their wish to leave the R.A.N. within 64 days of joining. Similar facilities have been arranged for other types of recruits, with variations in the period when optional discharge can be claimed.

This "taste and try" scheme gives the recruit the opportunity of discharge before committing himself to nine or 12 years' minimum service.

To 30 June 1970, 47 recruits out of a total 531 had chosen to leave within the prescribed time. A further 517 recruits entered during the period had not reached their optional discharge date by that time.

REVIEW OF SAILOR STRUCTURE

The Naval Board decided that a review of the sailor structure of the R.A.N. was desirable and a committee has begun investigations and is expected to present its report by the end of 1970.

It will assess the need for redesigning the branch structure, with resultant changes in manning concepts, to meet the needs of the Navy in the foreseeable future.

The committee will also made recommendations in respect of initial engagement and re-engagement periods, training patterns and promotion opportunities.

TRAINING

Of the total R.A.N. strength approximately 6,500 are directly and indirectly involved in formal training.

There are 750 training courses in the R.A.N. varying in duration from one day to four years.

Of the total 750 courses, 586 are operated by the R.A.N. itself; the remainder by industry, universities and technical colleges, or other Services, both Australian and overseas.

To ensure continuous updating of courses a Training Research Organisation maintains permanent liaison with leading technological institutions.

Two senior R.A.N. officers completed a two months' overseas training investigation mission in 1970 which will ensure full use of the latest proven methods and techniques in R.A.N. training.

The R.A.N. College has expanded its commitments in the field of tertiary academic training for junior officers.

A new University subject, Oceanography 1, is being presented in 1970, and passes will count as a unit towards the Bachelor of Science degree which cadets may gain from the University of New South Wales.

In addition to degree courses in science and engineering, junior officers may now study for arts degrees at the University.

W.R.A.N.S.

The Women's Royal Australian Naval Service is heading towards a ceiling figure of 40 officers and 795 Wrans.

At 30 June 1970, there were 31 officers — with three cadets under training — and 645 Wrans.

The Wrans Reserve continues to provide trained personnel to fill the Permanent Naval Forces vacancies and there are 23 carrying out full-time service.

The regulation permitting Wrans to remain with the Navy after marriage, which was introduced in April 1969, has resulted in the continued service of two married officers and 19 married Wrans of all ranks.

PAPUA-NEW GUINEA DIVISION

Four officers of the Papua-New Guinea Division who joined in December 1966, are undergoing further sea training in patrol boats. Another three officers who joined in December 1968, are at present undergoing midshipman training.

A further 37 recruits entered the P.N.G. Division in 1969-70, bringing the total strength to seven officers and 208 sailors.

Four P.N.G. apprentices have completed training at the R.A.N. Apprentice Training Establishment, H.M.A.S. Nirimba and a further 13 P.N.G. apprentices are undergoing training. Trained P.N.G. sailors are progressively replacing R.A.N. sailors in patrol boats based at H.M.A.S. Tarangau, Manus Island.

NAVAL RESERVE FORCES

On 30 June 1970, the Naval Reserve Forces had a total strength of 5,359 made up as follows:

R.A.N. Emergency Reserve 67 Officers and 830 Sailors.
Citizens Naval Forces 1245 Officers and 3074 Sailors
W.R.A.N.S. Reserve 2 Officers and 141 Wrans

A total of 220 Reservists was serving periods of full time service with the R.A.N.

Members of the R.A.N.R., the main training component of the C.N.F., have continued to make good use of the support craft attached to their training establishments in Brisbane, Sydney, Melbourne, Adelaide and Fremantle. As well, they have carried out periods of training with the Fleet.

CIVIL PERSONNEL

A total of 11,609 civilians was employed by the Department of the Navy on 30 June 1970.

During 1970-71 these civilians will be employed on a variety of tasks in support of the R.A.N. Many of these tasks are expanding considerably to meet Australia's need to be self-sufficient in technical, logistic and support aspects.

BUILDINGS, WORKS AND HOUSING

Expenditure on buildings and works during 1969/70 was $11.39m. In addition $2.80m was advanced to the States under the Commonwealth States Housing Agreement towards houses under construction and the cost of a further 428 houses and flats for naval personnel.

Major projects let to contract during the year included new barracks for officers and sailors at the Naval Air Station Nowra, barracks for senior sailors, swimming pool and gymnasium at the Junior Recruits Training Establishment. H.M.A.S. **Leeuwin**, W.A., a barracks block for cadets at the Royal Australian Naval College. Jervis Bay, and a testing and laboratory building at Garden Island Dockyard. Other projects included improvements to workshop facilities and engineering services at the Naval Dockyards and logistic support projects at Naval stores and armament depots.

Provision is made in the 1970/71 programme for an expenditure of $12.3m on buildings and works which will include a new radio receiving station in the Northern Territory, major instructional buildings at the Naval Training Establishment, H.M.A.S. Cerberus (Flinders, Vic.) and the Apprentices Training School, H.M.A.S. Nirimba (Quakers Hill, N.S.W.), a new oil fuel installation and improvements to electrical services at H.M.A.S. **Tarangau**, Manus Island. The programme also includes the construction of 16 houses in the Darwin area (six of which will replace old houses), and further improvements at the Naval Dockyards.

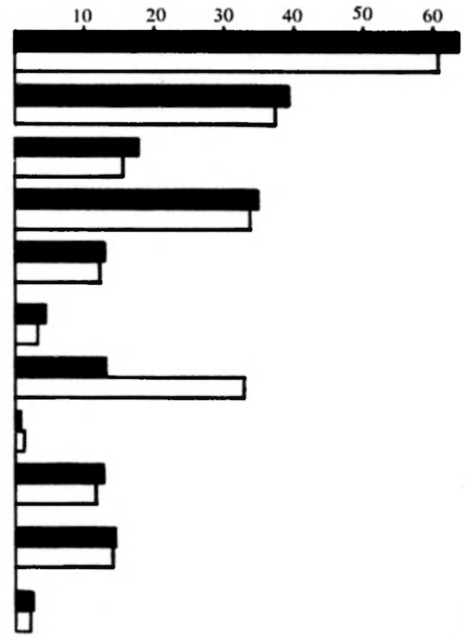
As at 30 June 1970, 3670 married quarters were available, under construction or on approved programmes for R.A.N. personnel and their families throughout Australia and Papua/New Guinea. Provision has been made in 1970/71 for $1.876m. to be advanced to the States under the Commonwealth State Housing Agreement towards the cost of houses under construction and a further 374 married quarters for rental by Naval personnel.

Items of forward planning include the proposed construction of a causeway linking Garden Island with the mainland at Cockburn Sound, W.A., as the first step in providing the naval support facility.

NAVY EXPENDITURE

The chart below shows the major categories of proposed expenditure for the Navy in 1970-71 compared with actual expenditure in the previous year.

	Estimated 1970-71 $m	Actual 1969-70 $m
Service Pay and Allowances	63.841	60.177
Civil Salaries	39.626	36.370
General Expenses	17.608	15.799
Maintenance Stores	34.918	32.671
Maintenance of Equipment	12.510	12.498
Maintenance of Buildings and Works	4.600	4.021
Naval Construction	13.554	32.582
Aircraft Purchase	.880	2.735
Capital Equipment	13.280	12.507
Buildings, Works, Sites and Housing	14.209	14.196
Recoverable Expenditure for Other Governments	1.862	1.777
Total from Appropriations	216.888	225.333
Outlays from United States Credits	26.122	15.807
TOTAL NAVY	243.010	241.140



"The Civilian Arm of the Navy"

The principal objective of the Navy League of Australia is to stress the vital importance of Sea Power to the Commonwealth of Nations and the important role played by the Royal Australian Navy.

The League, in conjunction with the Commonwealth Naval Board, administers the Australian Sea Cadet Corps, by providing finance and technical sea training for boys who intend to serve in the Naval or Merchant Services, also to those sea-minded boys, who do not intend to follow a sea career, but who given this knowledge will form a valuable reserve for the Naval Service.

We invite you to swell our ranks and so keep up to date with Maritime Affairs to help to build an ever-increasing weight of informed public opinion. The Navy League will then become widely known and exercise an important influence in the life of the Australian Nation.

The League consists of Fellows and Associates. All British subjects who support the objectives of the League are eligible for membership. Members receive copies of the League's magazine "The Navy".

DIVISIONS

New South Wales – Box 1719, G.P.O., Sydney, 2001.

Victoria — Room 6, 2nd Floor, 528 Collins Street, Melbourne, 3000.

Queensland – Box 376E, G.P.O., Brisbane, 4001.

Tasmania –

South Australia – Box 1529M G.P.O., Adelaide, 5001

Western Australia – 182 Coode Street, Como, 6152.

Australian Capital Territory – 60 Limestone Avenue, Ainslie, 2602.

Northern Territory – C/- Mrs. V. M. Slide, 12 Allen Street, Fannie Bay, 5790.

THE NAVY LEAGUE OF AUSTRALIA

Application for Membership

To: The Secretary,
The Navy League of Australia.
(.................... Division).

Sir,

I am desirous of becoming a Member of the Navy League of Australia with whose objects I am in sympathy.

Name (Mr.) (Mrs.) (Miss) (Rank) ....

Please Print Clearly.

Street .... Suburb ....

State .... Post Code ....

Signature .... Date ....

Enclosed is a remittance for $4.20 being my first annual subscription.

AFTER COMPLETION, THIS FORM SHOULD BE DISPATCHED TO YOUR DIVISIONAL SECRETARY — NOTE LIST OF ADDRESSES ABOVE.

THE NAVY LEAGUE OF AUSTRALIA

WESTERN AUSTRALIAN DIVISION

President's Report

(Presented, 13 August, 1970)

Again it is my pleasure to offer for your approval the Annual Report and Financial Statement of the Western Australian Division of the Navy League of Australia.

The period under review has been a most satisfactory one for the Division. Although no new units have been formed, the Division's four training ships, T.S. Perth, T.S. Bedford, T.S. Vancouver and T.S. Morrow have all consolidated their position and all have, I am proud to say, established headquarters, a position unfortunately not enjoyed by some Divisions in other States.

The H.M.A.S. Perth Memorial Headquarters Building continues to be of great benefit to the Division. Recently an inspection of the building was carried out by the Minister for Navy, The Honourable D. J. Killen, M.P. who, in congratulating the Division, expressed the opinion that it was the ideal setup for Cadet Training.

The Division has not only been able to use the building as a training establishment but has been able to utilise it for social functions. In this manner the Division, besides being able to save money, has turned the building into a true headquarters for all its activities.

The amalgamation of the Australian Sea Cadet Corp and the Naval Reserve Cadets has drawn closer, but as yet is not an accomplished fact. Your Division has given this move a great deal of consideration, but sees danger in any proposition that does not envisage some partnership between the Naval Board and the Navy League in the administration of the Cadets. The views of the Division have been conveyed to the Minister for Navy who has promised to give them his consideration.

The League again participated in Navy Week celebrations and is greatly indebted to Naval Officer in Charge and all personnel for the interest they have shown in the League's activities.

On the financial side the year has been a most successful one, due chiefly to launch owners from the Royal Freshwater Bay Yacht Club, Royal Perth Yacht Club, and South of Perth Yacht Club, who generously provided their vessels for another Night Afloat. Some forty vessels participated and close on 1,000 people enjoyed a splendid evening and the proceeds were over $1,200.

On the social side, your Executive arranged a picture show and afternoon tea on M.V. Australasia and held a very successful Malayasian evening in the Headquarters Building. Other functions are planned for the forthcoming year and it is hoped that by holding regular entertainment more young people will be attracted to the League.

My report would be incomplete without an expression of thanks to our Chairman, Mr W. H. Jacobs, our Secretary, Mr R. A. Hannah, Treasurer, Mr I. Bishop, and members of the Executive Committee.

I would also take the opportunity of thanking Mr Michael Worner who acted as Treasurer up till late 1969 and whose resignation was brought about by a transfer to Victoria.

In an effort to broaden the naval viewpoint the Executive has invited representatives from other naval organisations to join the League Executive. Already representatives from the Naval Association, H.M.A.S. Perth Survivors and the Submariners Association have accepted invitations and it is felt their presence at the Executive table has been both beneficial to the Navy League and the Associations they represent. It is hoped to invite other organisations to join us if the opportunity presents itself.

In conclusion may I pay tribute to Captain L. T. Vickridge, O.B.E., V.R.D., R.A.N.R., who has played a major part in the efficient running and operations of the Sea Cadet Units.

ROLAND SMITH,
President.

EA CADET RAINING SHIP —Bundaberg

On 25 July, 1970, at Bundaberg, Queensland, representatives of the Bundaberg Harbour Board and the Territorial Branch of the Navy League signed a 21 year lease for the use of 2½ acres of land at Port Bundaberg, where the local Branch of the Navy League intends to construct a Headquarters Building and boatshed for Sea Cadet Training Ship Bundaberg.

On this special occasion, Mr R. Moisel, President of the Bundaberg Branch received the Branch's Warrant of Commission from the President of the Queensland Division of the Navy League of Australia, Surgeon Commander Athol H. Robertson, R.A.N.V.R. (See photograph).

The lease was signed by Commander Robertson and the Chairman of the Bundaberg Harbour Board, Mr Robert C. Gibson. (See photograph).

The official proceedings were chaired by Alderman G. G. Boreham, Bundaberg's Deputy Mayor and former R.A.N.V.R. Officer.

The commanding officer of T.S. Bundaberg, Lieutenant B. Boneham, A.S.C.C., has two officers, four instructors and sixty Cadets in the Unit.

When the Port Bundaberg site is fully developed with buildings and parade ground, T.S. Bundaberg will be one of the best housed and most envied units in the Queensland Division and Australia.

Top photograph: Surgeon Commander Athol Robertson, R.A.N.V.R. (right) President of the Queensland Division of the Navy League of Australia, hands over the Warrant of Commission to the President of the Bundaberg Branch of the League, Mr R. Moisel.

Lower photograph: Surgeon Commander Robertson signs the lease for 2½ acres of land for the Bundaberg Unit of the Australian Sea Cadet Corps. He is watched by Mr R. Moisel (left) and Mr W. F. Moffatt, Secretary of the Bundaberg Harbour Board.

JOIN THE AUSTRALIAN SEA CADET CORPS

If you are between the ages of 13 and 18 years

The Australian Sea Cadet Corps is a voluntary organisation administered by the Commonwealth Naval Board and The Navy League of Australia.

The aim of the Australian Sea Cadet Corps is to provide for the spiritual, social and educational welfare of boys and to develop in them character, a sense of patriotism, self-reliance, citizenship and discipline.

Uniforms are supplied free of charge.

Cadets are required to produce a certificate from their doctor to confirm they are capable of carrying out the normal duties and activities of the Cadet Corps. If injured while on duty, Cadets are considered for payment of compensation.

Parades are held on Saturday afternoons and certain Units hold an additional parade one night a week.

The interesting syllabus of training covers a wide sphere and includes seamanship, handling of boats under sail and power, navigation, physical training, rifle shooting, signalling, splicing of wire and ropes, general sporting activities and other varied subjects.

Instructional camps are arranged for Sea Cadets in Naval Establishments, and they are also given opportunities, whenever possible, to undertake training at sea in ships of the Royal Australian Navy.

Cadets, if considering a sea career, are given every assistance to join the Royal Australian Navy, the Mercantile Marine or the Royal Australian Naval Reserve, but there is no compulsion to join these Services.

For further information please contact the Divisional Senior Officer in your State, using the Form provided below.

Senior Officers, Australian Sea Cadet Corps

NEW SOUTH WALES: Staff Office Cadets, H.M.A.S. Watson, Watsons Bay, N.S.W., 2030.
QUEENSLAND: C/- Box 376E, G.P.O., Brisbane, 4001.
WESTERN AUSTRALIA: C/- 182 Coode St., Como, 6152.
SOUTH AUSTRALIA: C/- Box 1529M, G.P.O., Adelaide, 5001.
VICTORIA: C/- Room 6, 2nd Floor, 528 Collins St., Melbourne, 3000.
AUSTRALIAN CAPITAL TERRITORY: Industry House, National Circuit, Barton, 2600.
NORTHERN TERRITORY: Mrs. V. M. Slide, 12 Allen Street, Fannie Bay, 5790.

TO: The Senior Officer,
Australian Sea Cadet Corps

I am interested in joining the Australian Sea Cadet Corps and would be pleased to receive further information.

NAME ....

STREET .... SUBURB ....

STATE OR TERRITORY .... POST CODE ....

PHONE No .... AGE ....

(Please Print Clearly)

Please address your envelope to the Senior Officer in your State or Territory —see list of addresses above

BEARCAT

. . . Home for Elite Flyers

Vietnam from the Bearcat Pilot's Angle.

One hour's drive from Saigon you find an elite team of young Australians who are tackling what may be the worst war job in Vietnam.

Flanked by Vietnamisation, pacification, and at times mortification, they go out at dawn each day and become targets for an array of weapons that only Vietnam has seen.

Suddenly, their war has turned time back to the days of the cumbersome, slow air machines of World War I when ground troops had the supreme pleasure of being able to shoot down attacking aircraft.

Officially, it's called Helicopter Flight Vietnam — HFV.

It comprises 46 men of the Royal Australian Navy's Fleet Air Arm.

They fly the Vietcong-studded Mekong Delta.

Their company is called EMU — Experimental Military Unit — because they are a unique air-war group. They are totally integrated with a United States Army unit.

The joint company of 280 men is the 135th Aviation Company.

Its home is Bearcat, 15 miles south-east of Saigon. It's a dust-streaming flattened "horror" stretch of Vietnam. Nothing of the soft greens and geometrical patterns of the rice fields Bearcat is barren.

The task of the Fleet Air Arm is simple.

Every morning of the week they pick up South Vietnamese troops of the 7th ARVN Division. Then they fly them to where the enemy is.

Which helps to explain why three of the eight Australian pilots have been wounded since the present flight arrived in Vietnam in September, 1969.

The toll for the previous R.A.N. teams since 1967 included three pilots and two air crewmen killed.

Since September 1969, the company's 30 helicopters — all Iroquois — have suffered a total of 281 "hits" by everything ranging from mortar shrapnel to streams of 50 calibre shells through the plexiglass.

In this period, United States losses in the combined RAN-US team have been six men killed in action and 14 wounded.

Survival is the issue. Helicopter pilots carrying in troops in the Mekong Delta can expect to be fired on at an average of about every second mission.

"The enemy are getting much more accurate in their fire than they used to be", Lieutenant Commander David Farthing, 30, of Nowra, N.S.W., said. He is the commanding officer of the RAN crews and executive officer of the company.

"We used to catch most of the fire in the rear part of the aircraft. Nowdays they have learned to put their fire into the forward sections."

Strangely enough — for Vietnam — there was a brighter note.

"There are signs that we are breaking down the enemy's morale in the Delta," Lieutenant Commander Farthing said.

"Sometimes, now, the enemy are starting to break and run — even from prepared positions," he said

The enemy may be under change. But the men of the 135th can't count on easy rides.

In one engagement on the present tour, a Vietcong 50 calibre gun shot down one of the company's Iroquois, killing its four-man U.S. crew.

The official report stated that "the enemy was so well entrenched that it took 18 hours to secure the still-burning aircraft."

During the engagement, helicopters flown by the dead crew's U.S. and Australian fellow-pilots continuously flew down the 50 calibre gun's fireline.

Sub-lieutenant Roger Cooper, 20, of Waterloo, S.A., earlier had his Iroquois hit by the same gun in the operation

"Sub-lieutenant Cooper's aircraft kept flying but it was so badly damaged in the engagement that it was 'written off'," Lieutenant Commander Farthing said.

Lieutenant Richard Marum, 27, of Pemberton Street, Albury, N.S.W., has been awarded the title of "Magnet" by his crewmates.

He attracts firepower as well as giving it out.

His aircraft has been hit on 11 separate occasions.

They recall the neat bullet hole through his windscreen and the crease still evident in his flying helmet.

He spent a "brief period" in hospital in South Vietnam after being shot in one hand and a leg.

There is never any dullness at Bearcat. There are plenty of war stories with a difference.

One memory that Lieutenant Peter Clark, 23, of Crows Nest, has is the day he was landing troops when the Vietcong began firing from nearby supposed friendly houses.

"Next, they began to mortar us from the treeline," he said. He took off safely.

Gunships were called in and reported they were taking fire from a complete circle around the original pick-up zone, which had previously been considered a quiet "ell-zee", or landing zone.

A naval air mechanic works on the engine of an Iroquois helicopter at Bearcat base.

Peter Clark recalled the day he saw Sub-lieutenant Eric Wile, 24, of Victoria Street, Taree, N.S.W., put his helicopter down in a matchbox sized clearing.

"We watched him wait on the ground for 20 minutes to pick up troops. All the time he was taking fire from the Vietcong while his crew was firing back. We saw one of his crew open up a softdrink while he fired one-handed," he recalled.

Sub-lieutenant Clive Mayo, 21, of Shillington Street, Blackheath, N.S.W., is an expert at having his fuel tank blown by enemy fire. He has had his fuel cell punctured twice.

He was shot in the left hand on one mission. It was the "world's most active bullet," he said.

"It came in through the cargo door, hit the fire extinguisher and shattered, hit a map case in fragments — and bits went into my hand."

He kept flying and they cut the pieces out that night.

Sub-lieutenant Andy Perry, 21, of Kettering, Tasmania, does not long to go on night troop landings. He's tried them before and has firmly decided he prefers day operations.

However, recently, after eight hours day flying he answered a call to assist in a night operation before returning to Bearcat base.

He led a group of nine aircraft to the landing zone and began taking heavy machine gun fire a mile from the landing point.

"Normally you don't get it until you are almost there," he said.

"We took our first hit at about 500 feet. It came in under the seat. Then, just before we hit the ground, a bullet came through the windshield and I felt blood on my face.

"The troops jumped out from my side and they all fell over — dead — from a heavy machine gun.

"A piece of shrapnel came off the pedals and hit me on the foot. By this time I was sure I was in something of a state of disrepair. We took six more hits in the cockpit," he said.

He discovered later that he was suffering only slight cuts from the broken glass and had a bruised foot.

Later that night he took part in three more troop landings.

Roger Cooper of Waterloo was forced down in a night operation by a 50 calibre enemy gun.

He was able to land the aircraft at a fire support base, with his own radio units out of action. He passed a warning about the 50 calibre enemy gun to another gunship.

"The gun shot them down at about the time we finished passing the message," he said.

Lieutenant Commander Farthing has one of the most demanding jobs in the squadron, apart from just being "boss" to his Australian team and looking after their well-being.

His flying task is operating the command and control helicopter during operations.

He directs the operations in terms of gun-ships, troop-carrying "slicks", and whatever else becomes necessary in the exasperatingly complicated ground-air war in the Delta.

The Navy men at Bearcat have exhibited the quality that often comes to the surface in Australian troops overseas — helping to improve local conditions.

Unlike some other areas of Vietnam, Bearcat offers no "local scene" in which to escape for a few hours. Living

Checking helicopter equipment at Bearcat, Vietnam.

at Bearcat means you work, eat, sleep and fly — at Bearcat.

The Australians decided to make life a little less primitive.

They dug in and built flush toilets and workable bathing facilities.

Lieutenant Pat Arthur, 25, of Camberwell Road, Hartwell, and his comrades went to work on their accommodation areas. Paint, carpentry, lamps and even curtains and an airconditioning unit appeared.

"You have to make the best of what you have," Pat Arthur said.

When his tour is up he intends to "head for a Pacific Island and collect sea shells until my next assignment."

Actually, he is not being an escapist. He is regarded as the company's naturalist.

All of the operational pilots with the EMU company have now logged more than 1,000 flying hours in Vietnam.

They fly, on an average between 115 and 120 hours a month. In June they flew 29 days.

Some days are worse than others.

Lieutenant D. B. Gibson, 26, of Albany Highway, Cannington, is now recovering after receiving serious multiple wounds when his Iroquois landed on a 105 MM booby trap mine.

His aircraft was completely destroyed. Two men in it were killed in the blast.

It had been thought to be a safe landing zone.

The Vietcong like putting booby traps on well-used landing zones.

On this occasion, Lieutenant Gibson had been about to put down on one area of the zone but had been guided in to the blast area by a South Vietnamese soldier who mistakenly believed he was helping the helicopter crew.

Lieutenant Robert Giffens, 22, of Thebarton, S.A., is back flying with the company after being shot through both legs.

Giffens was flying a gunship to support a ground battle when his machine became entangled in heavy fire patterns.

The Iroquois was hit on 11 occasions. One bullet entered his left leg, then carried through to his right knee.

As he was flown out he asked that he be treated in Vietnam — Australia was too far away.

Giffens offered to serve as an HQ officer on the ground at Bearcat while he was "learning to use crutches".

The doctors nodded kindly — and he was evacuated to Australia for specialised treatment immediately. It took months to get him "fully mobile".

The 135th adopted an Australian lingoism as its motto: "Get the bloody job done."

They're getting it done. And it is bloody.

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BRITAIN'S NUCLEAR AGE NAVY

Strong arm of Britain's nuclear age navy is undoubtedly its Polaris force. This article surveys the Polaris contribution and the capability of today's Royal Navy — its ships, equipment, missiles and naval aircraft. The importance of Britain's contribution to maritime defence will loom large in the present discussions for a joint five-power Commonwealth naval force in South East Asia after 1971, likely to be commanded by an Australian Admiral.

By COMMANDER N. E. WHITESTONE, R.N.

Britain's Royal Navy has reached a crucial point in its history. For the past four years it has been busy reshaping itself for a future without aircraft carriers in the early 1970s. Now, at the eleventh hour, it seems likely that the aircraft carrier, still the most powerful conventional warship afloat, will be reprieved. But before a final decision is reached, the new Government must study all the implications, and this may take some months.

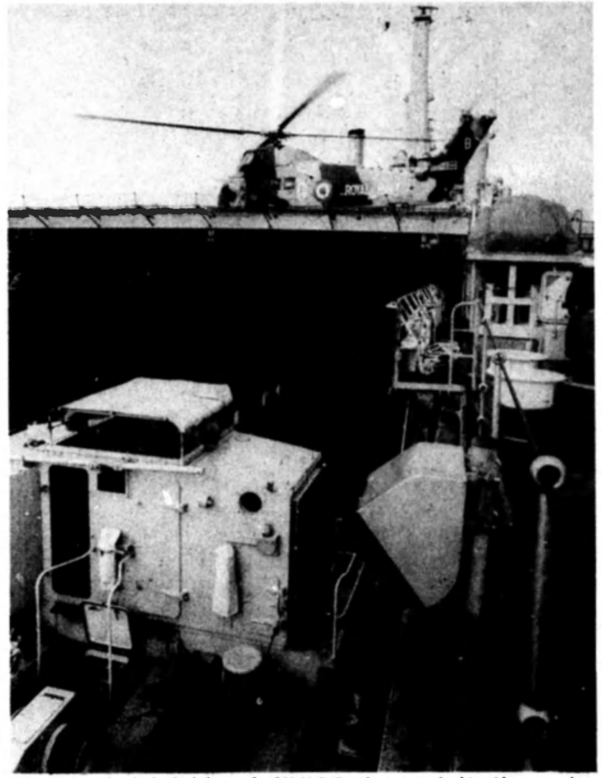
Discussions are in hand concerning a joint five-power Commonwealth force in South-east Asia after 1971, and a carrier would be an important element in its naval task force which, in all probability, will be under the command of an Australian Admiral.

The steering hydroplane console of the nuclear-powered Polaris submarine H.M.S. Renown. She is one of the force of four Polaris submarines, all of which are now in commission.

H.M.S. *Valiant*, one of the British navy's nuclear-powered submarines. With British-designed and built reactor, she successfully completed the 12,000-mile-submerged homeward voyage from Singapore in 28 days.

POLARIS IN COMMISSION

Pride of place in today's nuclear age navy must be given to its Polaris force of four nuclear-powered submarines, all of which are now in commission and contributing to a continuous deterrent patrol. The building of these vessels, on time and within the given budget, has been a monumental task — "the toughest peacetime task in a given time scale which the navy has ever been handed", said Mr Christopher Mayhew, the Navy Minister at the time. All four vessels bear famous big ship names, as befits their size and status — **Resolution**, **Repulse**, **Renown** and **Revenge**. Another question facing the government is whether or not to build a fifth which would ensure that two of these vessels are on patrol at any one time.



The dock and vehicle deck from aft of H.M.S. *Fearless*, assault ship. Above can be seen the flight deck with helicopter.

The navy's nuclear-powered fleet submarines, formerly known as hunter-killers, of which the Dreadnought, built in Britain with an American-designed reactor was the first, will assume increasing importance. Dreadnought was followed by the Valiant, with a British-designed and built reactor, which successfully completed the 12,000-mile-submerged homeward voyage from Singapore in 28 days, and then by the Warspite and Churchill. Other submarines of the came class, Courageous and Conqueror, are now under construction, while three vessels of a new Swiftsure, or improved Valiant class, are on order.

The Oberon class of conventional patrol submarines, generally acclaimed as the finest of its kind in the world, has been built or ordered for Australia, Canada, Brazil and Chile. A new submarine base, built on the Clyde in Scotland includes a Polaris school, to train the navy in this new art of naval warfare.

POWERFUL ADDITION

Two assault ships, Fearless and Intrepid, now form a powerful addition to Britain's amphibious forces. Able to carry and put ashore a battalion of infantry with heavy tanks, these ships can be trimmed down and the dock space flooded, allowing landing craft, each carrying two tanks, to move out through the lower stern.

The commando ship, which has proved its worth so convincingly east of Suez, enables a small but balanced military force to be deployed quickly at trouble spots — or, if required, it can maintain an unobstrusive presence below the horizon ready for an emergency. The former light fleet carriers Bulwark and Albion, converted to this role and equipped with Wessex helicopters, can each make a vertical assault with a force consisting of a Royal Marine Commando, 750 strong, a supporting battery of artillery and light transport. Further supplies can be maintained by airlift.

An interesting new ship, expected to enter service next year, is the Bristol, the sole survivor of a class originally known as Type 82. Slightly larger than the existing County class guided missile destroyers, and driven by combined steam and gas turbines, she might be described as a cruiser escort. The ship has been designed around two new weapons, Seadart and Ikara.

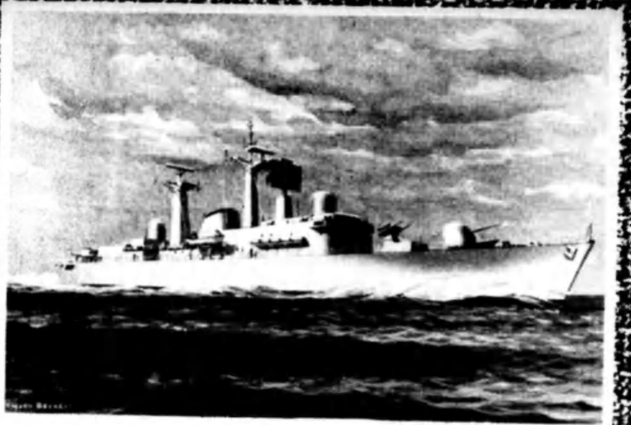
Seadart, a medium-range, supersonic surface-to-air missile, is an improvement on Seaslug, carried in the County class — it can also be used against ships and enemy missiles. Lighter than Seaslug, and taking up less space, it can be fitted in small ships.

IKARA — AUSTRALIAN INVENTION

The new anti-submarine, rocket-propelled weapon Ikara, an Australian invention, sends a homing torpedo to its target partly by air, and finally underwater. With the reputation of being a most accurate weapon, it will greatly enhance the anti-submarine armoury of the British fleet.

A special feature of the Bristol will be the latest Action Data Automation weapon system (ADA), which computes the information from the radar and long range sonar and controls the Seadart and Ikara Weapons. It also feeds information on the battle picture to accompanying ships.

The Royal Navy has pioneered the use of gas turbine machinery in warships and, following extensive trials over the past two years in the frigate Exmouth, it has been decided to equip all future major warships with this form of propulsion (refer article — "The Royal Navy's Trend Setter" — in this issue). The main unit is the Rolls-Royce Olympus, a marine version of the engine chosen for the



The first of the British navy's new class of guided missile destroyers, designated Type 42. The first to enter service is the 3,500 ton *Sheffield* which will join the fleet in January 1973.

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Concorde airliner. The main advantages of this machinery are a significant reduction in space and weight, the possibility of a main engine change in 48 hours, simplicity of installation and saving of up to 25% in valuable technical manpower.

The Sheffield, the first of the navy's new 3,500 ton, all-gas turbine Type 42 destroyers, also designed to carry Seadart, is due to join the fleet in January 1973. Her new single 4.5 inch automatic quick-firing gun can deliver as many rounds a minute as the twin 4.5 inch gun in the Leanders, but with a crew of four, as against 24 in the Leanders. She will carry the new Anglo-French twin-engined helicopter, the WG13. Two of these ships have been ordered by Argentina.

The fast frigate Amazon, originally the Type 21, was designed as a joint venture by Yarrow and Vosper Thornycroft to fill the gap between the present Leander class and its successor, the Type 22. While the Amazon will carry the Seacat close range anti-aircraft weapon, the Type 22 will be armed with Seawolf, with exceptional anti-missile capabilities.

THREE NEW SCIMITARS

The first of three new 100 foot fast training boats, the Scimitar, has just entered service with the Royal Navy. Her two Rolls-Royce gas turbines give a speed of over 40 knots, and with a third engine, for which space has been left, she could achieve a much higher

The long-range strike aircraft Buccaneer seen above H.M.S. *Eagle*.

The new angled flight deck of H.M.S. Ark Royal. She is now equipped with the Phantom fighter, rated the finest carrier-borne aircraft in the world.

speed. Designed to give the fleet practice in countering enemy missile-carrying boats, she can simulate missile or torpedo fire.

The Phantom fighter, the finest carrier-borne aircraft in the world, now in squadron service in the Ark Royal, gives the Royal Navy a priceless asset of instant response that it has never had before, and is the best answer to submarines firing cruise missiles and enemy fast patrol boats. Its performance far exceeds that of the Sea Vixen all weather fighter, also at sea in the carrier. The Buccaneer provides the long range strike and the Gannet the airborne early warning. In the Sea King and Wessex III helicopters, the navy has powerful anti-submarine systems.

But many naval observers hold that the future of naval air support lies with the Harrier jump-jet, which made such a dramatic appearance in last year's Transatlantic Air Race, and which could be carried in the new "through-deck" cruisers — carriers in all but name — after 1976.

The intensive maritime development of this aircraft is vital for the future navies of Britain and her allies, and it is to be hoped that one of the smaller carriers will be entirely devoted to this task.

Naval Cadet Force News

NEW SOUTH WALES

This report is for the period 1 July 1970 to 30 September 1970 and covers weekend training and other activities carried out by the Naval Reserve Cadets in New South Wales

Weekend training postings were to the following H.M.A. ships —

Ships	Dates	Number of Personnel
H.M.A.S. Melbourne	24 July — 26 July	34
H.M.A.S. Supply	24 July — 26 July	18
H.M.A.S. Stalwart	24 July — 26 July	33
H.M.A.S. Stalwart	31 July — 2 August	33
H.M.A.S. Supply	7 August — 9 August	18
H.M.A.S. Stalwart	7 August — 9 August	34
H.M.A.S. Yarra	14 August — 16 August	8
H.M.A.S. Stalwart	21 August — 23 August	34
H.M.A.S. Melbourne	21 August — 23 August	34
H.M.A.S. Perth	28 August — 30 August	20
		266

During the weekend covering Saturday 4 July and Sunday 5 July a seminar was conducted in H.M.A.S. **Watson** for all Commanding Officers and adult personnel responsible for Unit stores. The objective was to explain and discuss the changes in procedure and documentation relating to the issue of stores and other facets outlined in ANO 128/70.

St. Ives High School Naval Reserve Cadet Unit led the Education Week March through the City of Sydney on Tuesday 11 August. Naval, Army and Air Force School Cadet Units participated. The salute was taken at the Town Hall by Rear Admiral G. J. B. Crabb, C.B.E., D.S.C.

On Sunday 30 August the Naval Reserve Cadets provided a Guard of Honour in Garden Island prior to the Annual Legacy Church Service in the Dockyard Chapel.

T.S. Albatross (Wollongong) was declared the "Most Efficient" Unit in New South Wales for 1969/70. T.S. **Condamine** (Manly Unit) received a special mention.

T.S. Hawkesbury (Gosford) provided a Guard of Honour for Opening Day of the Royal Motor Yacht Club at Rose Bay on Saturday 5 September.

T.S. **Sirius** (Arncliffe) provided a Guard of Honour for Opening Day of the Royal Motor Yacht Club at Port Hacking on Saturday 19 September.

The New South Wales Division held their Annual Church Service at the Dockyard Chapel, Garden Island, on Sunday 20 September 1970. Prior to the Church Service, 300 personnel of the Naval Reserve Cadets were on parade and they were inspected by Rear-Admiral G. J. B. Crabb, C.B.E., D.S.C., Flag Officer Commanding East Australia Area. The President of the New South Wales Division of the Navy League, Rear-Admiral H. A. Showers, C.B.E., was present at the Church Service.

The Senior Officer of the Cadet Force has accepted an invitation for a representative of the Naval Reserve Cadets to join the Service Section Advisory Panel for The Duke of Edinburgh's Award in Australia.

(Sgd.) L. MACKAY-CRUISE,
Commander, R.A.N.R.
Senior Officer.

ANNUAL REPORT

To The Navy League of Australia

N.S.W. DIVISION

For the year ended 30 June, 1970

Once again the subject of rationalisation must come to the fore in this report.

That progress has been made is evident from the number of Cadet Memoranda that have been issued detailing changes, amendments and improvements to existing regulations. However, to achieve a worthwhile degree of greater efficiency and effectiveness throughout the Cadet Force there is the need for complete rationalisation to become a reality. Without it there must continue to remain the element of uncertainty which is detrimental to that vital ingredient for any youth organisation — esprit de corps.

The strength of the Cadet Force in this Division remains steady at a figure of 600 including Officers, Instructors and Cadets. There are 12 Units comprising 9 'Open' Units (6 in the Metropolitan area and 3 in the country) and 3 'Closed' School Units. The latter are located in The Scots College, Sydney Grammar School, and St. Ives High School.

The Navy League of Australia has advanced considerable sums of money to T.S. Condamine (Manly Unit) and T.S. Hawkesbury (Gosford Unit) for their building projects.

Manly Unit have themselves raised a substantial amount and hope to commission their new headquarters by the end of 1970. The Commanding Officer, Officers, Instructors and Cadets of this Unit are to be congratulated for their continued perseverance and untiring efforts to erect a building of which they will be justly proud.

Gosford Unit has made good progress since my last report and have completed the reclamation and filling of land as a foundation for their building. The assistance given in many different ways to the Unit by the local community of Gosford and surrounding districts has been quite beyond expectations.

Opportunities for continuous training periods of at least 7 days duration, and periods of weekend training are becoming less frequent each year. I must again stress the necessity for the Authorities to realise this is a growing problem and that planning should commence now to consider how this shortage of billets can be overcome. A solution would be to have the one location with all facilities readily available at all times to receive Cadets for training. We have an obligation to provide such an amenity for our Cadets as do already the other Services.

T.S. Albatross has been declared the "Most Efficient" Unit for 1969/70 and this Unit located at Wollongong is to be congratulated. Once again T.S. Condamine (Manly) received a special mention.

The Cadet Force wishes to thank Admiral Showers and his Executive for their continued support and to express appreciation to the Secretary, Lieutenant Commander Andrews, for his invaluable liaison and co-operation. Lieutenant McPherson, Cadet Liaison Officer, H.M.A.S. Watson, has continued to be a tower of strength.

To the Officers, Instructors and Cadets of all Units I say thank you for a job well done and ask you to accept my gratitude for the devotion you have shown.

L. MACKAY-CRUISE,
Commander R.A.N.R.,
Senior Officer.

31 August, 1970.


JEST CHIPPY?
or ALL SQUARE and ABOVE ...-
BORED by VIC
"AWRIGHT, NOW, WOT BIRD ...- HIGH JACKED MY PLANE!"
MT

THREE OF A KIND

By W. G. T. SAMPSON, who served in the Royal Australian Navy, 1928-1946.

"A people without history is like a man without memory; it needs the facts of life of the past as a tree needs roots in order to live a free life!" — C. E. Fox

A tall glossy hat suddenly went flying (in mid-air) from the head of a legal person as he walked down one of Sydney's unpaved and dirty streets. The angry man spun round to see who caused the grave insult to his person.

A boy of twelve years had recovered a rotting apple from the gutter and with sheer glee and deadly accuracy let fly with the piece of fruit at the judge. The dreadful brat was drafted aboard the Nautical School Training/Prision Ship, Vernon for behaviour correction.

Very early in the Nineteenth century, child abandonment and parental hawking of their offspring for money, was a vicious and tragic problem.

Magistrates, in cirect confrontation with children committing crimes, particularly with infants as young as eight years of age had but one recourse — gaol.

Public anger probably prodded at least two Colonies, New South Wales and Victoria, to attempt some form of humane approach to remove children off the streets and away from ghoulish adult behaviour.

New South Wales in 1866 acquired a vessel, Vernon, formerly a paddle steamer built in 1839, which had been converted to sail when her engines proved uneconomical to run. It was to be a Nautical School Training Ship for boys.

Judges in this era saw fit when in conflict with child offenders, to order them aboard the ship. The legal authoritarians were not concerned with creating a dual role for the ship but to get the deserted little animals off the streets.

It was a severe life on the Vernon — caning on the buttocks, unsparing. For more serious offences, solitary confinement on bread and water on the Orlop Deck or placed alone in dark, rat-infested holds.

Almost five hundred boys under eighteen years were usually housed on the ship and their only visits to land from the school/prison were to the sports ground on Cockatoo Island. Their parents could visit them twice a year.

Up to the year 1890 some 2,367 boys had been admitted on board and 2,134 left. Many boys were rescued from unhappy surroundings and reasonably or completely turned out from the school with many becoming useful and very successful members of society.

In 1891, New South Wales negotiated the purchase of another vessel to replace the Vernon.

In 1866, Clipper Ship owners, Messrs Devitt and Moore of Aberdeen, Scotland, purchased on the slipway an incomplete vessel being built as a steamer (2,131 tons).

Around this era of time, American — Boston/Baltimore built Clipper Ships were clobbering Britain's sailing trade. The dour Aberdeen Ship Builders said: "Aye! We'el noo tek it!"

One Clipper, the Thermopylae sailing under the White Star Flag of George Thompson, smartly lowered the sailing records from London to Melbourne, 60 days, and won the honour of displaying on her masthead, The Golden Cock!

History refers to many Old Salts who spat over the side and said: "The Sobraon, built to be a r-o-o-d-y steamer, launched as a composite sailing vessel, 'er propellor shaft 'ole bunged 'orf and all, would 'ave, h'if given the chance, w-h-u-p-p-e-d the 'Bird' orf any mast 'ead. Aye! — Noo, e'en the Thermopylae."

The Sobraon cost the New South Wales Government, 11,706 Pounds to buy and 18,551 Pounds to refit her to become the new Nautical School Training Ship.

More than 4,000 boys served in the Sobraon.

On 12 December, 1912, Sobraon was towed to Mort's Dock to be converted for purely Naval Training purposes and to cost 10,000 Pounds

The young apprenticed boys off the Nautical School Training Ship were transferred to the Farm Home at Gosford, New South Wales.

There is a round brick memorial erected on a small hill at Port Chalmers in New Zealand. It was placed there by the local citizens to record the position where the wife of Captain Robert Falcon Scott, C.V.O., R.N., waved farewell to her famous Antarctic husband as his ship, Terra-Nova sailed by. Somehow or at sometime this man had recommended to the Commonwealth Government that he thought the Sobraon would make a fine Naval Training Ship.

How strange that this vessel should have been commissioned, H.M.A.S. Tingira on 25 April, 1912

Mortimer Froude, born 7 July, 1897, a rivet boy from Mort's Dock during the reconstruction of Sobraon earned the distinction of being the first Naval rating to join H.M.A.S. Tingira.. The boy died on H.M.S. Defeace, Flagship of the Royal Navy's First Cruiser Squadron when the vessel was sunk during the Jutland Battle, 1916.

The Tingira de-commissioned on 30 June, 1927

A Major S. Friere bought the Naval Training ship in 1935 for 2,600 Pounds and spent 4,000 Pounds in converting the vessel into a museum or at least to have the ship preserved as a National Relic The project failed for lack of public interest.

In a sense somewhere the Sobraon lives on. A deep water yachtsman bought teak from the Tingira and used most of the timber as a trim for his new ocean racing yacht which he named, Sobraon.

The Tingira, the vessel, died in 1940/41 in Berry's Bay, New South Wales.

Seven years before the Battle of Trafalgar (1805), England laid down at Woolwich a huge 2,730 ton, three decker, WOODEN LINE OF BATTLESHIP: His Majesty's (George III) Ship, NELSON.

The hull of this fine example of Naval craftmanship being of course, stout English Oak. Below the water line externally she was copper sheathed. Her decks: Oregon — African Oak — Pitch Pine — Kauri. A mighty Colonial Empire mixture.

Strangely, the Nelson never commissioned into the Royal Navy.

Almost seventy years after the vessel was laid down, her three decks were decreased to two, a steam engine of 500 nominal horsepower (2012 I-H.P.) installed, between decks the living quarters were drastically altered and this gift to the Victorian Colony cost the State, 42,000 Pounds sterling.

The Victorian Navy assumed control of England's presentation in 1866 and steamed/sailed Her Majesty's (Queen Victoria) Victorian Ship, Nelson from Portsmouth on 20 October, 1867.

Upon arrival in Port Phillip Bay on 4 December, 1868, the vessel was immediately taken over by Victoria's Industrial Department to be used as reformatory for boys who possessed certain aggressive characteristics of exhuberance.

In England's Naval and Military Gazette (30 April, 1870), reference is made to the use of the Southern Cross on an Australian Flag. "The new Victoria flag has been adopted and the Colony now possesses its own National Ensign. The inauguration ceremony took place on board H.M.V.S. Nelson on 9 February.

One hundred years after being laid down, this mighty tough Old Bird had given of herself: "Rough, but at least refuge for deserted children — suffered the indignity of being deprived of another deck (1878) — regained her warship status when the Victorian Naval Brigade slung their hammocks aboard — housed officers and men of the Victorian Navy prior to being sold at public auction (24.4.1898) for 24,000 Pounds and when owned by the Union Steam Ship Company of New Zealand Limited, Nelson as a hulk, was in Sydney, Launceston, then Hobart before being sold to be broken up in Shag Bay on the eastern shore of the River Derwent, Tasmania.

When the life of this ship came to an end, many historic statistics were made known.

Laid down: 1798 — Woolwich, England.

Launched: 20.6.1814 — To be, "The Largest Ship in England" and far excelled the Queen Charlotte which was reported to be the finest ever built on the River Thames. The Prince Regent, Emperor Alexander, Field Marshall Blucher (of Waterloo fame), General Count Platoff, King of Prussia and most of England's nobility and gentry witnessed the launching.

Demolished: 18.8.1920 — Perhaps there were quite a number of (purchasing) persons well aware that the aged warrior still had many three feet long and two inches in diameter copper bolts bracing her stout frame.

A new look at the Canadian Armed Forces

by

R. Barry Tackaberry

AFTER five years the Canadian Armed Forces are a very long way from being anything like a Single Service. However, it has to be admitted that the Integration/Unification experiment has eliminated a great deal of the duplication that existed under the Tri-Service organization.

Unfortunately the apparently uncoordinated approach of the Canadian Government to such a vast reorganization has come close to destroying the operational efficiency of the Canadian military machine. Having proceeded with the Unification of the Canadian Armed Forces almost to the point of no return, it is hard to believe that only now is the Canadian Government taking the firm decisions concerning military commitments that they are prepared to honour.

Such absence of clarity of foreign and defence policy prompted some early critics to object to the hasty reorganization of the military component of the National Defence Headquarters as the first phase in the Integration/Unification process. Four years ago these critics suggested that Unification should be based on the following orderly decision-making sequence:

(*a*) Production of Cabinet-approved paper clearly outlining the commitments the Government was prepared to honour.

(*b*) Preparation of a force-study detailing the forces required to meet the approved commitments and again benefiting from Cabinet approval.

(*c*) Drafting of a Command Structure for the Canadian Armed Forces which would provide the Commands and formations required to exercise operational control of all approved forces as per (*b*) above.

(*d*) Drawing up of the organization required for National Defence Headquarters to enable the Chief of Defence Staff to command and control the Canadian Armed Forces.

Instead of this orderly sequence, the first step towards Unification was the approval by the Canadian Government of a Bill in July 1964 appointing a Chief of the Defence Staff and doing away with the offices of the Chief of Naval Staff, Chief of the General Staff and Chief of the Air Staff. The elimination of the three Chiefs of Staff and the appointment of a single Chief of the Defence Staff brought all the problems inherent in any hasty centralization of power.

After two years—and five

For at least the first two years of the Integration/Unification experiment, the critics were justified in saying that the reorganization had resulted in a great loss of individual responsibility, slowness in the decision-making process and overwork at the top. The frequency with which major organizational changes were required at Canadian Forces Headquarters indicated the real failure on the part of the Canadian authorities to appreciate that as a minimum the Headquarters must provide simplicity of operation, clear-cut responsibilities, proper delegation of authority, and an effective system for co-ordination.

After five years the military component of the Department of National Defence in Ottawa, or Canadian Armed Forces Headquarters, is now organized along lines that appear to provide some semblance of order. With the elimination of much of the duplication of effort, it is hoped that there will be an early reduction in the size of the staffs required by this Headquarters.

Referring to the accompanying chart, it will be noted that Canadian Armed Forces Headquarters has completely absorbed the former Navy Headquarters, Army Headquarters and the Air Force Headquarters. All responsibilities have been assigned to four functional Branches, each headed up by a Lieutenant-General or officer of equivalent rank. These Branches have the following broad responsibilities:

(a) *Branch of the Vice-Chief of the Defence Staff*—military operations, plans and operational readiness and, in conjunction with the Deputy Minister of National Defence, the development of an Integrated Defence Program.

(b) *Branch of the Chief of Personnel*—formulation of the personnel policy including medical, dental and chaplain services.

(c) *Branch of the Controller-General Administration*—financial and manpower control and management.

(d) *Branch of the Chief of Technical Services*—engineering and development programmes and plans and policies for the procurement of material and maintenance.

The Department of National Defence in Ottawa is organized into the customary three major components of civil, military and research. Having elected after World War II to operate the traditional three Services, under a single Defence Department, Unification of the Canadian Armed Forces has not required any really major adjustments as far as the civilian and research components were concerned.

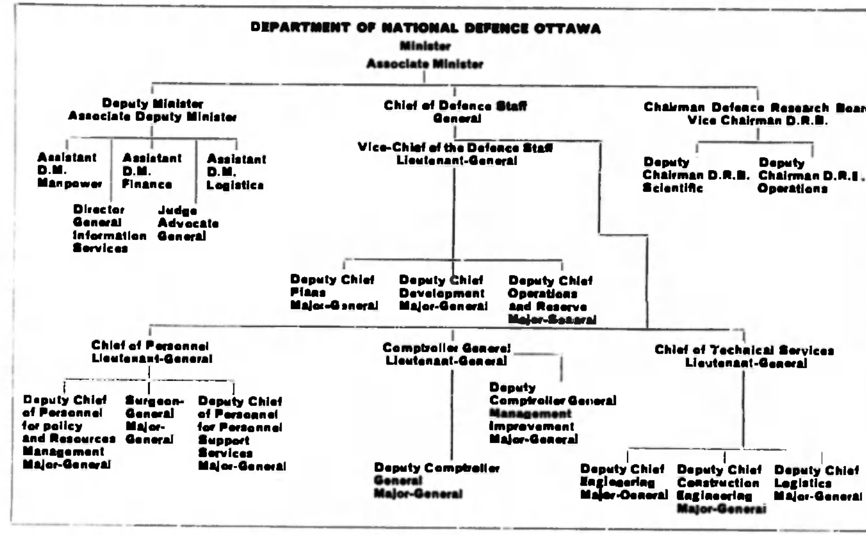
A certain amount of controversy has arisen in connexion with the requirement for the military to have a Comptroller-General Branch. Critics have challenged the need for a separate Branch headed up by a Lieutenant-General duplicating as it does many of the duties and responsibilities of the Deputy Minister and his civil component within the Defence Department.

Credence is given to this observation by the major changes that have taken place within Canadian Armed Forces Headquarters over the past two years, resulting in an appreciable reduction in the size of the Branch of the Comptroller-General. A number of authorities consider that the appointment of another Deputy Chief, within the Branch of the Vice-Chief of the Defence Staff, responsible for cost effectiveness studies, manpower and establishment control, etc., would obviate the need for this Branch.

Integrated Command Structure

The next phase in the Canadian Unification process was the development of an Integrated Command Structure for all operational forces. Again it should be noted that the various unified Command Headquarters were organized without any real confirmation concerning either the continuing commitments of the Canadian Armed Forces or the size of the forces to be authorized by the Government. In fact, the activation of these Commands was initiated prior to the completion of the Integration of Canadian Forces Headquarters in Ottawa.

The advocates of Unification contend that the Command Structure is functional and completely streamlined to reduce over-



head. Commands are described as being "mission oriented" to fulfill the roles in support of all the commitments and providing maximum effect within the resources available. It is implied that these new Commands are capable of responding as fully integrated and highly mobile formations in a way that is a very real improvement over the traditional operations of sea, land and air forces.

Initially it was envisaged that the Command Structure would replace eleven separate Service Commands with six integrated functional Commands. Three of these Commands were to be operational—Mobile, Maritime and Air Defence—and three to be support—Materiel, Training and Air Transport. Because of the haste in proceeding with the Integration/Unification process, it is perfectly obvious that a proliferation of headquarters resulted. Already steps have been taken to disband Materiel Command.

The authorities have suggested that while Materiel Command was established to provide the necessary supply and maintenance support to the other functional Commands, the responsibility for managing both the development programme and the procurement of new equipment was vested in the Technical Services Branch of Canadian Forces Headquarters. Apparently a careful and detailed study has now confirmed that Materiel Command should be amalgamated with the Technical Services Branch and that its functions should be administered by a Deputy Chief of Technical Services. It is predicted that other changes in the Command Structure will follow each successive reduction in the Canadian Defence Budget.

The actual Commands

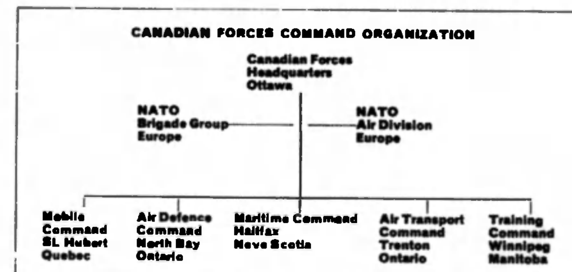
The accompanying chart provides a diagrammatic outline of the Command Structure as it exists at this time of writing.

With Headquarters in St. Hubert, near Montreal, Mobile Command is the largest Command in the Canadian Armed Forces. Until recently the land forces, constituting the bulk of personnel in this Command, were organized into four army brigade groups, three of which were in Canada with the fourth being the Canadian Mechanized Brigade Group in Germany as a part of the Canadian contribution to NATO.

The three Army Brigade Groups in Canada are now being reorganized into four combat groups, each of which consists of two infantry battalions, a regiment of armour and one of artillery and other supporting arms. The infantry battalions will have three, instead of four, rifle companies and the armoured and artillery regiments will have two, instead of three, squadrons or batteries. These four combat groups will be based at Gagetown in New Brunswick, Val Cartier in Quebec, Petawawa in Ontario and Calgary in Alberta.

In addition, a Canadian airborne regiment is currently being formed in Edmonton. This regiment will be a light, highly trained unit, which is intended to provide the parachute element for our contribution to the defence of North America.

The tactical air-arm of Mobile Command



consists of squadrons of CF-5 tactical aircraft helicopter support aircraft and Buffalo tactical transport aircraft. These squadrons will provide the integral air support required by the land forces of the Command. Canadian Defence authorities are careful to stipulate that the forces of Mobile Command are highly mobile and flexible, designed to satisfy the requirements of conventional warfare.

The new unified Maritime Command was formed in January, 1966, with Headquarters at Halifax, Nova Scotia. To facilitate local direction and control of ships on the Canadian West Coast, a Deputy Commander for Maritime Command, with a small staff, has been established in Esquimault, British Columbia.

The role of Maritime Command is to provide the combat-ready sea and maritime air forces required to meet Canada's defence commitments. Canada's Maritime Forces are described as being multi-purpose in character with functions not lending themselves to a distinction between those which are directly related to the defence of Canada and those which serve broader requirements. Generally speaking, the functions of the Canadian Maritime Forces provide an ASW fleet for defence against missile-firing submarines, the transport of land and air elements of the Canadian Armed Forces overseas and the maintenance of national sovereignty.

The task of Maritime Command

To carry out the various tasks required by its role, Maritime Command has available the following forces:

(a) *Atlantic*: 1 aircraft carrier, 9 helicopter destroyers, 4 destroyer escorts, 2 operational support ships, 3 submarines, 1 tracker aircraft squadron, 4 Argus squadrons, 1 Sea King helicopter squadron.

(b) *Pacific*: 9 destroyers, 1 operational support ship, 1 submarine, 1 Argus aircraft squadron.

Even the defence authorities in Ottawa have to admit that the Integration/Unification experiment has had little impact on Air Transport Command, which continues to be responsible for maintaining an operational effective air transport force to serve all elements of the Canadian Armed Forces. The Command Headquarters is located at Trenton, Ottawa, and air-lift resources are divided in the following categories:

(a) Heavy Transport—12 Yukon and 23 Hercules aircraft.

(b) Medium and Light Transport—7 Cosmopolitans, 7 Falcons, 17 Dakotas and 8 Caribou aircraft.

In addition to the air-transport role, Air Transport Command has the important responsibility for all search and rescue operations in Canada. For a country like Canada this commitment is a sizeable one. First, there is the need to have the military organization with the capability to locate and rescue downed aircrew during times of hostility. Second, there is the responsibility assigned to the Forces by the Canadian Government whereby they are charged with responsibility for providing search and rescue services on behalf of the Government under the terms of the International Aviation Agreements and for the co-ordination of all Maritime Search and Rescue work. To undertake these responsibilities, Air Transport Command has available 9 Albatross aircraft, 6 Labrador helicopters, 4 H-21 helicopters and 4 parachute-and-rescue teams.

A very large part of the Canadian Defence Budget goes to the maintenance of the operational efficiency of the Canadian Air Defence Command. As the critics of Unification predicted, the operations of this Command, with Headquarters in North Bay, were not significantly changed by the Integration of the Canadian Armed Forces.

This Command continues to contribute to the bomber-defence of the North American continent in partnership with the forces of the United States. It will be recalled that the United States and Canada established interdependent systems which constitute the essential elements of the North American Air Defence (NORAD) Command. The primary contribution of the Air Defence Command at the present time is to the heavy bomber defence forces equipped with CF-101 Voodoo interceptors and Bomarc B surface-to-air missiles. In addition, this Command operates a number of radars in support of its role.

Based on the former RCAF Training Command Headquarters in Winnipeg, Manitoba, the new integrated Training Command became effective in January, 1966. This Command has absorbed all the training establishments that existed under the Tri-Service organization. The Command is responsible for individual training for navy, army and air force components. The product being turned out by this Command has been the subject of very strong criticism by unit commanders serving with all the operational Commands.

Europe

Referring again to the chart, it will be noted that in addition to 4th Canadian Mechanized Brigade Group assigned to NATO and stationed in Europe, Canada has an Air Division in Europe equipped with CF-104 Starfighters. Because of the nature and role of the Air Division in NATO's 5th Allied Tactical Air Force, the Integration/Unification experiment has had little effect on this formation and the same applies in the case of the Army Brigade.

Experience over the past five years has certainly confirmed that a functional organization will not completely satisfy the requirements of the Canadian Armed Forces. Already the Canadian Defence Department has had to accept the need for 5 regional and 7 district headquarters across the country. These headquarters are responsible for a multiplicity of tasks including Canadian reserve and cadet organizations. To these headquarters is delegated the most important responsibility of maintaining close liaison with Provincial and Municipal authorities in connexion with the responsibilities of the Armed Forces for aiding the civil power and providing assistance to civil authorities.

At the time of the famous Unification Debate in Canada, two years ago, much was made of the need for the Canadian Armed Forces to develop the flexible and mobile units required to fulfill the envisable responsibilities of Canada as the global peacekeepers of the 1970s. The then Minister of Defence, Paul Hellyer, was optimistically predicting that 'the peace-keeping responsibilities devolving upon the United Nations can be expected to grow', to quote the Canadian White Paper on Defence of 1964.

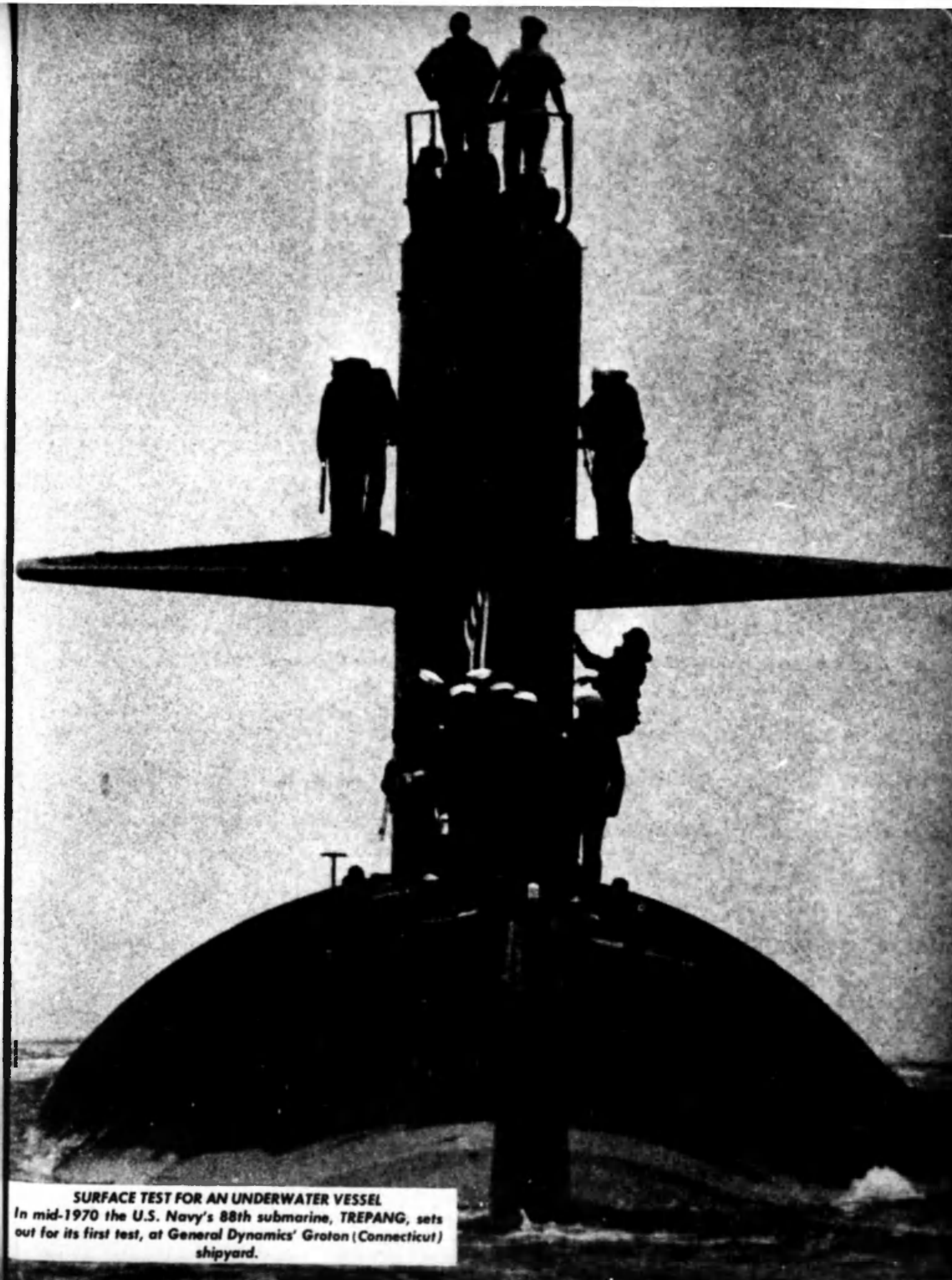
It is all too obvious that Unification was designed to provide the forces required to satisfy the desired participation of Canada in U.N. operations. With an Armed Forces now totalling approximately 100,000, only some 1,000 all ranks are currently deployed on peace-keeping and truce supervisory operations. The current major commitment is Cyprus where a reduced battalion, together with headquarters and support elements for a total of 51 officers and 528 men, is deployed under U.N. Command. Involvement of members of the Canadian Armed Forces in a multiplicity of other U.N. and Advisory Commissions operations brings the total up to the 1,000 mark.

The future

For the foreseeable future, the Canadian collective defence arrangements will require the Canadian Armed Forces to work closely with Navy, Army and Air Force formations of the United States and the United Kingdom. While commending integration, the critics contend that Unification will contribute nothing to the capability of the Canadian Armed Forces to operate with such formations. The minimal changes made in Air Defence Command, the Army Mechanized Brigade Group and Air Division certainly lend credence to this contention.

Although Integration/Unification has resulted in the elimination of a great deal of duplication of staffs, the Canadian Armed Forces is not a Single Service. To give some semblance of Unification the decision has been taken recently to outfit all personnel in the 'new look' all-green uniform by 1971.

It is increasingly obvious that any true Unification of the Canadian Armed Forces will require the Canadian Government to renegotiate their present military commitments. In view of recent announcements concerning Canadian Foreign and Defence Policy, it may very well be intended that the Canadian Armed Forces should be reduced to the status of 'peacekeepers' by the '70s.



SURFACE TEST FOR AN UNDERWATER VESSEL
In mid-1970 the U.S. Navy's 88th submarine, TREPANG, sets out for its first test, at General Dynamics' Groton (Connecticut) shipyard.

The 'Liberties' that are being replaced

by C. Hope Johnston, correspondent to "Navy".

NOW THAT THE WORLD's tramp-ship owners have got the message that the Liberty and other war-built cargo ships have to be replaced (for insurance and other reasons), there is an increasing tendency to drop the misnomer 'Liberty replacements' to describe the modern, economic ships being built in more than a score of different shipyards. The new ships are faster with speeds of 14-15 knots against 10-11 and larger 14/15,000 tons d.w. against 10,000 tons and have other advantages.

At present this category of ships, with variations, is being built in the U.K., Japan, West Germany, Spain, Belgium, Greece and Yugoslavia. Since May, 1966 well over 250 of these ships have been built or are on order, with two types accounting for half the market. First in the field by a slight margin was the 'Freedom' ship designed by G. T. R. Campbell, the Canadian naval architect, and built by Ishikawajima-Harima Heavy Industries (IHI), Tokyo and this has an improved version named the 'Fortune'. The second in order of time is the SD14 (originally to be a 14,000-tonner) designed by Austin & Pickersgill, of Sunderland.

For most people today the Liberty ship has an American connotation. It is time to put the record straight and show that it was a purely British conception and design, and that the blue-prints, specifications and other data were passed to the United States and Canada during the war. This was all done at government level.

In September 1940, two Sunderland friends, R. Cyril Thompson, M.A. and Harry Hunter, B.Sc. received telephone calls from the Admiralty urging them to go to the U.S.A. on an urgent mission. Thompson was managing director of the family shipbuilding firm of Joseph L. Thompson & Sons, and Hunter was a director of the North Eastern Marine Engineering Company. The object of the U.S. trip was to obtain new cargo tonnage as quickly as possible to offset war losses. The ships, numbering 60, were to be of 10,000 tons deadweight. At that time America had not come into the war and there was as yet no Lend-Lease so they had to be paid for.

The 'Francis Drake' in a North African port in World War II

On 21st September they sailed from Liverpool in the Cunard liner *Scythia*—during an air raid. They reached New York on 3rd October and were joined by three other members of the mission already there. They were William Bennett, Lloyd's Register of Shipping Surveyor for Canada and the U.S.A.; J. S. Heck, Lloyd's Register engineer surveyor for New York; and Richard R. Powell, 35-year-old Assistant Secretary of the Admiralty.

At Washington they had a conference with Rear Admiral Emory S. Land (chairman) and Commander (later Rear Admiral) Howard L. Vickery (deputy chairman) of the U.S. Maritime Commission. In October the British party started a tour of shipyards and potential building sites in the U.S.A. and Canada, covering 12,000 miles in two weeks and visiting Mobile, Pascagoula, Los Angeles, San Francisco, Portland (Oregon), Seattle and Tacoma as well as Vancouver and Victoria, B.C.

Most of the Americans they met were not too optimistic that Britain, then fighting alone against Germany and Italy, would survive the war. Then they were introduced to Henry J. Kaiser, head of the gigantic civil engineering group which had recently completed the Grand Coulee Dam, largest structure of its kind in the world. His group had an interest in Todd Shipyards Inc. and in a two-berth shipyard at Tacoma. Kaiser was willing to mass-produce the ships even if he had not at that time the slipways necessary. He signed the contract on 20th December, only 77 days after the British mission landed.

Leaving Harry Hunter to plan the programme in the United States, Cyril Thompson sailed for Britain in the *Western Prince* with the contract and other documents. The ship was torpedoed and sunk off Iceland on 14th December. Collecting some clothes and grasping his briefcase Thompson got into a lifeboat. Physically a large man he did a long spell of rowing during his nine hours in the boat and helped to keep up the spirits of the other survivors. They were picked up by a Scottish tramp ship and landed at Glasgow. His papers had been damaged by sea water and he had them copied before reporting to the Admiralty.

On his next journey to the States Thompson went by K.L.M. plane via Lisbon, Portuguese West Africa, Brazil and Trinidad.

The mission then began a search for sites for new yards. One chosen was at Richmond, California and the other at Portland, Maine. Each was given an order for 30 ships. Existing Canadian yards were asked to build 26 ships. Henry Kaiser engaged thousands of workers mostly without shipyard experience: there were 12 million unemployed in the country at that time. By mid-1943 Kaiser's two yards employed more people than the whole of the British yards. Because there was a good deal of experience in welding techniques available it was agreed that the U.S. Liberty ship programme should use this while the Canadian yards, like the British shipbuilders up to then, stuck to riveting.

All the plans for the ships and engines were prepared in Sunderland but the drawings had to be expanded to suit a different type of as-yet inexperienced labour. Gibbs & Company, New York naval architects did the special drawings for the hulls.

There was a race between the U.S.A. and Canada to complete the first of the ships. The *Ocean Vanguard*, from Richmond, was completed a few weeks earlier than the *Fort St. George*. But both took their place in their same first convoy. The *Ocean Vanguard* had to be brought through the Panama Canal to Halifax and the Canadian ship sailed down the St. Lawrence. On passage, the U.S. ship was involved in a collision but made port safely. This satisfied the doubters that welding was safe for ships.

By July 1962, just 19 months after the contract was signed, the Richmond yards had completed their 30 ships and the Portland yard reached its quota four months later.

In the September 1944 issue of *Shipyard Spotlight*, the Admiralty's news magazine, the editor (the writer of this article) told the story in a feature headed, 'We gave these designs to the U.S.A.'. This covered a wide field of war-building and included the comment: 'Even the now-famous Liberty ships built by Henry Kaiser had their origin in Britain . . .'.

The *Daily Mirror* of 12th October quoted the article giving it the banner heading, 'Britons invented the Liberty ship'. On the following day, the *Chicago Tribune*, owned by the anglophobe Colonel R. R. McCormick, under the heading 'Britons claim credit for Liberty ships and landing craft' began: 'London, Oct. 12. The *Shipyard Spotlight*, a monthly magazine issued by the Admiralty, claims British designers invented the Liberty ship and turned over the plans to Henry Kaiser . . .'.

How did the ship type get its name? At the end of 1941 it was disclosed that Joseph L. Thompson & Sons, Sunderland, had completed a new standard cargo ship with a deadweight capacity of 10,150 tons. Named the *Empire Liberty*, she was the first of a series being built for Government and private account. The builders had evolved the hull form and design, it was stated, and the plans had been passed to the U.S.A. and Canada. There, certain modifications were made, notably relating to welding to suit the labour skills there.

As far as the hull was concerned the *Empire Liberty* was a sister to the *Ocean Vanguard*, the first of 30 ships built by the Todd-California Shipbuilding Corporation at Richmond. The *Empire Liberty*, renamed *Mentor*, survived into the 1960s when she was owned by J. C. Dracoulis, of Ithica, Greece. The *Ocean Vanguard* was the victim of a U-boat on 13th September, 1942.

Due to the exigencies of newspaper space little appeared in British newspapers about the *Ocean Vanguard* and her sisters. Contemporary accounts from California are worth quoting now.

The work of reclaiming the ground and laying-out of the shipyards at Richmond started on 20th January, 1941. The first keel plates of the *Ocean Vanguard* were laid on 14th April. The ship was launched on 16th August.

It was at 5.38 p.m. on Saturday, 16th August that the *Ocean Vanguard*, known as Keel No. 1, was launched from No. 3 slipway, to be replaced by the first plates of Keel No. 8. Normal work stopped in the yard from noon until 8 p.m. when the 'swing shift' went on duty.

Among those on the launching platform were Rear-Admiral Emory S. Land; Mrs. Land, who named the ship; Sir Arthur Salter, of the British Merchant Shipping Commission representing the British Government, and Lady Salter; William Bennett, Harry Hunter and Richard Powell, members of the British Purchasing Commission; and Henry J. Kaiser, president of the Todd-California Shipbuilding Corporation.

In the course of his speech Rear-Admiral Land said: 'Ships have won every great international war. This ship and hundreds of her sisters which will be produced in the shipyards of America and Great Britain will win this war. Of that I have not the slightest doubt . . . . Our immediate need in the American supreme shipbuilding programme of all time is to produce more than 1,200 merchant vessels by the end of 1943 and that means two ships every day for the next two years.'

Telegrams of congratulation were received from Lord Halifax, British Ambassador in Washington; Mr. A. V Alexander, First Lord of the Admiralty; and Mr. F. J. Leathers, Minister of War Transport.

Second ship of the series, the *Ocean Vigil*, went down the ways at Richmond on 31st August. She was named by Mrs. Kaiser whose matron of honour was Mrs. F. C. Cocks, wife of the Todd-California resident Lloyd's Register surveyor. The superintendent shipwright responsible for the launch was Mr. Ken Cameron, Ross-shire-born Clyde-trained craftsman; it was his 101st launch.

On 17th September, designated 'Liberty Fleet Day' by the President, 14 ships were launched in American shipyards. Two of these were from Richmond. Mrs. Cocks launched the *Ocean Voice* at 3 p.m. and Mrs. Clay P. Bedford, wife of the general superintendent of the Richmond yards, the *Ocean Venture* at 5 p.m. On that day the *Ocean Vanguard* had steam up for the first time and sounded a salute on her whistle.

From then onwards there was a positive procession of launches from the yards that had been created at Richmond that year. The next in order were the *Ocean Viking*, *Ocean Vestal* and *Ocean Vesper*, launched on 30th November. In 1942, in addition to the 'Oceans', new ships were rolling out for the Maritime Commission for America had come into the war.

The productivity of the American yards was phenomenal. The majority of the workers had come from other industries including automobile manufacturing. By prefabrication and the use of welding which could be learned in a few weeks they knocked up sections weighing as much as 80 tons which were moved to the slipways for assembly. This was the secret of fast shipbuilding. Record after record was broken.

Here are the facts about one 1942 record relating to the *Joseph N. Teal*, from an Oregon shipyard: keel laid 13th September, launching 23rd September with the ship 87 per cent complete. The hull was 100 per cent complete, welding 100 per cent, riveting 100 per cent, pipe installation 95 per cent, boilers installed and steam up. Outfitting took only four days and the ship was delivered 27th September. The total manhours on the job was 375,000 compared with 900,000 first required per ship.

The *International Maritime Dictionary* by Rene de Kerchove, published by D. van Norstrand Co. Inc., New York, in 1948, has this entry: 'Liberty ship. Emergency-built single-screw cargo steamer designed by U.S. Maritime Commission to compensate for the loss of merchant ship tonnage from submarine warfare. The first keel was laid in April 1941. More than 2,300 vessels of this type were built in the U.S.'

It is indeed time to get the historical record straight!

HOW TO LIVE WITH POLLUTION

by Dr David T. Bellamy, Mr Alan Whitick, and Mr D. J. Jones.

Undoubtedly the easiest way for a maritime community to get rid of anything is to throw it into the sea. Until recently, therefore, Britain's inland waterways were regarded and used as trunk sewers. Recognition of the problem of freshwater pollution only came when lakes and rivers became too objectionable to "live" with. Legislation to alleviate this problem followed only after it had been proved to be both a danger to health and economically bad in terms of loss of amenity and fish production.

Pollution of the sea, as such, has always seemed much more of a remote possibility; the 330 million cubic miles of salt water appear to be the solution to the problem of pollution, not part of it. This is no longer true. Today it is impossible to overlook marine pollution; in fact in some places it is already revolting to have to overlook it.

If by pollution we mean upsetting the balance of natural living systems, then man must pollute the sea. The complex of marine life is a huge living system. The plants both floating and attached, macro- and microscopic, trap and fix light energy. Part of their standing crop feeds the host of herbivorous animals, whose numbers are kept in check either by lack of food or by the carnivorous animals which feed on them. Thus there exists in the sea an infinitely complex but perfectly balanced web of life, an ecosystem. The point of the balance is the complexity of the system, each part of which plays its exact role in the self regulating rule of survival of the fittest. The ultimate control is by the environment and especially that factor which becomes limiting, in the sea, light penetration and the availability of the key nutrients, nitrates and phosphates.

The marine ecosystem is buffered against change, the component systems handling what they have evolved to handle, slow changes in temperature and salinity. Rapid, localised, catastrophic changes such as the effects of volcanoes, hurricanes, tidal waves, and so on can also be dealt with by restocking from nearby areas.

Modern technology has made man into a great geomorphological and geochemical force. Every day larger and larger quantities of material derived from the Earth's crust flow through his short term economy and end up in the sea. Some are beneficial, some are inert, others are detrimental and are drastically changing the marine environment. Among these there is an increasing number of new substances which are directly toxic to most forms of marine life and although they are at present localised they are increasing year by year. The system tries to rebalance itself but in places there are signs that it is not being successful. These signs do and must continue to cause concern, for the sea is not only the world's last sink but it is the world's last source of minerals and food.

What are these signs and how can the sea continue to be used as a sink and at the same time a resource? Study of a component ecosystem is yielding results which are of value in answering both these questions. The inshore marine fringe takes the full brunt of the pollution load and it would seem obvious to look there for any signs of change. Around the coasts of Britain the most widespread ecosystem of the fringe is the kelp forest.

The complex of factors which control the performance of the kelp forest ecosystem are summarised in Figure 1, which also indicates where pollution might act.

The kelp forest

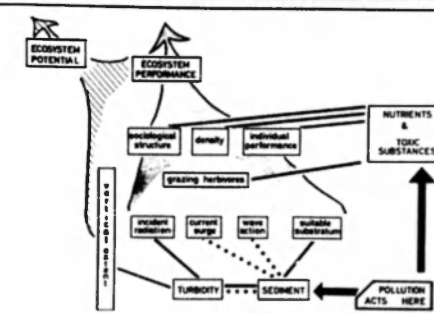


Figure 1: Summary of the factors affecting the kelp forest ecosystem.

Measurement of the environmental factors such as current surge, wave action, turbidity, sedimentation and incident light energy all require the development of integrating data logging equipment. The probability of damage or loss in this alien environment is a cogent fact. Similarly measurements of the levels of nutrient and toxic substances require regular and detailed analysis to avoid drawing wrong conclusions from freak conditions. However, even if all these factors could be measured accurately there would still be the basic problem of what are their biological effects.

As it is possible to measure some of the factors easily and with moderate accuracy it would seem sensible to allow the ecosystem to monitor pollution and act as an "early warning system."

The inshore marine ecologist is however faced with two major problems; the great variation in environmental conditions over very short stretches of coast and the element of chance in the recruitment and establishment of species whose disposal phases are planktonic. This makes meaningful ecological comparisons very difficult.

What then can be measured? Sociological structure, that is the plant make-up of the ecosystem, is a simple matter of accurate observation and so is the measurement of the depth range and density of the individuals, extensive survey and direct observation using free diving techniques being the key to success. Measurement of performance is more difficult. The kelp is however a perennial, the holdfast (attachment organ) and stipe (stalk) living for a number of years, a new lamina being produced annually. Net annual production of the perennial parts may be obtained from a simple age to weight relationship, see Figure 2. The figure so obtained can be regarded as a measure of performance in relation to the environment *in toto* over the life span of the plant. The production of the lamina may be measured by regular or peak cropping; this would give a measure of performance for the current year.

Plot performance may be calculated by multiplying the annual increment per age

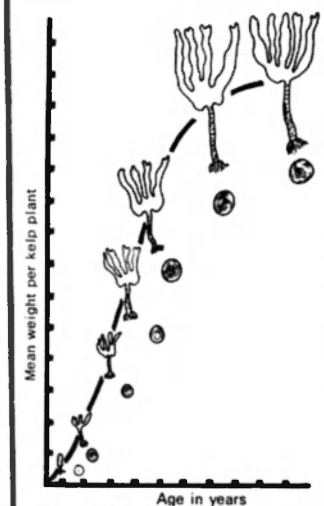


Figure 2: Growth curves for weight of kelp plant as against age.

class by the mean number of individuals per class in the relevant populations. By measuring the performance of the ecosystem at all depths a figure for its potential can be obtained.

Turning to the animals associated with the kelp forest, the problems of comparisons that would mean anything appear even greater when the natural fluctuations in their populations are taken into consideration. There is, however, one group of animals which seem amenable to study.

The holdfast of the kelp consists of a mass of branches, the interstices of which produce shelter (ecospace) for a variety of animals. As the holdfast grows, so the ecospace volume increases and the animal population likewise builds up within it. Detailed study of the development of the fauna shows it to be a gradual process which follows a definite pattern. It would seem, therefore, that the fauna from a full age-range of holdfasts represents an ecosystem feature developed and stable over a long time.

These animals may be considered in four main groups according to their method of feeding; (1) filter feeders, animals which feed on microscopic particles by "sieving" them from the water; (2) browsers, hervibores feeding on plant material by grazing; (3) carnivores, animals feeding on other animals and (4) omnivores, animals which feed on a variety of foods, plant or animal, living or dead. By using sufficient samples and counting all the animals present in the holdfast of different ages it is possible to build up a broad picture of the fauna's structure.

Table 1 gives comparative data of this type from two series of kelp forest collected over little more than 100 km of coast. One series is from the unpolluted water of south Scotland and north Northumberland, the other being from the chronically polluted waters of County Durham. The differences between them may be related to pollution as follows:

The pollutants and the possible effects are best considered under four main headings, as each group will effect the ecosystem in a different way.

Toxic Substances

The great difference in animal and plant diversity could be due to the effects of poisons. However, dilution in the open sea must be very great and it would seem that lethal concentrations of such substances would be found only in close proximity to a badly sited outfall.

There are, however, two ways in which toxic substances can be concentrated in marine ecosystems, firstly by the filter feeders. These are organisms which must pass large volumes of water through their bodies in order to concentrate sufficient food, and could also inadvertently concentrate poisons. Secondly, concentration can occur via the food chain. For example, animals feeding on the filter feeders, mentioned above, could obtain high doses of poisons which could in turn be passed on to other carnivores and scavengers and again concentrated. It is among these organisms that indicators of the effects of poisonous pollutants should be expected. The overwhelming dominance of filter feeders at the polluted sites would indicate that toxic substances are not important in this case unless it is argued that the organisms in question are not susceptible.

Sediment

Regarding survival, the most critical stages in the life cycle of any organism are those of settlement and establishment of their dispersal phases. There is often a specific requirement for the right sort of substratum. A deposit of sediment covering bare rock could account for the lack of certain species from the polluted ecosystems. Similarly deposition of suspended material such as fly ash, which in sea water can set solid, can cover and exterminate the normal soft-bottom animals and plants. As the small animals are the staple diet of large fish populations this would upset the balance of the whole inshore fringe. These are big problems for the disposal engineer. For instance, if the fly ash could be made to set with a pitted surface the development of an interstitial fauna could help replace the normal food source of the fish.

Sediment can have a more direct effect in that deposition onto the surface of any photosynthetic organs or organisms will cut down the amount of light reaching them and will therefore reduce their performance. Since the rate of sedimentation will be greatest at depth and in sheltered areas, detailed comparative studies of shallow and current surge sites would help to distinguish between them.

Suspended Material

Fly ash, coal washings, industrial and domestic wastes, sewage, other colloids and oil must all play a part in reducing the amount of light available on the floor of the sea and this effect, of course, increases with depth. This alone could account for the reduction in depth range and in individual and plot performance of the kelp. The shading effect should be greatest on the plants growing under the forest canopy, thus helping to explain the overall loss of diversity and the drastic reduction of ecosystem performance. Likewise suspended material and sediment could directly influence the browsers and filter feeding animals, the effect being dependent on its toxic neutral or nutritive nature. In the case under consideration the overwhelming predominance of filter feeders in the polluted system point to the latter.

Nutrients

Nutrients must themselves be considered under two different headings—inorganic and organic. The inorganic nutrients such as phosphates and nitrates, which are scarce in the sea, could be important in maintaining growth and development within these systems which are subject to other ill effects of pollution. In an area of chronic industrial pollution, such as the NE of England, the removal of sewage nutrients via a long sea outfall (in an attempt to overcome the main aesthetic problems of pollution) could well be the "last straw" and bring about the complete loss of all below tide-line ecosystems. The organic nutrients (sewage, paper-pulp waste and effluents from silos and food factories) can supplement the natural food-

Table 1A: Comparative data from two series of kelp forest ecosystems, one series unpolluted, the other subject to long term chronic pollution.

	Sociology. Floristic diversity. Total number of species of seaweed recorded		Maximum depth range of the kelp forest	Depth	Integrated figure for individual performance of kelp	Net annual production kelp	Net annual production epiphytes	Total net annual production
						Grams ash free dry weight per m² (plot)		
Mean values from 6 unpolluted sites	Greens	28	−1 to −17M below OD.	−1 to −2M	550	2100	530	2630
	Browns	56		−4 to −7M	420	920	340	1260
	Reds	83		−16 to −17M	91	130	2	132
	Total	167						
Mean values from 5 heavily polluted sites	Greens	10	0 to −4M below OD.	−1M	410	970	220	1190
	Browns	15		−4M	300	450	30	480
	Reds	22						
	Total	47						

Summary: Figures for the polluted ecosystems expressed as a percentage of the comparable figures for the non-polluted ecosystems are given below:

		Individual	Plot	Epiphytes	Total Plot
Floristic diversity:	28 per cent				
Depth range:	25 per cent	75 per cent	46 per cent	42 per cent	45 per cent
Ecosystem potential	16 per cent	71 per cent	49 per cent	9 per cent	38 per cent
Performance:	−1 to −2M −4M depth				

Table 1B: Comparative data regarding the 'infauna' of kelp holdfasts on two different dates from the two series of ecosystems detailed below. Comparable sampling techniques were used throughout.

		Unpolluted	Similarity	Polluted
		Total no. of individuals per 100.	No. of individuals of each species – unpoll.: polluted (per cent.)	Total no. of individuals per 100.
September 1967	Filter Feeders FF.	13	4	98
	Browsers B.	4	20	0.1
	Carnivores C.	30	66	1
	Omnivores O.	53	29	1
	Per cent similarity of the fauna on the two sampling dates	FF B C O 41 30 59 87		FF B C O 3 93 59 34
June 1968	Filter Feeders	25	8	87
	Browsers	2	74	3
	Carnivores	21	66	7
	Omnivores	52	42	4

Summary: The polluted systems: (1) are dominated by filter feeders; the populations of which are very unstable. (2) have very stable populations of browsing organisms.

chains, help in maintaining large populations of scavengers and thereby affect the balance of the whole system. In a recent study of pollution and the commercially important kelp, it was found that sewage nutrients can maintain large populations of browsing organisms which keep the kelp down. The stability of the browsers on the Durham coast could be explained in this way.

It is obvious that the possible effects of pollution are many and that much more basic work is necessary before these conclusions can be regarded as anything more than inspired guesses. The sites at present under intensive study in Britain are shown in Table 2 (see page 11).

Economic Aspects

There still remains the question, "What are the economics of marine pollution? Are the enormous capital and recurrent expenditures which would be required to stop marine pollution really necessary, or will man have to take for granted that certain stretches of the coastlines of the world will be unfit for human recreation?" It is impossible to give an answer but there are some relevant points. Modern work method is leading to more leisure time; polluted beaches are most likely to occur close to built up areas on the coast where much of this new-found leisure time will be spent. Loss of animal and plant diversity and productivity of the inshore marine fringe, must lead to a reduction in our inshore fisheries. How much "abuse" will the marine environment withstand before something catastrophic takes place?

Proper decisions must be based on much more data. Not only in the British Isles but throughout the world selected marine ecosystems should be studied in enough detail so that they could be used as sites for monitoring the increasing effects of pollution.

Man cannot avoid ppluting the sea! But the question is how can he do it without causing catastrophe? Dr H. T. Odum, a leading ecologist, has recently put forward the exciting idea that as pollution presents new opportunities for the evolution of organisms and ecosystems it could be exploited by man. In the light of sound biological knowledge regarding the exact effects of pollution gained from studies as outlined above it should not be an impossible feat of ecosystem engineering to produce new living systems which would handle man's many wastes and provide and maintain a productive stable, "unpolluted" marine environment.

NATO's A.S.W. Potential

Precis by William Charles Colvin

The following article gives a concise general account of the present state of anti-submarine warfare in the West. It has been selected from a longer piece, which it is unfortunately not possible to reproduce in full, giving additional material on the types of ships and aircraft employed in the anti-submarine role.

Before any submarine can be attacked it must first be found. In the last war most submarines were found because sooner or later they had to expose themselves above water, either to attack, or to charge their battteries, or to transmit on their radio. The Germans used radio a great deal and were frequently located by the highly efficient allied DF chain.

Now we are faced with the nuclear submarine, capable of tremendous underwater endurance without refuelling, capable of remaining submerged indefinitely without showing even a periscope above the water, capable of diving to far greater depths than any submarine in the last war, and above all, capable of speeds up to around 35 knots submerged. However, even nuclear submarines still have to expose something to transmit on their radio or to use their radar.

Such a submarine is far more difficult to locate and, given good radio discipline, might never be located until it performs some hostile act. Fortunately for us the Soviets at present would appear to have only some 60 nuclears capable of being used against shipping and nearly half of these are in the Pacific, but probably these 60 are worth at least 120 conventionals.

It is impossible to overstate the value of high submerged speed. Thirty knots is as fast as the modern frigate or destroyer and certainly far faster than a surface vessel can steam if her sonar is to be of any use. Admittedly many ships are now provided with helicopters, but at present most of them are purely weapon delivery vehicles and are not capable of using sonar.

However, not every Russian submarine encountered will be a nuclear, and the conventional submarine has not improved so very much over those used in the last war. Thus in any future Battle of the Atlantic, NATO will be faced with much the same problem as in the war years, but with the added problem of the nuclear and with fewer anti-submarine craft available.

There are nine means at present of finding submarines:

(a) by sonar from surface ships
(b) by sonar from submarines
(c) by sonar from helicopters
(d) by sonobuoys in conjunction with aircraft
(e) by various airborne detectors
(f) by radar in ships or aircraft
(g) by fixed sonars in the ocean
(h) by shore, ship or aircraft Direction Finders
(i) by Electronic Warfare.

It sounds a formidable list but let us look at it in more detail.

Ship sonar

The range of a ship-mounted sonar is strictly limited. Sonars can be used in the active role, i.e. a pulse is transmitted which, if it encounters an underwater object, is reflected back, or in the passive role, i.e. a listening watch is kept on the hydrophones in the hope of hearing a submarine's propeller noises.

Unfortunately the ocean is not a good medium through which to send sonar pulses and the range obtained by this means is not great. Actual ranges are classified, but it is doubtful whether any hull mounted set could detect a submarine by active means at a distance over 10 miles, and at times ranges are as small as a few thousand yards. Water, however, is a good conductor of sound and passive sonars sometimes have very much longer ranges.

There are a number of types of hull-mounted sonars. Most ships have a long range detection set, which is not particularly accurate, and a shorter range, much more accurate, attack set. The US has developed a 'bottom bounce' sonar in which the sonar wave is reflected off the sea-bed on-to the target, and it is claimed that the system produces increased detection ranges.

Another possibility, known as Variable Depth Sonar (VDS), consists of a sonar transducer towed astern of the ship. By varying the length of tow the depth of the transducer can be varied. The reasoning behind this method is that temperature layers are formed in the water due to the surface or near-surface water being heated by the sun. There are distinct layers between water of different temperatures which tend to reflect or refract the sonar wave, and it is possible for a submarine to get below a layer and remain undetected. With VDS it is possible to lower the sonar transducer below the layer and so catch the submarine unawares. In addition it is sometimes possible to transmit the sonar beam between two layers which has the effect of giving it much longer range. On the whole though, VDS does not increase detection range, but it has proved successful in detecting submarines hiding beneath temperature layers.

A problem highlighted by the fast submarine is whether to use a searchlight type of sonar beam or one which transmits all round. In the searchlight type the energy is concentrated in one direction and the operator trains his beam, transmits, waits for an echo (if there is one) to return, trains his beam a few more degrees and repeats the process until he has covered his assigned arc of search, which may be from 70 degrees on one bow to 70 degrees on the other. The process, as can be imagined, is a long one and, with submarines capable of far greater speeds than the detecting ship, is a highly dangerous one, since the submarine may approach from outside the arc, or even from inside it whilst the sonar beam is pointing in another direction.

As a result, the tendency nowadays is to go for an all round sonar, one which will 'floodlight' the area all round the ship. This is safer, but a certain amount of energy is lost, so detections are made only at closer ranges.

Ship sonars suffer from the noise made by the vessel going through the water and in rough seas they are badly affected by the ship pitching. Thus a hull mounted sonar cannot be used effectively at high speeds or in rough weather if the ship is steaming into the sea. There is also the everlasting problem of 'non-subs' – sonars frequently find it difficult to differentiate between submarines, whales, schools of fish, wakes of other ships and old wrecks, and it takes a very experienced operator to pick out the real submarine. Work is going on to endeavour to do this by computer, but so far nothing has been found to beat the experienced sonar man.

Submarine sonar

A far better platform for a sonar set is a submarine. Submarines can very their depth to suit the temperature conditions, they are not bothered by rough seas, their own cavitation and other noises are far less than those of a surface ship, they are a far more difficult target for the enemy submarine to torpedo and are immune from the anti-ship missile. Certain NATO submarines have been fitted with very large and powerful sonars (far bigger than is practicable in a surface ship) and these are giving satisfactory longer detection ranges. So valuable is a submarine as an anti-submarine vessel that a number are being built especially for this purpose; the British nuclear *Valiant* class is an example.

Helicopter sonar

A helicopter, provided it is large enough, can lower a sonar transducer into the sea, known in the Royal Navy as 'dipping' and in the US Navy as 'dunking'. Like the VDS, the sonar can be lowered beneath the temperature layers, but unlike the VDS it cannot be towed. In other words the helicopter when using its sonar has to hover.

Helicopters can be used instead of ships on an anti-submarine screen. They lower their transducers, carry out a sonar search whilst hovering raise the transducer, proceed to a new position and repeat the performance. Rough weather does not affect the sonar and the helicopter, by reason of its much faster speed than a ship, can be sent away from the screen to investigate distant contacts without being absent for as long as would a surface vessel. Another advantage the helicopter has over a ship is that an enemy submarine cannot hear it coming on her hydrophones.

Because of its size and weight the dipping/dunking sonar can only be fitted in the larger helicopters, which normally are too big to operate from frigates and require special helicopter carriers or conventional aircraft carriers. Smaller helicopters are used for anti-submarine work flying from frigates or destroyers, but they merely carry the weapon, and are dependent upon the parent ship for detection of the submarine and for orders on when and where to deliver their homing torpedoes or depth charges. The British system is known as MATCH. The US has a similar system using an unmanned drone and known as DASH, but the drone is expendable each time, whilst in the British system the helicopter returns.

Sonobuoys

A fixed wing aircraft cannot hover, so cannot use the helicopter type of sonar. In place of it sonobuoys are used. These are small sonar sets in themselves, but they transmit what they hear by radio to a monitoring aircraft. Sonobuoys can be either passive or active, that is to say they listen only or they transmit and listen for the returning echo. The former type cannot tell the direction of the sounds they hear nor their range, thus they are dropped in patterns which are plotted by the navigator in the aircraft. When they hear anything he draws range circles round each buoy, allowing an estimated range depending on the conditions. Where the circles from two buoys cut is the probable position of the submarine. Three buoys are normally used to obtain a better fix. The term 'draw' is used metaphorically, in fact the whole system in a modern aircraft is automated.

Passive buoys can also be used to obtain range by what is known as the echo ranging system. Small underwater explosive charges are dropped and the buoys compare the time of receipt of the shock wave direct with that received when reflected from the submarine and thus determine the range of the latter. More sophisticated buoys transmit and receive and can pass to the monitoring aircraft both the direction and range of their contact, but the passive buoy used alone has the advantage of not giving away its presence to the submarine.

Sonobuoys can be used in a variety of ways: to protect a convoy, for example, an aircraft could lay a barrier of buoys either side of the convoy's path. Alternatively a moored barrier of buoys could be placed across a harbour mouth or a narrow strait. Consideration is also being given to laying them in the open ocean and monitoring them by satellite.

Another method is to lay a pattern of buoys round the suspected position of the submarine, established perhaps by a DF fix or intercept of its radar before it fully submerges. If the pattern is correctly laid the submarine could be contained inside it.

Most of these methods were used in the last war and were effective against the slow conventional submarine; their efficacy against a fast nuclear is problematical.

Other airborne detection methods

Two other airborne detection devices are in use today. A diesel submarine on the surface or snorting will leave diesel fumes behind her after she has submerged. These can be detected by a device in the aircraft known by the Americans as a 'sniffer' and by the British as *Autolycus*. All the device will do is to indicate that a diesel fitted craft has been in that vicinity recently. Against nuclears it is useless and, as its range is small, it is not of any great value against the conventional submarine.

Another slightly more promising equipment is known as MAD (Magnetic Anomaly Detector). It is a magnetometer, fitted at the end of a long boom at the tail of the aircraft, and it detects minute changes in the earth's magnetic field. The large metal mass of a submarine (even submerged) will cause some slight change in the magnetic field and MAD can detect this, but again the range of detection is small.

Another use of an aircraft is to obtain the temperature of the sea at various depths and to pass the information to the co-operating ships and helicopters, which of course urgently require it so that they can work out what temperature layers there are and at what depth to set their VDS or dipping sonars. The aircraft drops a bathy-thermograph sonobuoy, which lowers a temperature measuring device into the water and as it sinks it measures the temperature against depth. These measurements are received by the buoy and transmitted to the monitoring aircraft.

Radar detection

Both ships and aircraft are equipped with radars capable of detecting submarines on the surface and/or their snorkels and periscopes, although the range of detection of the latter two is limited, particularly in rough seas.

Radar is a two-edged weapon, as submarines can listen for radar transmissions on their intercept receivers and should be capable of receiving them well outside radar detection range. A submarine is thus actually alerted by the hunter's use of radar and often has plenty of time to dive before the transmitting ship or aircraft gets anywhere near detection range.

Conventional submarines have to expose a snorkel in order to charge their batteries. In addition, in the last war the German U-boats often surfaced in order to close their target at a higher speed, and indeed, in bad weather, to be able to detect the target at all. It is possible that Russian submarines (except the nuclears) would do the same. Radar has improved since the last war but so have intercept receivers, so the balance between the hunter and the hunted remains much the same.

Fixed sonars

Probably the most closely guarded secret by both sides is the capability and location of fixed ocean sonars. These powerful listening posts can be moored, or actually laid on the sea floor, in positions where submarines are likely to transit, such as narrow straits, entrances to channels or other important areas. They can be connected electrically to the shore and are extremely difficult and expensive to maintain. However they do offer about the only possible means at present of detecting the nuclear ballistic missile submarine, provided the sensors can be laid in sufficient numbers in all the areas through which these craft are likely to pass.

It is interesting to note that at the recent discussions in Geneva on the proposed Sea Bed Treaty, the Russians wanted a complete demilitarization of the seabed, whereas the Americans wanted the ban to apply only to nuclear weapons on the ocean floor. This may mean nothing, but it could mean that the Russian seabed sonars are not so far advanced as the American types, or alternatively that the Russians fear the seabed sonar more than the Americans do.

The United States are known to have two projects, *Caesar* and *Colossus*, which consist of a number of passive seabed sonars, and a development project called *Trident* for an active system.

Direction finding

One of the Allies' greatest assets in the last war was their highly efficient shore DF network. It eventually became virtually impossible for a German U-boat to transmit on its HF radio without being reasonably accurately 'fixed' by the DF stations. A great many of the stations have of course been closed down, but the technique has been kept alive and it would not take long to re-establish the DF chain. Even the modern short (or squash) transmission can be picked up.

The success of a DF chain naturally depends very much on the extent to which the enemy submarines use their radio. The Germans, in their 'wolf pack' tactics, used radio a great deal, but it might well be that the Russian submarines have different tactics which do not involve so much use of it. For all that, it is difficult for a submarine to remain at sea for, say, 30 days without having to communicate at some time with the shore or with her supply vessel or consorts.

NATO is well placed geographically to establish a long chain of DF stations in a north–south direction, thus giving a good base line for fixes of submarines in the Atlantic, but not so well placed for fixes in a northerly or southerly direction. Submarines working off the southern tip of Africa might present quite a problem to NATO DF stations, at least until such time that South Africa was brought into the network.

Electronic warfare

Very much allied to shore DF is Electronic Warfare (EW) as practised by ships and aircraft. Nowadays both are fitted with intercept receivers and DF equipment.

As the submarine can hear the ship or aircraft's radar before she is detected, so can the latter hear a submarine's radar. Similarly radio transmissions by submarines on HF, quite apart from being intercepted by the shore, can be localized by the ships. Of course EW is only of use when the submarine is on or near enough to the surface to use its radar or radio, but intercept receivers on sonar frequencies can also be used and once again the sonar transmission can be intercepted before the submarine is close enough to make a sonar detection. Of course the reverse is only too true, and a submarine can intercept the ship's sonar transmissions well before she herself is detected.

Future methods of detection

Detection of submarines about to attack a convoy is one thing, but detection of the lone nuclear ballistic missile submarine, hiding at depth anywhere within a radius of up to 2,000 miles from a target, or the cruise missile boat, is quite a different matter.

The suggestion that each such vessel should be tracked from its base by an attack submarine so that, in the event of war it could be immediately torpedoed, is obviously impracticable. Fixed seabed sonars offer a possible solution, but at best they could only indicate that a submarine had passed over them and the areas they could cover would be very limited. Surface or aircraft patrols can cover only a small area and can never be certain of finding a fully submerged submarine, so are of little use.

The fact must be faced that the detection of a nuclear ballistic or cruise missile submarine at present would be purely a matter of luck. It may be that in the next decade or so, some quite revolutionary method of underwater detection capable of covering enormous areas will be discovered, and no doubt scientists on both sides of the Iron Curtain are studying the problem, but at the moment no such breakthrough appears likely.

There are a number of new methods of detecting submarines under investigation, but they are mostly designed to detect the submarine on or near the surface. Satellite reconnaissance of the seas is by no means impossible, but nobody so far has discovered any method of detecting a fully submerged submarine from a satellite. Again it has been suggested that the laser beam shows promise, either from a satellite or from an aircraft. Provided sufficient energy is put into the beam it can penetrate water and the US is currently studying the use of a beam said to be capable of detecting a submarine as deep as 500 feet. But laser beams are narrow: trying to impinge a beam on a submarine from an aircraft would be like trying to spear an unseen fish from a boat.

Another method under study is the use of infra-red. A submarine is much hotter than the surrounding sea and in addition, a nuclear vessel discharges hot effluents. Present day infra-red devices can detect temperature differences down to 0·3°C and this figure is improving all the time. An airborne detector which scans the surface of the sea with an infra-red cell is already in existence, but it only covers about one mile either side of the aircraft. When dealing with the enormous expanse of the oceans, which after all cover 70 per cent of the world, a much bigger swept area is necessary, or alternatively an impossibly large number of aircraft.

Weapons

So far we have only discussed the detection of the elusive submarine, but it is no use detecting it unless it can be attacked and destroyed. What weapons then are there available in NATO to effect the kill?

The old depth charge rolled over the side from the ship has been replaced in the more modern NATO navies by the mortar capable of throwing charges a considerable distance from the ship in any direction. Thus it is no longer necessary for a ship to pass over the submarine to effect an attack. This is a great advantage as the submarine never quite knows when the attack is going to take place and it is much easier for the ship to keep continuous contact.

Mortars have a limited range and a much more sophisticated type of weapon has been in use in the US and Royal Australian navies for some time and is shortly to be introduced into the Royal Navy. The US Navy's ASROC and the RAN and RN *Ikara* systems both basically consist of rocket propelled aerial missiles each carrying a homing torpedo. The missile is fired in the general direction of the submarine contact and on command from the ship releases its torpedo, which enters the water and homes on to the submarine. ASROC cannot be guided in flight, but *Ikara* has guidance, so if the submarine makes a sudden alteration of course after the missile has been fired, the latter can be guided to intercept.

Helicopters and fixed wing aircraft can use depth charges, but nowadays rely more on homing torpedoes. These torpedoes can be of two types; the passive which homes on to the noise made by the submarine's propellers, or the active which has its own built-in sonar and homes on to the sonar returns. This is expensive and the passive homer is the more common.

Submarines attacking other submarines use their normal torpedoes (which may be homers), but the Americans have developed SUBROC which, like ASROC, is an aerial missile, but in this case fired when submerged. Its trajectory takes it out of the water, through the air, and into the water again near its target where it explodes like a depth charge. Its advantage over an ordinary torpedo is that the submarine cannot hear it coming on its sonar, and so takes no avoiding action, such as stopping its propellers and making a rapid change of depth.

No mention has been made so far of nuclear warheads. Of course either depth charges, mortars or torpedoes can be fitted with nuclear warheads, but these are unlikely to be used, at least until the rest of the war had gone nuclear.

Another useful weapon against submarines, particularly in their transit areas is the mine. This is no place to go into the various types of mines which have now been devised, but a well placed, sophisticated minefield laid from underwater outside a known enemy submarine base might easily prevent many a submarine from reaching its patrol area.

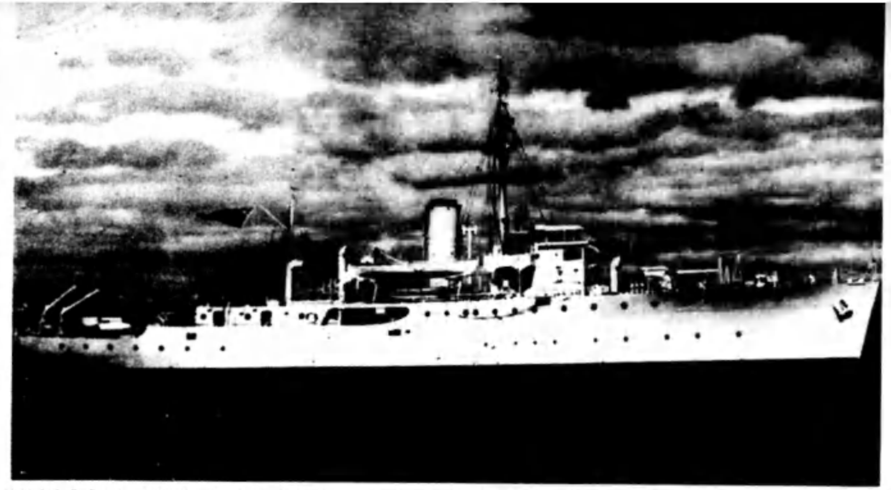
There is no doubt that at present the lone nuclear submarine lurking with its ballistic missiles in the vastness of the oceans is unlikely to be detected. Submarines engaged in attacks on shipping, transiting narrow waters or using their radio may be detected given a sufficiently large force of ASW ships and aircraft. Modern weapons render the chance of a 'kill' once detected more probable than in the last war.

There is an urgent requirement for a break-through in underwater detection. If some method could be found to extend the range of active sonar from a mere 10 miles at the outside to hundreds of miles, the situation would be different. Alternatively, or perhaps additionally, if fast moving aircraft could tow a long range sonar set through the water or achieve some other means of through-water detection, or if satellite detection of submerged submarines became possible, the nuclear submarine might find life much less easy.

It is not beyond the bounds of possibility that one day a break-through will be achieved. When it occurs it will be one of the most closely guarded secrets in the world, but until that day comes there is no doubt that the submarine has the edge.

Personnel Strength of the Royal Australian Navy, 1950-1971

Strength as at	Permanent Forces	Citizen Forces	Emergency Reserves	Total
June 1950 ..	10,252	4,943	..	15,195
1951 ..	12,381	6,254	..	18,635
1952 ..	14,144	7,398	..	21,542
1953 ..	14,273	6,767	..	21,040
1954 ..	14,181	4,800	..	18,981
1955 ..	13,211	4,944	..	18,155
1956 ..	13,096	4,821	..	17,917
1957 ..	11,661	6,656	..	18,317
1958 ..	10,745	7,982	..	18,727
1959 ..	10,699	7,850	..	18,549
1960 ..	10,598	7,816	..	18,414
1961 ..	10,722	7,770	..	18,492
1962 ...	11,103	6,424	..	17,527
1963 ..	11,663	5,433	..	17,096
1964 ..	12,569	5,202	..	17,771
1965 ..	13,503	3,762	443	17,708
1966 ..	14,714	3,797	686	19,197
1967 ..	15,893	3,931	793	20,617
1968 ..	16,454	4,047	904	21,405
1969 ..	16,943	3,971	1,114	22,028
1970 ..	17,304	4,462	897	22,663
Estimated Strengths at June 1971	17,820	4,330	798	22,948



H.M.A.S. *Deloraine* (J232), a *Bathurst* class corvette and sister ship to H.M.A. Ships *Katoomba* and *Lithgow*. All three vessels played a major part in sinking the Japanese submarine I 124. Surviving WWII, all three corvettes were scrapped in Hong Kong in 1956-57.

R.A.N. SANK FIRST JAP SUBMARINE

By Jack Millar

In 1942 the Japanese were sweeping all before them in their swift drives southwards, and playing a leading part was the Japanese navy, with its vastly superior forces.

Against such numerical strength at that time the allied navies could do no more than harass the enemy with hit and run raids. One of the most active arms of the Japanese navy early in the war was its submarine force, flung out across the vast Pacific, ready to pounce on any unsuspecting merchantman or warship.

Included in their underwater fleet were four mine-laying submarines — I's 121 to 124 and these craft were among the hardest worked of all.

Built about 1925-7, these 1140-ton submarines were considered obsolete when war commenced, nevertheless they carried and laid many mines which sank or caused considerable damage to many of our ships.

Armed with one 15 cm. gun, they had a top surface speed of 14½ knots and a range of 10,500 miles at an economical speed of 8 knots. Their operational time range was about 20 days.

With a safety diving depth of only 195 feet they were considerably hampered compared with later subs, which could go down to 325 feet with safety. In an emergency many went below this depth without damage.

Carrying 12 torpedoes I's 121 to 124 were also equipped for laying 42 mines, which was an extremely hazardous task. To the Japanese they were regarded as cranky craft to handle and manoeuvre, owing to their small hydroplanes and rudders and throughout the service were known as the "dreaded submarines".

CRANKY CRAFT

If the least bit lightened they tended to surface and if over weighted would sink deeper. The 40-odd mines had to be moved one by one to the tail of the subs, while at the same time water was pumped to the fore end to prevent tail-heaviness — a reallv dangerous task.

U.S.S. *Alden* (DD 211) a flush-deck destroyer, sister ship of U.S.S. *Edsall* (DD 219). A lookout aboard *Edsall* was the first to see the Japanese submarine I 124, near Darwin, on 20 January, 1942.

When a mine was dropped the same weight of water had to be let in, otherwise the stern would break surface. If too much water, the boat would sink.

Usually the mines were laid with a two-knot tide running at the entrance to bays, making it extremely difficult to keep the submarines level at the prescribed depth and at the same time lay the mines in the correct positions. This called for the utmost skill on the part of the captain, navigator and trained operators to avoid any dangerous errors.

During 1940 these submarines were equipped with petrol tanks on the upper deck for refuelling aircraft, adding another role to their already arduous duties.

On 1 December, 1941, the four Japanese subs were at Hainan Island when they were ordered to take up their assigned war positions.

LAYING MINES

At the time of the attack on Pearl Harbour, I's 121 and 122 were laying mines in the Singapore shipping channel, and I's 123 and 124 were doing likewise in Philippine waters. I 124 laid her full complement off Manila harbour, and 8 December, found her busy rescuing crashed aircraft crews from the air assault in Manila. In addition she was sending out invaluable weather reports from the area.

As the Japanese drive southwards gathered momentum, so too did the minelaying subs keep ahead of the surface forces, sowing their lethal "eggs" of destruction at the entrances to allied harbours.

During the early hours of the morning of 20 January, 1942, I 124 was on a mission to mine the approaches to Darwin harbour, and was only about 60 miles west of the port. In close proximity were the United States destroyers Edsall and Alden, escorting the tanker Trinity to Darwin with urgently needed oil supplies. Suddenly, at 6.30 a.m. an excited lookout on Edsall reported a submarine dead ahead. Before the action alarm bells had ceased Edsall was racing in to attack, leaving Alden to protect the tanker.

The submarine, none other than I 124, immediately dived to escape the destroyer bearing down on her. Edsall dropped all her depth charges without any conclusive results, and immediately wirelessed Darwin reporting the sub's presence.

TWO CORVETTES

In Darwin were the corvettes H.M.A.S.'s Katoomba and Lithgow, which had only arrived the previous day as escorts of a convoy from Thursday Island. Another corvette, H.M.A.S. Deloraine, based in Darwin since 7 January, as a unit of the 24th minesweeping flotilla, was already at sea sweeping the searched channel.

On receipt of the enemy submarine report from U.S.S. Edsall the naval officer in charge, Darwin, Captain Thomas, immediately ordered Deloraine, Katoomba and Lithgow to the attack.

Deloraine was first on the scene at 1.35 p.m., where I 124 showed she was very much alive by firing a torpedoe at her. Its track was reported by Deloraine's lookouts and on the bridge Lieut.-Commander Menlove gave orders for a drastic evasive alteration of course, allowing the torpedo to pass harmlessly by.

The pinging echo of Deloraine's asdic then made contact, and it was loud and clear.

In she raced, covering the last few remaining yards at full speed, the crew tense at their action stations, bracing themselves for the explosion they knew was coming. Suddenly, when dead on target, the firing bell was pressed and a moment later the depth charges were down.

Behind Deloraine, the whole surface of the sea jumped and quivered as the pattern exploded. A huge column of water shot high into the air, and it seemed to those on board that no submarine could possibly live through such a barrage, but when it subsided the surface remained empty.

Wheeling into the fray once more, Deloraine carried out a series of such attacks, until at last success came her way. Oil and air bubbles were observed on the surface.

Was she damaged, or had the wily Jap commander merely shot oil to the surface to suggest a kill? Despite the crankiness and difficult manoeuvrability of I 124 there was to be no surrender. In true Japanese style it was determined, if need be, to die fighting for the Emperor.

By 3 p.m. Deloraine had expended her outfit of twenty depth charges, and she remained on the scene until Lithgow arrived at 4.20 p.m. and Katoomba at 6 p.m.

SEVERE ATTACKS

These two ships then carried out a series of attacks, and Captain Cousin, in Katoomba, who had taken over as senior officer, sent Deloraine racing in towards Darwin to get more depth charges from the anti-submarine patrol vessel, H.M.A.S. Vigilant.

Patience is a good attribute when hunting submarines. A quick kill is not always possible, and in the Atlantic it was sometimes necessary to stalk a Nazi U-boat for days before the final blow. Nor were they always successful, as the cunning submarine commanders, using all manner of ruses, occasionally managed to outwit their hunters and creep away to safety in the depths below.

As soon as Deloraine rejoined the other two ships with another 15 depth charges at 3.15 a.m. on 21 January, her asdic got a firm contact, and she at once attacked. At 3.56 a.m., under the directions of Katoomba, Deloraine carried out a series of concentrated attacks until all her depth charges were used.

If I 124 had not already been dealt her death blow, Deloraine's attacks certainly wrote finis to her career.

Following them, large quantities of oil rose to the surface from the doomed submarine — so much that she could not possibly have survived such a withering bombardment of depth charges.

At the time it was thought in Darwin that three submarines had been destroyed — two by Deloraine and one by Katoomba, but only one, the I 124, was ever located.

WAS ON SCENE

Living in Hobart, Tasmania, now is one who vividly remembers I 124. He is foreman stevedore Darell Law, who at the time was a R.A.N. diver based at Darwin.

Following the sinking, a team of Australian and American naval divers were sent out to find the wrecked submarine.

"It was dead easy, as the sea was covered with fuel, oil, and we soon located the I 124 in 180 ft. of water. I actually clambered all over her," Law said.

At that depth it is very near the limit for the conventional diving suit. "Preparations were made for raising her, but the big raids on Darwin shortly afterwards found our services required elsewhere and it was abandoned," he recalled.

I 124 lies there to this day, the remains of her crew no doubt still entombed within her hull.

In the overall assessment credit was given for her destruction to the three Australian corvettes — Deloraine, Katoomba and Lithgow, and the U.S.S. Edsall.

Very little publicity has been given to this naval incident in the war against the Japanese, and it is fitting almost 30 years later, to recall the gallant deeds of an Australian warship named after the picturesque and thriving Northern Tasmanian township of Deloraine.

Although essentially a team effort, there is little doubt that H.M.A.S. Deloraine played a major part in sinking I 124, first unit of the Japanese Navy to fall victim to the Royal Australian Navy.

LETTER TO THE EDITOR..

Pamela Payne,
50 The Parade,
Ocean Grove, Vic.
P.C. 3226

Dear Madam,

Thank you for your letter enquiring what you should do with a drunken sailor.

As I put down my tumbler, and pick up my pen to reply I note that four days have elapsed since you wrote. If your particular sailor is still drunk I suggest you pump all bilges, and stand from under while he heaves ho!

Now that you have broached the subject I will be happy to give you my opinion, in general, upon the matter of Jolly Jack Tar when half-seas over. As an ex-wren with a bottle of gin and some angostura at my elbow, I feel well qualified to do so.

Drunken sailors come in all shapes, colours and sizes. If you are colour-conscious you may feel that chinks are more dangerous on plonk, or that Tanzanians are uncertain how to handle Vodka. Don't worry. The most important thing is how heavy is the sailor, supposing he overlays you on dry land, or falls overboard and you have to rescue him from the drink.

Sailors tend to congregate in dim lurks, and lurk in dark cellars for the purpose of drinking. You must remember that a matelot, or sailor (I refer to the genuine article) is a product of the Wet Canteen, dressed in his slops, a descendant of Nelson, with his glass under his arm, and presumably full of Nelson's Blood ever since he was a tiny tot. Even the bow on his cap-band, secured around a threepenny bit is tiddly.

Having filled you up with facts only slightly diluted with small beer, I shall come to the point.

I am of course presuming that you yourself have not inbibed, well any way not more than two helpings of trifle, and a trifle of tipsycake. First of all take a quick recce. Is he swaying? Is he sleepy drunk? Is he fighting drunk, or about to be sick?

Here are the answers, women take particular note. If he's swaying, push him and then get out of the way. If he's sleepy drunk, empty all the dregs from the glasses into a pint mug, hand it to him, and wander away. If he's fighting drunk take off a shoe and threaten to clobber him with it. While he is trying to focus on the shoe deal with him in the way your Father should have taught you. If he's about to be sick, thank heavens he's not in your home, turn your back and stand yourself a large brandy at the bar. It may be a long walk home.

All this sounds rather brutal, but you are obviously not used to drunken sailors if you ask for my advice. I have dealt with them all from "middies" on schooners to submariners almost totally submerged. Frankly I have a very soft spot for sailors, drunk or sober, and it can be hard to tell the difference.

Yours till Hell freezes over,

(Signed)
ESKIMO NELL

News from...

BRITAIN

(The Editor is indebted to the officers of the Information Service of the British High Commission in Australia for their ready assistance in the compilation of this article.)

MORE RELIABILITY, BETTER PICTURES FROM NEW RADARS

Marine radars just developed are claimed to offer higher standards of reliability and brighter, clearer pictures over ranges up to 48 miles.

The two radars — one has a four foot, the other a six foot long aerial or scanner — represent three years of research and engineering by London's Decca Radar Company. The pictures received on their nine inch screens are described by the firm as "the best we have ever produced".

Mr. Charles Taylor, sales director of Decca, told journalists from Britain, the Netherlands, Norway, Greece, France and Federal Germany at a preview in London recently: "The elimination of valves and thermionic devices is a fundamental move to improve reliability of marine radar. Instead we have used the latest solid state devices to produce a very high performance radar for shipping up to 6,000 tons or use as a second radar on much larger vessels.

"We have produced a high performance radar using entirely new techniques to obtain this performance, without sophistication while achieving higher reliability."

Decca has designed all components of the new RM914 and RM916 radars to be underworked — so attaining long life. The aerial has been shaped to create less wind resistance, so that smaller motors and gears are needed to drive it.

The radar set itself is of modular construction, so that sections can simply be unplugged and replaced, and special controls eliminate the need for frequent tuning. The radar screen can also be fitted with a digital range readout.

HIGH FOCAL PLANE SPAR BUOY

A glass reinforced plastic spar buoy able to maintain high stability in the strong currents of estuaries and harbours has been introduced by a British company.

The 3 ft. diameter buoy has a focal plane height of 11.5 ft. and a draft of 10.5 ft. The long counter-weight tube contains iron ballast and the batteries. The buoy will give up to one year's unattended service using filament or cold cathode light sources.

Maintenance requirements are kept to a minimum by use of colour impregnated glass reinforced plastic, stainless steel lifting eye, mooring eye and radar reflector (optional), with foam filling for positive buoyancy in the event of serious collision damage, and a neoprene fender.

Handling costs are inexpensive as the buoy weighs only 835 lb. complete with cast iron ballast weight and 40 dry cell batteries, providing a capacity of 100 amp./hr. Re-batterying may be carried out on station from the deck of any convenient vessel.

APPROVAL FOR BRITISH ANTI-COLLISION DEVICE

After 12 months' rigorous testing through some of the world's most crowded shipping lanes, a British marine radar which can predict the effect of a vessel's contemplated change in course and speed has been officially approved and adopted.

During the past year the Marconi Predictor unit has been in constant use aboard the 22,000-ton liquid gas carrier Methane Progress and the ship's Master, Captain M. M. Murchie, reports that even in particularly dense traffic the ship was able to proceed without any delay.

"The system has proved invaluable with its self-plotting facilities and this, combined with its excellent standard of reliability as a conventional radar, must make it a good recommendation as an anti-collision aid."

Dial In

Predictor is the first marine radar in the world to provide fully automatic plotting of all targets together with rapid and automatic prediction of the effect of a contemplated change in course or speed.

Without the need for constant radar observation or manual plotting, the unit provides a full six minutes of radar history which is automatically stored and up-dated and which can be traced out rapidly on a screen.

The prediction facility which has given the equipment its name enables a ship's officer to "dial in" a contemplated change of course and immediately check the relative tracks of all targets on the display which would result from this possible new course.

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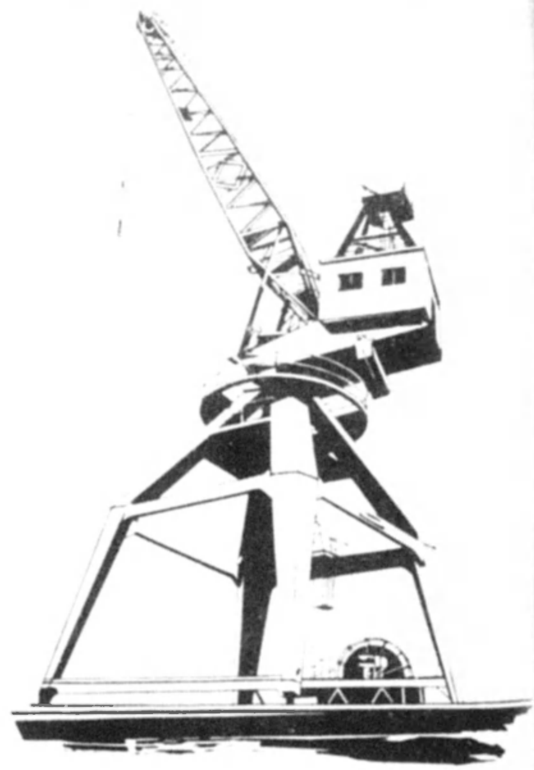

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300-310 BOTANY ROAD, ALEXANDRIA, N.S.W. 2015 AUSTRALIA
Telephone: 69-6651. Telegrams and Cables: "Favhold", Sydney. Telex 21559.
Victorian Branch: 11-13 Thistlethwaite Street South Melbourne, Vic. 3205. Tel.: 69 7617-8.
West Australian Branch: 55 Matheson Road, Applecross, W.A. 6153 Tel.: 64 5773.

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