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Canadair V-Stol

First flight of the Canadian CL-84-1 tilt-wing V-STOL utility aircraft is planned to take place in June, following the roll-out recently of the first aircraft being built for the Canadian armed forces. In its military designation of CX-84 the type will be evaluated to determine the effective role of such aircraft in a military environment. This will cover not only a range of land-based roles but also maritime operations from aircraft carriers and seaplanes. In its production version the CL-84-1 has 7% more power, added avionics, external hardpoints and provision for greater fuel loads. Operating to a gross weight of 14,500 lb. (STO) or 12,600 lb. (VTO), the aircraft has a payload, with full internal fuel, of 4215 lb. (STO) and 2315 lb. (VTO); its cruise speed at 10,000 ft. is 300 m.p.h. (STO) and 305 m.p.h. (VTO), and range, with full payload and 10% fuel reserve, is 320 miles (STO) and 340 miles (VTO). An increased performance version of the type, designated CL-84-1C, will be available within about 20 months, and as a troop carrier will take 16 passengers plus the crew of two. Several growth versions, one powered by General Electric T-64 engines instead of the present 1500 shp Lycoming LT-250-4C engines, have been studied by Canadair. The added power of the T-64, combined with increased wings, engines, and 5 ft. greater wing span, would permit a cruise speed at 20,000 ft. of 425 m.p.h., and a 575 mile radius of action without refuelling.

The armed forces budget had not yet allowed Mobile Command all the light tactical transport and reconnaissance aircraft needed; the Air Reserve has stepped in for the interim. Thus, in addition to some of their former duties, the reserve’s 100 pilots will take part in tactical field exercises during the year, building up operational experience while giving some needed support to the Command.

Naval reservists are trained to support the regular force in specific areas. This year about 50 reservists will take courses to become qualified divers. A further 950 will receive instructions in such varied trades as communications, finance and administration, cooking and service, and naval control of merchant shipping. The Mobile Command Reserve will also send about 1,000 reservists to sea during the May-June exercises, these reserve units will spend about a week at Mobile Command bases. The third component, the Ready Reserve, is composed of reservists who take advanced training with regular units in almost any specialty. The Ready Reserve provides these men with basic military and trade qualifications and all their advanced training is with regular units.

During 1969, the land, sea and air reserves will be working as close to the regular force as possible, establishing themselves as an effective resource for operational commanders.

International Fire Prevention Contest

Canadian Forces Base Command presented the top entry in the Canadian Military Division of the 1969 International Fire Prevention Association’s Annual Contest.

The competition provides recognition for excellence in the field of fire safety education and performance and has four divisions — Municipal, Industrial, Military and Government. The award was presented to Lieutenant General M. E. Pollard,
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compartment general of the armed forces, by Mr. M. S. Hurst, Ontario provincial fire marshal, at a ceremony on Parliament Hill attended also by winners from all phases of Canadian fire prevention.

General Pollard in turn presented the award to Captain J. M. Paul, commander, C. F. B. Cornwallis and Mr. R. M. Atwell, base fire chief.

Defence Research Board Grants
Approximately $3,000,000 in grants has been awarded this year to 40 Canadian universities by the Defence Research Board for fundamental research studies related to defence problems. The recipients, staff members of the universities, carry out basic research and are expected to publish the results of their investigations, which are not secret.

Other objectives of the programme are to develop an interest in defence science within Canada's scientific community, and indirectly, to assist in staffing the Board's seven research establishments with promising young scientists.

The grants may be used to pay research assistants, usually graduate students, and technical personnel, to purchase equipment and expendable materials and supplies; for travel connected with the research programme of the individual concerned, and to cover the costs of publishing the research findings in the scientific literature.

JAPAN
Choppers for smaller vessels
Planners of the Japanese Maritime Self Defence Force are reported to be increasingly interested in the possibility of equipping smaller warships with torpedocarrying light helicopters instead of the earlier planned Goodyear DASH ASW drones, but are awaiting U.S.N. reaction to proposals by Bell and Hughes for such types. Bell is said to have approached the Japanese with a proposal for the Model 206A, equipped as an ASW variant with MAD gear, four sonobuoy sensors, and armament of one Mk 46 or two Mk 44 torpedoes. Similarly Hughes suggests an ASW version of the OH-6A, while Sud Aviation is proposing an Alouette 3 ASW development.

NETHERLANDS
New Radar
Hollandse Signaalapparaten N.V. in Hengelo, the leading Dutch maker of radar, fire-control and similar electronic equipment, has designed a new radar in collaboration with the British and Netherlands Royal Navies. It gives a 3-dimensional picture on the screen of any object scanned. This radar will make it possible to observe aerial and surface objects simultaneously, and also allow altitude measurements. In other words, it will replace 3 conventional radar systems. The most likely application of this new naval radar is very early warning of missiles fired by enemy ships, combined with remarkably accurate determination of the missile's trajectories. In this way, evasive manoeuvring will become much more reliable.

UNITED KINGDOM
H.M.S. Churchill
Britain's eighth nuclear-powered submarine was launched by the Hon. Mrs. Christopher Soames on 20 December, from Vickers shipbuilding works, Barrow-in-Furness. H.M.S. CHURCHILL is the sixth nuclear submarine to be launched by Vickers, which company has already completed three Fleet and two Polaris submarines. Speaking at the luncheon following the launching, Sir Leslie Rowan, Chairman of Vickers, referred to the long association between Vickers at Barrow and submarine building. H.M.S. CHURCHILL is the 302nd submarine to be built by the firm, and the 271st to be built by the company for the Royal Navy. Mrs. Soames, in her reply to Sir Leslie's toast of the ship and her sponsor, said she felt it would have appealed to her father that the men who
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New Navy Fighter

**S-3A**

S-3A is the official designation for the proposed new U.S.N. carrier-based ASW aircraft, formerly referred to as the VSX programme, and S.U.S.165,000,000 has been requested in the fiscal 1970 budget for its development. Selection of the development contractor was expected to be made after a short while ago and late reports suggested that Lockheed and General Dynamics' Convair division were nearly even in favouritism from a technical viewpoint.

**Research Ship**

Depicted in this artist's concept, the U.S. Coast Guard's most advanced oceanographic vessel, the WHEC-701 is a 387-foot high-endurance cutter, scheduled for completion in 1972. The ship displaces 3,045 tons, has a 51-foot beam and a draft of 17 feet six inches. It is built of sail steam turbine engines, delivering 10,000 shaft horsepower. It will be propelled by four ducted thrusters, two located in the bow and two in the stern. Further, the submarine must match their courage with the most advanced technical skills and knowledge.

**UNITED STATES OF AMERICA Nuclear Research Submarine**

The first nuclear-powered research submarine, the NR-1, which was launched in January (see photo, previous page), is 140' long, 12' in diameter, has a submerged displacement of 410 tons, and will have a crew of five, plus two observers. She will be propelled by twin screws, and will be maneuvered by four ducted thrusters, two located in the bow and two in the stern.

**System U.L.M.S.**

Studies now being made by the U.S.N. to establish the configuration of a proposed new submarine, capable of launching big, long-range ICBMs, are regarded as important to the future of United States missile defence programming because of growing problems related to land-based ICBM systems. Present Polaris and Poseidon missiles are comparatively limited in size and range because they are carried internally in FBMs submarines and launched vertically. This fact is cited by commentators who suggest that the proposed new U.S.N. system, designated ULMS, will be based on a submarine configuration which may carry the new ICBMs horizontally and, perhaps, externally. In the current fiscal year about S.U.S.5,000,000 is budgeted for study of the ULMS system, and the commentators note provision of $20,000,000 in the 1970 budget to prepare for 'Possible engineering development' in 1971.

**New Navy Fighter**

Photograph is a full-scale mock-up of the Navy's newest carrier-based fighter, the F-14A. Powered by two Pratt and Whitney TF-30-P-12 afterburning-type turbofan engines, the Grumman-built plane will have a crew of two, seated in tandem. It was designed to provide high-speed and fast accelerations and is expected to be in the Fleet by 1973.
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News from Britain

BRITISH SHIPBUILDER'S DESIGN TESTS IN SHIP MODEL EXPERIMENT TANK

A view of the ship model experiment tank, showing the carriage and some of the electronic experimental equipment of the Vickers shipbuilding group. The experiment tank, where investigations are made to cover hull design and resistance and propulsive tests in both still water and waves, is claimed to be the second largest privately owned facility of its kind in the world. It is here that the company pioneered design tests in waves as a logical extension of the long accepted still water tests. Its clients come from all quarters of the world, and as a result of the experiments it is able to effect detailed improvements in their initial design.

The tank is equipped with a wave generator capable of producing regular or random waves on scales corresponding to the whole range of all seas ever likely to be encountered in practice. Work of this nature is now an increasing design demand in the field of commercial shipbuilding, both for technical and commercial reasons. Investigations undertaken at St. Albans include a wide range of ships such as ferries, liquefied gas carriers, 250,000-ton dead-weight tankers, drilling rigs, and the Atlantic Platform designed jointly by Vickers and another British company, Standard Telephones & Cables Limited.

An instrument technician works on a fully operational radio-controlled model vessel built by Vickers, the British shipbuilding group, for the Department of Navigation at the Sir John Cass College, London. It was built at the company's ship model experimental tank at St. Albans, south-east England. The 4-feet long prototype is designed to be operated in a specially designed tank with simulated river and deck systems by officer students who can control it as they will be expected to control their own ships. The model is packed with the most ingenious and elaborate electronic and mechanical devices which enable the operator to undertake to scale all movements concerned with the navigation of the vessel. The tank is equipped with a wave generator capable of producing regular or random waves on scales corresponding to the whole range of all seas ever likely to be encountered in practice. Work of this nature is now an increasing design demand in the field of commercial shipbuilding, both for technical and commercial reasons.
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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 these with which a stamped and addressed envelope is enclosed.

A model of a British-designed Atlantic Plot form being tested in simulated mountainous waves at the St. Albans, southeast England, ship model experiment tank of the Vickers shipbuilding group. The tests demonstrated the remarkable stability of the platform which is one of a series developed jointly by two British Arms, Vickers Ltd. and Standard Telephones & Cables Ltd., to provide unbroken air navigation aid for aircraft crossing the Atlantic Ocean as well as meteorological data stations and oceanographic stations.
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THE VALLEY

HELICOPTER-DESTROYERS FOR THE ROYAL AUSTRALIAN NAVY

Dear Sir,

In reply to Cadet-Midshipman Dickenberg's answer to Mr. R. J. Hallett's article on "Helicopter-Destroyers For The Royal Australian Navy" I would like to put forward the following ideas.

Firstly, Mr. Dickenberg seems to think that these ships are too old to be converted to D.D.H. status. If so, then why does the Royal Navy still have most of its Type 15 and Battle class ships in full commission. This point aside, if he had read Mr. Hallett's article fully he would have noticed that Mr. Hallett stated that the conversion would also involve a major extended refit, meaning a possible renewal or reconditioning of the present set of machinery.

Also Mr. Dickenberg states that the cost of these conversions would be almost that of new ships built for the purpose. But actually it would be more convenient and cheaper to use the Battle and Type 15 ships as the base for this type of warship: after all, they still have a great deal of useful life left in them. During the Second World War did Australia throw away its old "V" and W" destroyers? No, put them to work and they did as good a job as modern British ones. It is also a fact that this type of ship would suit our Navy's needs for patrolling the waters of Australia, as well as supplementing Australia's small naval force.

The one thing that I agree with from Mr. Dickenberg's article is the need for the Australian anti-submarine missile, the IKARA, which is probably our best weapon against submarines. With this added piece of equipment the Battle class and Type 15 would have considerable striking power against a sub., not to mention its A/A capabilities. The Seacat A/A missiles and the 40mm. guns provide adequate protection from air attack whilst the ship has the three previously mentioned ways of fighting submarines; by helicopter depth-charging, by Limbo mortars and by Ikara missiles.

Admittedly it would be better to build the already proven "Leander" class frigate, but it is also much dearer and would take a much longer time before they were completed, leaving Australia poorly...
patrolled and protected. So why not try the useful type of ship? Anyway, it would cost just as much to perform Mr. Dickkenberg's alteration as it would to build Mr. Hallent's or my conversion which use these ships to their best advantage. Mr. Dickkenberg has also omitted one of the best anti-sub weapons (which Mr. Hallent has on his ships) from his designs. This weapon is the limbo depth mortar.

So from this I would have the ships emerge from conversion as follows:—

**BATTLE** class — Length 379 ft., beam 41 ft., draught 13 ft. 6 ins.
- Aircraft — 1. Sea King, or 2. Westland Wessex helicopters.
- Armament — 2. 4.5 in. dual-purpose guns; 1. Ikara A/S missile launcher; 7. 40mm. A/A guns; 2. Seacat A/A missile launchers; 1. Limbo A/S mortar.

The **Battle** class would have its bridge removed and replaced by the modern frigate style bridge. The main deck would be raised one level, a hanger added, an Ikara launching stage and a flight deck. This would be broken at the stern by a quarterdeck, one level lower, on which is situated the Limbo mortar, and to port and starboard of the funnel for lifeboat davits. The Ikara would be mounted on a raised deck abaft the funnel. The Seacats would be situated on top of the hanger, while the 40mm. before would be displaced either side just behind the bridge. The 4.5 in. turret would remain in “A” position.

**TYPE 15** — Length 358 ft., beam 36 ft., draught 13 ft. 6 ins.
- Armament — 1 Ikara A/S missile launcher, 7 40mm. A/A guns, 2 Seacat A/A missile launchers, 1 Limbo A/S mortar.

Both are based on the design put forward by R. J. Hallent in May-June-July issue of “The Navy”. Personally I think this is a very good way to build up our navy's strength and to bring it up to date with the Royal and Canadian navies.

Finally, I wonder if R. J. Hallent would like to reply to the articles by John Mortimer, Midshipman Dickkenberg and also to mine.

Yours truly,
(Sgd): WILLIAM P. DART,
24 Russell Street,
Newtown, Geelong,
Victoria, 3220.
May 10, 1969.

**Attention Navy Men**

A number of Naval Cadet Units are in need of additional Officers and Petty Officer Instructors with Service background to instruct Cadets. Anyone who may be prepared to give of his time on Saturday afternoons is asked to please contact the Cadet Liaison Officer, Lieutenant McPherson, H.M.A.S. WATSON, telephone 37-1311 extension 256 between 0800 and 01530 for further particulars.

The Units concerned are:—

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<th>Unit</th>
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<tr>
<td>T.S. ALBATROSS</td>
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<td>T.S. HAWKESBURY</td>
<td>Gosford</td>
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<td>T.S. PARRAMATTA</td>
<td>Rydalmere</td>
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<td>T.S. WARREGO</td>
<td>Hunter’s Hill</td>
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<td>T.S. SYDNEY</td>
<td>Snapper Island</td>
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<td>T.S. CONDAMINE</td>
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<tr>
<td>T.S. TOBRUK</td>
<td>Newcastle</td>
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Cadets range from 14 to 19 years of age and Units parade on Saturdays.
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SPEEDING THE COLLECTION OF MARINE DATA
By K. BUDD

Considerable attention has been paid in recent years to space exploration; at the same time, but accompanied by far less publicity, developments have been made with the aim of improving man's relatively limited knowledge of 71 per cent. of the world's surface — the oceans. The vastly increased expenditure on exploring the oceans in recent years has not been directed merely towards the uncovering of oceanic information, for there is positive evidence that the resources of the sea, the seabed and its substrata could be of great benefit in respect of the world's needs for food, fuel, power, mineral resources, and chemicals far into the future.

Britain has pioneered work in oceanography, marine biology and other studies into the nature of the marine environment. This basic research work is now being supplemented by British industry, which is playing an important role in developing and marketing equipment and services to explore and exploit ocean resources. An idea of the extent of these activities can be gauged from the large British participation in the International Oceanological Equipment and Services Exhibition and Conference held in Brighton, England, last February.

Britain is host country for Oceanology International '69, when Anthony Wedgwood Benn, Britain's Minister of Technology, opened the exhibition at the Decca Navigator Company's stand. Mr. Wedgwood Benn, who had earlier opened the exhibition, is inspecting a model of Bacchus (British Aircraft Corporation Commercial Habitat Under the Sea), a new, fully transportable device for underwater exploration which can be deployed to 1000 feet and equipped with lights that can be used for weeks at a time. Oceanology International '69 included equipment from 300 companies throughout the world displayed in 55,000 square feet of exhibition space. Special oceanographic research and survey vessels from Britain, Russia, America and Poland were on view at two nearby harbours.

International organisations taking part included the United Nations Food and Agricultural Organisation, UNESCO, and the International Monetary Fund.

There is an acute need for rapid gathering of data in the production of accurate charts of the seabed; the total tonnage of world shipping is rapidly increasing, and the introduction of huge supertankers means that depths of channels must be precisely calculated and charted. Some channels tend to silt up and need to be carried out quickly and often to be of optimum benefit.

With this in mind, the Decca Navigator Company exhibited details of its joint project with the firm of Hovemarine to construct, equip, market and operate the world's first high-speed automated hydrographic surveying system. The ship, Sea Surveyor, is equipped with a mechanical system for underwater exploration which will be capable of carrying out marine surveys at more than twice present speeds, and under automatic control.

The craft, built by Hovemarine, will cruise at 30 knots (55.5 km/h), while pre-programmed survey lines can be surveyed using the Decca Omnimatic 70 computer coupled to a Decca Atlas autopilot. Depth information is recorded by echo-sounder and displayed in analogue form on a chart, and...
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is then converted into a digital form to be recorded on punched tape together with the craft's position and time.

On completion of the survey a punched tape is fed into a shore-based computer which will "type out" the finished chart, making all necessary tidal corrections. The first order for a production Survey-marine has been received from the East Pakistan Inland Water Transport Authority.

FAST DATA-LOGGING
Another company concerned with the rapid processing of marine data is Dynamco, which has for many years supplied data-loggers to marine scientists. It displayed the latest addition to the Microscan range, the 6500 HiScan, a fast data-logging system capable of recording microvolt level signals at up to 150 channels/second on computer-compatible tape.

The HiScan uses the same scanning and serialising systems as the standard Microscan range, but has a modified voltmeter with a scale of 1,000 microvolts providing the necessary high speed analogue-to-digital conversion. A unit of this type was delivered recently to one of Britain's most important marine establishments, the Admiralty Underwater Weapons Establishment. The same company also recently introduced the 6400 Microscan, a four-tier multi-function system with an input capability of 100 channels, programmed range changing controlled by a pin board and dual output capability. In addition to the measurement of signals from analogue voltage signals—for example, thermocouples and resistance thermometers—the 6400 can be fitted with a constant voltage power supply for strain gauge bridges, or an automatic off-limit detection and warning system and a six-decade digital look for real time print-outs as well as other optional equipments.

TRANSMITTING BUOYS
As an alternative to gathering oceanographic and meteorological data by making measurements from a ship, a number of companies have developed ocean buoys which can be moored at a variety of depths and automatically transmit data to shore or shipborne stations. One type, shown on the stand of E.M.I. Electronics, can be moored at depths down to 19,680 feet (6,000m), and provision can be made for it to accommodate sub-surface and surface electronic packages and sensors.

The standard buoys have a sub-surface float that can support instrumentation to a maximum weight of about 110 pounds (50 kg), and a surface float that can hold up to 22 pounds (10 kg). The surface and sub-surface floats are launched separately and there is an automatic mooring device. More than 150 buoys employing similar automatic mooring principles have been successfully launched.

SOPHISTICATED DATA-PROCESSOR
A sophisticated data-processing system for small research vessels was also displayed. Called the Elliott Hydropic System, it will be fitted to the British fisheries research vessel EXPLORER and will increase considerably the amount of data that small vessels (up to 200 feet—61m) will be able to collect and process at sea.

The system was designed originally for ocean surveys and research, and has been expanded, initially for research purposes on board the EXPLORER, but with a
general application to fishing vessels. It uses an Elliott MCS 920c computer and its on-line computing techniques will be used to gather and process data from about 60 sources.

Facilities include connection of any electronic navigational aid to the system, signals from echosounders are monitored and analysed, and the behaviour of the trawl is monitored by acoustic measuring and telemetry systems. Other logging functions include strain gauge accelerometers, trawl warp vibration, warp angle measurements, and so forth. Audible warning of loss of optimum engine room conditions is given, and corrective actions indicated.

One of the problems associated with presenting data from an echo-sounder to a computer is that in many cases information about the seabed is recorded in analogue form — that is, as a direct trace of the contours of the bottom. This has to be converted to digital form for analysis by a data-logger. In an attempt to speed up this process, Kelvin Hughes has introduced an automatic digital output unit which can be used in conjunction with its MS 36 hydrographic echo-sounder. This sounder consists of recorder, power/transmitter unit, and transducer. The standard model operates at 32 kHz and is provided with either inboard or outboard transducers. The automatic digital output unit provides a depth readout, either at a fixed rate determined by internal circuitry or on demand from an outside source.

CORRECTION

In John Marriott's article on page 71 (column 3, eight lines from bottom) in the February/March/April, 1969 edition of "The Navy", 'The Royal Navy's New Tactical Teacher', the whole playing area is described as covering 2,048 square miles. This should of course, read 'in an area 2,048 miles square'.

BE A SPORT!

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Remember The Life You Save

MAY BE YOUR OWN
Continuous training periods of 7 and 10 days duration were conducted in January.

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<th>Naval Establishment</th>
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<th>Course</th>
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<tr>
<td>H.M.A.S. CRESWELL</td>
<td>5-12 January</td>
<td>Physical Training Instructors Badge Air Badge</td>
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<td>H.M.A.S. NIRIMBA</td>
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<tr>
<td>H.M.A.S. ALBATROSS</td>
<td>5-15 January</td>
<td>Gunnery Badge</td>
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<td>H.M.A.S. WATSON</td>
<td>5-15 January</td>
<td>Gunnery Badge</td>
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Invaluable sea training for 5 days was also given to 45 Cadets who travelled from Sydney to Adelaide in H.M.A.S. "SYDNEY". These personnel returned to N.S.W. by coach.

Weekend training took place in the following ships and establishments—


The Annual Swimming Carnival was held in H.M.A.S. PENGUIN on Saturday, 22 February. The overall aggregate point score winner was Scots College R.A.N.R. School Cads Unit followed closely by T.S. TOBRUK (Newcastle Unit).

Weekend training took place in the following ships and establishments:


The overall aggregate point score winner was Scots College R.A.N.R. School Cads Unit followed closely by T.S. TOBRUK (Newcastle Unit).

In equal third place were T.S. HAWKESBURY (Gosford Unit) and T.S. PARRAMATTA (Parramatta Unit). The year’s decision was made that the trophies and medals for the three annual competitive meetings (Swimming, Athletics, and Sailing) would be presented at a special ceremony to be held at the end of the year.

The first of the 1969 Annual Inspections by the Representative of the Flag Officer-in-Charge, East Australia Area took place on Saturday, 1 March when Commodore K. Graham, M.B.E., R.A.N., inspected the Hunter’s Hill Unit, T.S. WARREGO.

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It is pleasing to be able to report that the Cadet Force in New South Wales has been declared a Hot Weather Area for all Units.

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

Parades are held on Saturday afternoons and certain Units hold an additional parade once 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.

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Australian Sea Cadet Corps

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

NAME

ADDRESS

STATE OR TERRITORY

PHONE No.

AGE

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

THE NAVY
By C. Sattler and B. Morrison.
Photographs supplied by the authors.

On the 15 November, 1939, the keel of the first Australian improved "Tribal" class destroyer was laid down at Cockatoo Docks and Engineering Co. Ltd., Sydney. She was launched on the 30 October, 1940 by Lady Gowrie. Having been commissioned on 30 March, 1942, under the command of Commander J. C. Morrow, D.S.O., R.A.N., ARUNTA proceeded on a period of working up trials, which consisted of anti-submarine patrols and escorting coastal convoys.

The 29 August saw her first victory against the enemy, when she detected and sunk by depth charges, the Japanese submarine RO 33 ten miles South East of Port Moresby. Whilst operating in the New Guinea area, she rescued the survivors of the S.S. ANSHUN, which was sunk at Milne Bay by Japanese cruisers on the night of 6/7 September, 1942.

In January, 1943, ARUNTA took part in the evacuation of guerrilla troops from Timor, becoming a unit of Task Force 74 on the 4 May. This Force consisted of the Australian cruisers AUSTRALIA (Flag), SHROPSHIRE, destroyers WARRAMUNGA, ARUNTA and U.S.S. RALPH TALBOT and HELM. As a unit of this Force, she supported the American landings at Kiriwina and Woodlark Islands during June-July, 1943. In company with the three other destroyers of the Force, ARUNTA bombarded Japanese ammunition dumps near the mouth of the Anwek River (New Britain) TF 74 next supported the landings at Arwe in December and the second landing at Cape Gloucester on 26 December, 1943. Temporarily attached to TF 76 (U.S. Amphibious Group), ARUNTA and WARRAMUNGA took part in the landing of the U.S. 32 Division at Sio, New Guinea. She captured her only prisoner of war in this area, when the pilot of an enemy aircraft was rescued after he had been shot down by American fighter planes.

In March, 1944, as a unit of TF 76, she took part in the landings at the Admiralty Islands. Rejoining TF 74, she supported the Hollandia invasion and the capture of Wadke Island in mid-May, expending over 300 rounds of 4.7 inch ammunition in this later bombardment. While acting as a guard ship for the Bok landings, ARUNTA with other units of TF 74 and TF 75 (cruiser group), contacted four Japanese destroyers on the night of 7 June, 1944. A high speed but unsuccessful chase developed (ARUNTA exceeding 30 knots), which was abandoned when the leading allied destroyers were 30 miles South East of Mapi Island.

ARUNTA also participated in the following operations in this area:

2-7-44 — Took part in the bombardment of Noemfoor Island, Dutch New Guinea 545 rounds 4.7 inch fired.
7-44 — Bombardment of coastal guns east of Aitape, New Guinea.
30-7-44 — Support of landings at Cape Sansapor as a unit of TF 78.

After a refit in Sydney, she rejoined TF 74 and took part in the last major landing in the New Guinea campaign, the seizure of Morotai Island 15 September, 1944. ARUNTA sailed from Hollandia on 13 October as a unit of TF 77.3 (cruise group) under
In January, 1954, ARUNTA sailed for a seven month tour of duty in the Far East operating as one of the allied units of the Korean Patrol groups based in Japan. Returning to Sydney in October for a refit, once again she sailed in mid-May for her second deployment in the Far East, returning to Sydney on 19 December, 1955. Most of the time was spent around Australian waters until 16 June, 1956, when ARUNTA arrived in Sydney for the last time flying her paying off pennant. She was handed over to dockyard hands on 21 December, 1956 for preparation to be placed in reserve having steamed 357,273 miles since her commissioning in 1942.

For eleven years since she remained in the Reserve Fleet at Sydney, many people hoping she would be preserved as a Naval Museum, but unfortunately, it was announced that this valiant ship had been sold to the China Steel Corporation in 1959. It was this ship that had been sold to the China Steel Corporation in 1959.
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Corporation of Taipei, Formosa, on 1 November, 1968.

The tow to the breakers yard at Kaohsuang was started at 10.50 a.m. on 12 February, 1969 by the Japanese tug "Toko Maru", ARUNTA leaving Sydney for the last time at 1.20 p.m.

At sunrise on 13 February, 1969, ARUNTA was observed to be listing to starboard. The tug reversed course for the coast but at 1.15 p.m., the tow was cut as ARUNTA was lying on her starboard side, capsized, eventually sinking by the bow at 4.40 p.m. in position 33.42 South, 152.23 East.

Armed with a fireboat.

Sister Ships — WARRAMUNGA, BATAAN (ex KURNAI).

STATISTICS AS COMPLETED

Displacement — 1,970 tons


Machinery — 2-Parsons Geared Turbines, S.H.P. 44,000 = 34 knots (sea speed 36.5 Knots

NOTE: In 1955 Turret 4.7 in. removed, 2 pdr. replaced in 1950 by 2-40 M.M. A.A. (2 x 2). Armament after Conversion to Anti-Submarine Destroyer — 4-4.7 in. (2 x 2), 6-40 M.M. A.A. (6 x 1), 4-21 in. (1 x 4) T.T., 1 squid triple barrel anti-submarine mortar.

Displacement — 2,012 (standard), 2,700 (full load).

Complement — 293.

Thirty-two THE NAVY Moy-Junio-July, 1969

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**Australian Navy Judge Advocate Observes U.S. Military Justice**

His Honor Judge Trevor G. Rapke, Queen's Council, Judge Advocate General for the Naval Forces of the Commonwealth of Australia, visited military installations in the United States under the sponsorship of the Judge Advocate General of the U.S. Navy, Rear Admiral Joseph B. McDevitt.

The purpose of Judge Rapke's visit was to study U.S. military justice and correctional systems and to discuss certain aspects of International law, administrative discharges, and criminal investigations.

His visit included tours of naval activities in San Francisco, Los Angeles, San Diego, Great Lakes, Boston, Newport, New York, Washington and Norfolk. He was an Army guest at Fort Riley, Kansas, and at the Judge Advocate General's School, Charleston, Virginia.

He toured Air Force facilities at Richards-Gebaur Air Force Base, Missouri, and Marine Corps facilities at the Marine Corps Development and Educational Command, Quantico, Virginia. As part of his research into military disciplinary and correctional programmes, he probed the U.S. Disciplinary Barracks at Fort Leavenworth, Kansas, and the Naval Disciplinary Command, Portsmouth, New Hampshire.

In 1965 Judge Rapke was made an Honorary Professor of Law at the Naval Justice School, Newport, R.I., and was at the same time admitted to practice at the U.S. Court of Military Appeals.

During his visit to the West Coast, Judge Rapke presented mementos of the late Prime Minister of Australia, Harold E. Holt, to the wardroom of the U.S.S. HARRY HOPE, HULL, and to the wardroom of the U.S.S. ARNOLD HOLT (DE 1074), named in honour of the former Prime Minister.

Judge Rapke's visit has also featured such diversions as a night cruise in a Chicago police car, attendance at the St. Patrick's Day Parade in Boston, and a tour of New York City by helicopter.

Judge Rapke departed the U.S. on 24 April for the United Kingdom where he is continuing his comparison of military justice and correctional systems.

HAROLD HOLT (DE 1074), named in honour of the former Prime Minister.
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More than 13,000 ships of many nations, ranging from aircraft carriers and giant supertankers to trawlers and hydrographic survey vessels, today have the facility of high-precision automated navigation through a unique British system of continuous position-fixing and recording. The Decca Navigator system, which is effective over wide areas from Japan to the Baltic Sea and from the Persian Gulf to North America's Gulf of St. Lawrence, also assists some 3,000 aircraft. Used by 14 navies of the world, the system was first employed to enable mineweepers to clear precise paths across the English Channel for the Allied Invasion of Europe in 1944.

The ability to establish and record tracks makes the system useful for trawlers working over shoals of fish or near reefs and seabed obstructions that might foul nets, and also for hydrographic survey vessels. It also provides accurate navigation control in routing schemes currently operating, or visualised, that fall within the transmission range of the Decca chains of radio stations. The use of modern radio navigational aids for this purpose is a recommendation of the International Maritime Consultative Organisation, resulting from an inquiry into the implications of the loss of the oil tanker TORREY CANYON off the south coast of England.

Some 34 Decca chains of radio transmission stations cover more than 6,500,000 square miles (16,800,000 km²) of land and sea in the Northern Hemisphere. The system will soon be introduced in the Southern Hemisphere, with the building of five chains around the South African coast.

DECCA NAVIGATOR WORLD COVERAGE

THE NAVY

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THE NAVY
May-June-July, 1969

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BEST WISHES TO NAVY ASSOCIATION

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conjunction with groups of shore-based transmitters working in the 70 to 130 kilocycles frequency band. It is entirely different from radio direction-finding, there being no directional "beam"; a network or grid of intersecting position lines is established through the synchronised Decca transmissions.

Basically, the system comprises three elements: the chain of transceiving stations, the receiver and Decimeter combination in a ship or aircraft, and the specially overprinted charts or maps on which the information from the Decimeters is plotted to provide a position-fix.

A chain consists of three pairs of transmitters, a common central master and three outlying slave stations. 50 to 100 miles (80 to 160 km) from the master, which arc designated red, green and purple. In the ship are three Decimeter indicator dials similarly designated as colours. Through the medium of the receiver, these indicators are actuated by the continuous unmodulated radio waves, with slave signals phase-locked to the master.

Decca Navigator hyperbolic system, illustrating an aircraft at the intersection of the red and green co-ordinates.

The Decca Navigator Mark-6 display head and associated controller provides a pilot with a continuous indication of his position.

Each Decimeter displays a relative to the ground stations. The numerical reading, the value of special charts are covered with a which at any given moment depends upon the position of the ship numbered to correspond to the...
Deco meter readings. The space between the grid-lines is called a lane, and the Deco meter counts the lanes as the ship or aircraft passes across the grid.

To take a fix, the officer of the watch will take the readings from only two of the colour Deco meters, that is those corresponding to the two patterns giving the best angle of cut on the chart and with these establish the point on the chart at which the two indicated position lines intersect, providing a precise position of the ship.

This operation is extremely simple, even for a person with no navigational training; it can be understood within minutes, it is claimed, with a high degree of proficiency in one or two hours. The receiver, measuring less than four cubic feet (0.1 m³), operates unattended, no tuning or other adjustments being required. Switching on and turning of the selector switch to the number of the transmitter chain are the only operations necessary for receiver use. Fixes can be obtained in a matter of seconds, and their accuracy is said to be unimpaired by violent movement of the ship or state of weather.

CONTINUOUS IMPROVEMENTS

Decca has continually improved and increased the facilities of the Navigator since it was first established. The introduction of lane identification transmissions in 1948, an important characteristic of the system for cross-checking and setting up, marked the expansion of the firm's equipment on an international basis.

This multipulse system entails the transmission of additional composite signals from the ground stations. It facilitates a new technique that provides improved position-line geometry from the patterns of adjacent chains. A position line of one chain is crossed with that of another to give a good angle of cut.

AUTOMATIC PLOTTING

Decca has carried automation even further into the mariner's world with the Marine Automatic Plotter, which provides an accurate and continuous record of a ship's position as registered by the Navigator. Actuation of the Deco meters is translated into a pen and paper movement, along both horizontal and vertical axes, to show the ship's track at any given moment. This is drawn on a compact display unit on which an area of chart measuring approximately 10 inches by 10 inches (25 cm by 25 cm) is visible at all times. Sections of chart moving progressively and automatically into position as the ship advances.

The facility enables ships to follow any desired course without the need for manual plotting, and is intended primarily for operations that demand accurate holding of pre-determined tracks or the recording of tracks that can be analysed later. As a result, it has particular applications, such as fishing, the navigation of ferries in congested and hazardous traffic routes, hydrographic surveying, dredging, undersea oil exploration, cable laying, sea search and certain naval operations.

A new track plotter — type 1877 — is to be introduced soon, which will widen its potential applications, particularly in merchant vessels for general navigation. It will not only accept Deco Navigator information, but other systems such as Loran when outside Decca coverage. It will also be possible to feed in dead-reckoning factors, such as heading of the ship and log distance readings.

INCREASING FISHING PRODUCTIVITY

The Decca Navigator is installed in more than 6,000 fishing vessels. A Norwegian Government survey of the effectiveness of such installations showed that productivity of a trawler or seiner can be increased by more than 20 per cent.

In the past, acceptance trials of new vessels have been limited by problems associated with measured distances, with visibility of shore markers and other factors governing consideration. Now, with Navigator and plotter installed, it is stated that trials can be conducted independently of such restrictions to an accuracy of about one-tenth of one yard, to a range of 100 miles (160 km), and a complete record of the trials, including turning circles, acceleration and crash-stop information is recorded. This is particularly useful for modern vessels such as the huge new tankers that are steadily approaching the 500,000 deadweight tons mark.

At the other end of the scale, Navigator and plotter can be of great use in the laying of buoys at precise points.

SITING OF CHAINS

With 18 chains operating in Britain and continental Europe, 3,500,000 square miles (6,970,000 km²) are covered by the system in north-west Europe alone. In North America, five chains provide navigational coverage of the Canadian eastern seaboard and the New York area.

The waters of the Persian Gulf are completely covered by two chains that provide pin-point navigation leading the world's tankers to the Middle East oil terminals. The approaches to the major Indian ports of Bombay and Calcutta are serviced by two chains, while in Japan the sea surrounding Hokkaido is fully covered. A further Decca chain, in Kyushu, is being constructed and there are plans to cover the remaining Japanese waters.

EVEN GREATER ACCURACY

While the Navigator system has brought a high degree of precision to position-fixing at sea and in the air, an even higher degree of accuracy has been achieved by a derivative of the system called Hi-Fix. This can be operated as a mobile chain of transmitters and has proven to provide the necessary accuracy over a shorter range required in such operations as hydrographic survey to create the charts of seas and waterways.

Along the master-slave base line of the system, a position fix can be repeated by this system within one yard (metre), to a range of approximately 100 miles (160 km). This degree of accuracy is not only
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THE NAVY

May-June-July, 1969

Page Forty-three

Page Forty-two
The Gun

A Developmental Resume

First of a Series: by Galatea

The Editor Invites Readers to Comment on this Article

Ever since Man discovered that, unlike other carnivores, he must rely on artificial aids to both hunt for his food and to counter his enemies; he has been fascinated by the power he evolved of being able to strike and kill, if necessary, from a distance.

The simple thrown rock was his bowmen in the 11th and 12th Centuries and was used to devastating effect in numerous major battles of the period. Massed, high-plunging fire was the tactic employed and when used "en bar rage" in a similar manner to the massed hub-to-hub artillery of World War I, produced appalling casualties amongst packed lightly armoured troops and cavalry. Such tactics were often the deciding factor in the frontal encounters which were the order of the day. King Harold II was killed in this manner at the Battle of Hastings in 1066 by a Norman arrow through the eye.

The scene at the height of the battle that brought about the last conquest of England. The picture is after an engraving from a well-known painting, and the death of Harold is shown. The Norman Duke (afterwards William the Conqueror) commanded his archers to shoot high in the air, and it was one of these missiles, falling "like a bolt from heaven," that cost the English king his life.
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Mechanically operated missile-directing devices were in use long before the birth of Christ, and certain types of these weapons were the only form of "artillery" known until the 14th Century. The ancient Romans in particular made notable use of, what were for the first time, rather sophisticated engines of war including huge catapults powered by a large skein of rope tensioned by pulling back on the arm of the catapult. That which was to be projected was placed in a large cup on the outer extremity of the arm, and then released.

A fair measure of distance could be achieved with this device, but being a large cumbersome machine, it was far more likely to be used in a static posture than in actual battle. Siege operations were its metier and many bizarre objects were hurled into the beleaguered towns and cities, including vessels of burning pitch, rocks, and even putrefying corpses: the latter for the purpose of spreading disease amongst the defenders.

THE CATAPULT

The above illustration shows that ingenious weapon of warfare the Roman catapult, being used to better down the walls of Carthage. This apparatus threw enormous stones, stones or arrows, the missiles being sent hurtling through the air when a heavy bow was released.

Page Forty-seven
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Naval operations of the time were assisted by smaller versions of the catapult, a cumbersome weapon of the size of vessel, and one of the very first guided weapons also made its appearance. This was an exceptionally large, crossbow-shaped weapon, usually mounted to fire forward, and which directed very large flechettes against enemy ships. Rags, sheepskin or wadding were wrapped around a proportion of the shaft’s length, then soaked in pitch or oil and set alight prior to firing. The primary objective was to set the ship afire and was therefore not intended to be an anti-personnel weapon, although, no doubt, other uses for it were found.

One of the first examples of chemical warfare raised its head in this era in the form of “Greek Fire”. The exact origins and ingredients of this compound are obscure, however its use was well established even prior to the time of the Roman Empire. As far as we can ascertain, the occasions of its use were not plentiful, even so, it found employment both at sea and on land. An educated guess names at least two of the ingredients — being boiling pitch and sulphur; the whole being heated under pressure — presumably with a type of bellows — and then let pass out through narrow tubes which could be directed by the operators at the foe: all very similar to the modern flamethrower, except that means of igniting this dangerous concoction are not known with certainty.

We shall never be certain as to exactly who discovered gunpowder, unless new documents come to light. However, the British historian Parrington (1960) concludes that as far as China was concerned gunpowder was known in the latter part of the Mongol Yuan Dynasty (A.D. 1260-1368), when the Chinese still had to acknowledge the existence of gunpowder notwithstanding the Chinese still had to acknowledge the existence of gunpowder. The Franciscan friar, Roger Bacon, writing approximately A.D. 1260, was the first man to actually record the composition of gunpowder, inasmuch as is known at the present time. But it is interesting to note that, awareness of the existence of gunpowder notwithstanding, the Chinese still had to purchase stone-throwing catapults from Persia as late as 1273 during the siege of Huang-Yang Fu. It is true that the Chinese had Roman candles, fire arrows, incendiary grenades and a primitive form of rocket, but it seems they were unaware of the explosive properties of gunpowder until 1365, when one of the first notations was made concerning “cannon”.

Almost from the beginning of the use of explosives in warfare, the gun and the rocket have co-existed. However, historically speaking, one of the main differences between the two weapons is not the obvious one of variance in type, but that which lies in the historical circumstances, prolonged development period of the rocket. Almosl 700 years were to elapse between the first recorded use of rockets in war (A.D. 1232) and the early years of the 20th century. All though that period the rocket activity escaped from the classic “firework on a stick” formula, whereas developmental work on the gun proceeded apace, combining book industry and craftsmanship, especially in the case of small-arms. Since it was — and still is — the predominant weapon, let us examine the ancestral development of the gun.

Like gunpowder, the origin of the first gun is clouded by myths, legends, half-truths and only a little fact. The first real evidence of its existence comes to light in 1326 with the first written reference to cannon, contained in a decree issued by the Council of Florence. The first-known illustration of a gun was found in Walter de Milemese’s English manuscript of the same year and depicts a bullock’s nose-shaped gun with a flared bell-mouth resting on a kind of treble. It is depicted as firing a large arrow with a bronze head and tail. Since there is no wadding or similar substance wrapped around the shaft to aid compression of the charge, power and range must have been very low, together with arroscopic accuracy.

The human race is indebted to China for the invention of so many wondrous things as paper, the original printing press, gunpowder, of woodblocks, and the compass; however one of the few things of which we can be fairly certain, about the origin of Gunpowder (black powder) is that the Chinese did not discover it.
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So, here at last we have the principles upon which artillery and naval ordnance were to remain based until the second quarter of the 19th Century. Iron, brass or bronze cannon, firing metallic spherical shot by means of the sole propellant and explosive known until a century or so ago, i.e. black powder. But there were some surprising variations. Stone round-shot was used, for the reason that, being lighter in weight than metal shot of the same calibre, greater range was possible for the same amount of propellant and, conversely, by using a lesser charge of powder in any given calibre (using stone shot) one could still obtain the same range as gunners using metal shot and a larger charge.

A less obvious but equally valuable reason for the use of stone round-shot was that an invading army need only carry a minimum of "ready use" metal round-shot in its baggage train; the remainder being formed on the spot by masons travelling with the army. In those days, when major wars were usually conducted in a very chivalrous and formal manner, the opposing sides usually had ample notice of the time and location for the impending clash, and so the masons had the opportunity to choose and use the local stone for the making of shot. However, since it was impossible to make stone shot as spherically perfect as its metal counterpart, cannon attribution was very high due to wear and explosive jamming. Grapeshot appeared at this time, but when this anti-personnel shot was in short supply the gunners were in the habit of ramming almost any available debris down the barrel, with the result that, once again, this uneven fodder caught upon scoring within the barrel, and upon firing packed itself into a solid mass and jammmed, thereby destroying the gun through explosive, in the process often killing or at least wounding the entire gun-crew. The lessons here in still had not been learned three centuries later, as 18th century blunder-busses occasionally blew up in the hands of coach drivers for the same reason.

But the most far-reaching development of the period was in the actual construction of guns. Even though large bells were being perfectly cast at this time, gun-casting was in its infancy. So, the first cannons were made up of longitudinal iron bars arranged in a circle, like barrel staves, partially welded, and then molten lead was poured into the remaining spaces for sealing purposes. The whole was held together with many iron hoops driven over the resultant tube and closed at one end with a heavy plug which, in turn, was wedged in position.

Contrary to popular opinion, breach-loading cannons appeared early in the 15th Century. They were generally small, light pieces with a calibre seldom exceeding four inches. The best example of this sub-type of gun is the breech-loading petarara made in the manufactory described in the previous paragraph. The complete breech was detachable and a number of them could be pre-loaded with powder and-ball and placed near each gun. When required for action, the gunner only had to place a loaded breech into the breach-block or breech-mouth, a wedge was driven into place, thereby securely fastening the breech-block to the barrel proper. A red-hot wire was then thrust onto a primed touch-hole in the breech, and upon firing the flash ignites the black powder. The resultant explosion, in the process often killing or at least wounding the entire gun-crew. The lessons here in still had not been learned three centuries later, as 18th century blunder-busses occasionally blew up in the hands of coach drivers for the same reason.

Guns of this period were unwieldy rather than heavy. However, we cannot progress further without mentioning a few huge guns — enormous even by today's standards — which the gunmakers of Europe produced in the mid and later 15th Century. The famous bombard "Mons Meg" was made in the previously described manner in Flanders from iron bars and hoops. Still on its huge wooden carriage with four iron-rimmed and studded spoked wheels, this famous piece is at rest in Edinburgh Castle. Its impressive statistics include a weight of five tons, a length of over 13 feet, a calibre of 19 inches and an ability to weigh a 1,125 pound iron shot to a range of 1,400 yards. A 54 pound stone shot could be fired for a distance of 2,800 yards. Mohammed II had several huge guns cast around 1450 for the siege of Constantinople. But eleven years later his bronze masterpiece was cast in the form of the "Dardanelles Gun" now residing in the Tower of London. This great weapon is 17 feet long, its weight 181 tons, and could fire an 800 pound stone shot to a distance of approximately 1,250 yards — an remarkable achievement. For easier handling for transport, the great breech could be unwound, an engineering feat in itself considering the bulk and weight of the gun, although it was most as-

The gunner only had to place a loaded breech into the breach-mouth, a wedge was driven into place, thereby securely fastening the breech-block to the barrel.
During the Spanish siege of Gibraltar (1779-1783) it was discovered that the 5.5" mortar bombs could be fired from 24-pounder cannon which had a calibre of 5.8". By shortening the fuse, the bombs could be made to explode at long range and in mid-air over the heads of the Spanish besiegers, thereby achieving with cannon that was otherwise impossible to do with mortars, for obvious reasons. As this was at best a makeshift device, Lieutenant Henry Shrapnel of the Royal Artillery designed a new type of shot in 1784. He called it "spherical case" shot and it comprised a hollow, round, thin-walled shot, filled with bullets and with the smallest possible burning charge which was only intended to break open the casing together with a standard fuse having an accurate predetermined length. A protracted decision to accept the shot was not forthcoming from the Ordnance Board until nineteen years later in 1803.

Navy ordinance has always had its own special problems, including the magnified one of keeping large quantities of black powder free from dampness in an unlikely and hostile environment, together with the confined and inflammable barracks, which of course precisely describes the wooden-walled fighting vessels of old. Also inherent with this form of combat were lack of manoeuvring room and between decks, for the guns and men, crowded with the long, flat and unimpeded ranges at which "slugging" matches could, but in fact rarely were, fought. Add to these factors the picture of what could happen when heavy guns broke loose in a room and hurtled through the living spaces, and the frightful injuries inflicted by huge splinters of wood flung up by the powder, as is well known.

Loose powder, in a wooden ship at the height of battle, presented a considerable fire and explosion hazard, so the exact quantity of powder required to charge a particular size of gun was made up in a paper cartridge. Apart from the obvious dangers of misunderstanding this method the knowledge that the same quantity of propellant was being placed in the gun each time it was charged helped the gunner considerably when aiming his weapon. If the shot charge also

THE NAVY

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The stage was almost set for what was to be the rapid tran-
sition from tradition to the modern ballistics era. The Royal Navy had first experimented with elongated shot in 1776, with the simple in-
tention of firing a heavier projectile without any increase in the cannon's bore, since it was found that when firing two shots simulta-
neously from the same weapon, each ball diverged considerably at longer ranges. The original oblong shot was cylinders rounded at each end; although the increase in re-
coil was considerable, the innovation was justifled; longer range was achieved. The wheel had almost turned a full circle. Lieutenant Colonel Croly of the British Army pro-
posed the use of a breech-loading rifled cannon with load-mounted shot in 1821, and in 1826 Lieutenant Colonel Miller of the R.N. Brigade invented the cylindrical pointed shell incorporating a per-
cussion fuse, although it had to wait until the Battle of Sinope (1853) and the Crimean War (1854-55) before it was first used with devastating effect.

Man's natural conservatism being what it is, it's hardly surprising that such 'advanced' ideas as breech-loading were not in general use until almost 70 years after Lieutenant Croly's original idea was proposed. Thanks to the Scottish clergyman John Forsythe, an in-
tention patented by him in 1807 was to revolutionise the whole world of gunnery, from the smallest to the largest siege gun. That invention was the Percussion Cap.

Forsythe's original intention was to speed up the lock time on his favourite fowling piece, as he was an ardent pheasant hunter. There was a considerable time-lag between the fall of the cock and the actual discharge of the weapon. This annoyed him considerably, because alert birds could escape the initial flash in the pan as the trigger was squeezed and could hence manoeuvre to escape the main charge. After considerable experimentation he succeeded in getting a very small amount of fulminate of mercury into a small "cap" of varnished paper which was inserted into a hollow in the striking face of a newly-designed cock (or hammer). Upon pulling the trigger the hammer was re-
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THE NAVY
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The biggest guns the world has ever known came into being when the Krupp arsenal designed and manufactured the two examples of the gigantic 80 cm Super Kanone (E) 140.6. Named Gustav and Dora respectively, each gun needed 4-6 weeks for construction and dismantling, and a 4,720-man detachment commanded by a General to maintain, protect and operate each weapon. Included in this figure was a 250-man loading and firing team. Each 25 ft. long shell weighed 10,500 pounds, with a range of 51,040 yards (29 miles). The rate of fire was, at best, 2 rounds per hour. Each gun, with its 80-wheel double-bogie railroad track carriage, weighed 1,350 tons! This was the Germans’ last big effort. Gustav was used on only one occasion, at the siege of Sevastopol, when approximately 40 shells in all were fired. One shot destroyed a heavily protected Soviet ammunition dump 100 feet underground. There is no record of Dora having ever been used in action.

To close this dissertation I would like to make clear certain points. As far as is practicable, within the scope of the subject under discussion, I have attempted to stay with the mainstream of weapon development, leaving the tactics concerning their use as far as possible by the wayside. Also, I apologise if I have not included other inventions and developments which readers may feel are pertinent. Included in this category are all small-arms, from pistols and rifles to medium machine-guns. These will be covered, along with the developmental history of guided missiles, in later articles within this series.
Slowly, with the rising sun, the ships of Rear Admiral David Farragut’s East Gulf Blockading Squadron moved towards the defences of Mobile Bay, in an attempt to close the last major Confederate controlled port in the Gulf of Mexico.

As early as the 16th of February, 1864, ships of the blockade had shifted to the attack, softening up the bay’s outer defences, and on the 2nd of August preparations were got underway on the wooden ships for the coming battle. Splinter nets were hung on the starboard sides, chains and hammocks were placed around the vital parts of the ships, all spars above the top masts were removed and on the U.S.S. “Richmond” even the top masts and top rails yards were struck.

By the 5th everything was in readiness and at 4.30 a.m. the ships began to take up their battle stations in the following manner. Farragut intended to run under the powerful guns of Fort Morgan, which could bring 43 rifles and smooth bores of between 10 inch and 32 pounder calibre to bear on the squadron as it passed. So as to blunt the fire of the fort’s guns he placed his monitors, of which he now had four (the single turret vessels “Teecumseh” and “Manhattan” and the twin turret eight draft vessels “Winnebago” and “Chickasaw”) to starboard of the wooden ships in a single line, with “Teecumseh” in the lead. The screw slopes of war with a gunboat lashed to their port side, 14 altogether, took up positions to port of the monitors so as to be spared the major part of Confederate fire.

Then once past the fort his ships would then engage the Confederate Squadron operating inside the bay. This squadron under the command of Rear Admiral Franklin Buchanan (Merrimac — Monitor engagement 9th March, 1862) consisted of a casement ironclad, the “Tennessee” and three paddlewheel gunboats “Gaines”, “Morgan” and “Selma”, all of which were unarmoured.

At 5.40 the fleet in sunny line moved in to the attack, with hoarse shouts of command mingled with rattling gun tackles and beating drums to disturb the stillness of the morning.

At 7.06 the first Confederate shots whistled out and as each ship came in range the firing became general. In the engine rooms of the monitors the stokers worked in temperatures of 150°, seeing nothing of the battle until they were moved up to the turrets for a breathing spell. The frequent blows on the turrets and the blinding smoke of their 15 inch guns being discharged quickly told them that neither their comrades or the enemy were idle.

As the monitor “Teecumseh” moved past the fort, she navigated...
towards the "Tennessee" which now moved towards the Federal fleet to engage.

From the second monitor the "Manhattan" men observed a tiny white wave of froth curl around the "Tecumseh's" bow as she reeled a little to starboard, then plunged to the bottom bow first, with her propellers still revolving in the air. On the "Hartford" to port of the monitors the crew sprang to the starboard rail and gave three ringing cheers in defiance of the enemy and in honor of the dying as the sloop passed through the wake of the sinking monitor.

In the sloop of war "Brooklyn" directly to port of the sinking Tecumseh there was a frothing of foam around her stern as she began backing to clear a row of suspicious looking buoys directly under her bow. Farragut was lashed to the rigging of his flagship the "Hartford", to get a better view of the battle quickly realizing the line was likely to be thrown into confusion directly under the guns of the fort yelled out "Damn the torpedoes, full speed ahead," and with this his flagship moved out from behind the torpedoes, which were heard bumping against the hull. The rest of the force followed.

The "Tennessee" now bore down on the flagship intending to ram, but this threat was avoided although the Confederate broadsides were not. The "Tennessee" then passed on down the line attempting to engage each ship in succession and in the course of this maneuver the she was ineffectually rammed by the sloop of war "Monongahela."

By this time the slow moving monitor, had moved up from the fort and began to open fire so the "Tennessee" moved to under the guns of the fort for protection.

As for the small Confederate gunboats, well they had not seen much of the action. The C.S.S. "Selma" was chased across the bay and forced to surrender by the U.S.S. double ender gunboat "Meta-comet", which had cast off from

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...the port side of the “Hartford” shortly after she engaged the “Tennessee”. The “Gaines” suffered a steering casualty early in the battle and was forced to retire and be run aground after she had been subjected to a concentrated fire from the passing “Hartford” and “Rich mond”. The “Morgan” engaged the “Metacomet”, trying to save the “Selma” but she faced the possibility of being cut off and captured so she retired under the guns of Fort Morgan and later escaped across the bay to Mobile.

The Union force now anchored briefly for breakfast and to take care of the wounded, and as the men looked across the bay, which now had become overcast they could see the sun outside the bay silhouetting the dark shape of the “Tennessee” under the guns of Fort Morgan, while up the bay the C.S.S. “Selma” could be seen boldly engaged with the “Metacomet”.

But hardly had the fleet stopped than the order was given prepare for action, and as men hastened to their stations the dark shape of the “Tennessee” could be seen moving from under the guns of the fort.

Farragut realized the destruction of his flagship was the intent of the ram, so he ordered his squadron to attack with gun and bow. For an hour the battle raged. The four times the “Tennessee” was rammed seemed to effect her little, but a shot from “Manhattan”’s 15 inch gun managed to remove two feet of wood and five inches of iron, but it failed to cause any casualties.

Broadside after broadside poured out at ranges of less than 10 feet, but the Confederates’ fighting ability was not diminished until a lucky shot damaged the exposed steering chains which due to Confederate inexplicable negligence lay exposed aft. For 20 minutes the “Tennessee” drifted with the current bounded by the unceasing fire of the Union monitors and wooden ships, but by 10 o’clock Commander J. D. Johnson, C.S.N., on behalf of the wounded Rear Admiral Franklin Buchanan, C.S.N., emerged from the ironclad under a white flag uttering the words “For god’s sake don’t fire. I surrender. I surrender.” From behind the bulwarks and engine rooms of the Union ships Black faced sailors appeared to cheer as the twin turretted monitor “Chickasaw” slowly towed the disabled ram towards the “Hartford” as a trophy of victory, a victory which would keep its full harvest in the following days.

That very afternoon the “Chickasaw” moved up to the rear of Fort Powell and reduced the fort via the unprotected side, and by the 22nd of August Fort Morgan, the last Confederate bastion at Mobile Bay had surrendered thus putting the finishing touch to the battle of the 5th, which had now deprived the army of the south of its last port in the Gulf of Mexico through which supplies and arms could be shipped from Europe.
Sir Barnes Wallis is working on the design for a fleet of containerised, cargo-carrying submarines, which will travel North from Great Britain and turn left under the polar ice cap to reach the Pacific Ocean and Japan.

It does not sound particularly practicable, but that can be said of most of his ideas.

Indeed it was said of most of them, but they all worked in practice. He is a scientifically-minded engineer with a flair for finding completely original solutions to problems.

Sir Barnes Neville Wallis, to give him his full name, is a courteous, lively, grey-haired man, whom one would place in his middle fifties. In fact he is 81, and fifty years ago he had already started designing the airships that were to occupy him until 1930. But he started his career in an unusual way.

After leaving school, he trained as a marine engineer at J. S. White and Company's shipyard at Cowes, where he met Hartley Pratt, the airship designer, who had recently left the company that had built Britain's first airship.

This was the Mayfly. Pratt was sure that it was structurally unsound. The name turned out to be uncoincidentally comic for the airship broke up as it was leaving the hangar, and when, in 1913, the company, Vickers, was asked by the Government to build another, it clearly considered that someone would soon recognise a bad design and probably produce a good one.

Hartley Pratt was invited to design what eventually became R9 and he asked Barnes Wallis to come to Vickers with him.

CHEQUERED CAREER

The R9 had the chequered career that seems usual in the airship industry. It was started in 1913, but was cancelled in 1915, when there were ideas that the Great War would soon be over. Barnes Wallis and Hartley Pratt enlisted in the Artie's Rifles.

Then it became clear that the war would not end quickly and they were recalled to finish their job.

The R9 was not really an original design, but Barnes Wallis's next one, the R10, was.

He had realised that the classical cigar shape of the Zeppelin was an ineffective one he decided that his ship was to be streamlined and thus more economic on fuel.

He started work in 1917, but the war ended before the airship was finished and government backing for what was essentially a military project was withdrawn. It was time, he thought, to get some academic qualifications.

RAPID PROGRESS

This took six months. London University demanded an Intermediate Examination, which usually took students a year; it took Barnes Wallis three weeks.

He then had what is normally a two-year course ahead of him for a degree in engineering.

This he finished in five months. Next he considered that he should polish up his knowledge of languages, so he taught in Switzerland.

Finally, coming to the conclusion that there was no future in airship designing, he went back to his old company, Vickers, as a salesman.

This was the only unsuccessful time in his career — he has been quoted as saying that his entire sales were worth only £29 — but at that moment there was a revival of interest in the airship.

A scheme for a fleet of trans-oceanic passenger airships was proposed by Commander Burney, and the first two, R100 and R101, were started at the same time as rivals.

Each had to be able to carry 100 passengers at 70 m.p.h. to India, and Barnes Wallis's design, the R100, made a successful trial flight to Canada and back.

Unfortunately the R101 crashed on her maiden flight and the plans for an airstrip fleet were abandoned.

This story, incidentally, has been admirably told by the novelist Nevil Shute, who was working with Wallis at the time as a mathematician, in his autobiography Slide Rule.

NEW TECHNIQUE

So Barnes Wallis turned to aircraft design and went to what was then Vickers Aviation Ltd. at Weybridge.

There he worked out how to build large aircraft by using a technique he had invented.

His geodetic construction method uses a lattice of thin girders which remain strong even if some of the girders are damaged, and Barnes Wallis and Rex Pierson, the chief designer at Vickers, used the method to build the Wellesley.

This aircraft was to establish the world's long-distance record in 1938, when two of them each flew 7,159 miles. This success led to the designing, by the same team, of the Wellington, an enormously successful bomber used in World War II.

BOMB DESIGNER

From aeroplanes Barnes Wallis went on to tackle the design of bombs. He was successful at the and two enormous empty bombs
small bomb could not inflict severe damage; using lots of small bombs, aiming was not accurate enough.

"DAM BUSTERS"

His next innovation, the bouncing bomb, was used. Dams were important war-time targets, but they were small targets, as seen from the air, and secondly because hitting the top of a dam did not markedly affect its ability to retain water.

So he devised the quite extraordinary idea of making a spherical bomb that could be given backspin as it left the aircraft. It would then skim along the water behind the dam until it reached the solid structure, which would be breached by the explosion. The bomb was successful in the raid it was used in, but it was not used in later raids.

His big bombs, on the other hand, were.

By now, bomb-dropping had improved and so had the technique of building bomb-proof shelters for bombarding rockers.

These launching sites were now impenetrable to ordinary bombs.

Barnes Wallis’s ten-ton bombs were so effective that the idea of launching from fixed sites was abandoned and a system of launching from moveable platforms was developed by the Germans.

SUPERSONIC PLANE

After the end of World War II, Barnes Wallis returned to aircraft design and attacked the problem of making an aircraft that would fly at supersonic speeds.

The difficulty is that supersonic flight demands swept-back wings so that the aircraft does not break up in front of them in an impene-

able wall.

Unfortunately, heavily swept-back wings do not provide sufficient lift for taking off and landing at low speeds.

NOVEL APPROACH

The Anglo-French Concorde solves the problem by using a nar-
row delta wing, which provides lift at slow speeds if it is relatively steeply inclined.

Barnes Wallis used a completely novel approach for his design the Swallow, which had movable wings.

The aircraft took off with its wings in the normal position for subsonic flying and then swung them backwards for supersonic flight, so that the aircraft looked much like a paper dart in shape.

His wings differed from conventional ones in another way.

Normal aircraft wings are fitted with slats and flaps to give lift at slow speeds, airbrakes to slow the aircraft, trimming tabs to adjust the balance of the aircraft in flight and ailerons to control roll.

The tailplane has elevators to point the aircraft upwards or downwards.

This collection of projections into the slipstream adds drag and lowers the efficiency and, in any case, the idea of using separate control surfaces, one for each function, is unworkable.

Concorde does away with most of them. The wing itself provides braking and low-speed lift, but the aircraft still needs elevons. combined elevators and ailerons, fitted to the trailing edge of the wings.

Barnes Wallis’s Swallow did away even with these.

The scientific adviser to the Ministry of Aircraft Production thought that Barnes Wallis’s swing-wing design had possibilities and he was given a contract to develop the idea.

He made a successful working model and spent nine years on experiments that provided the data for a scale design. Unfortunately the Swallow was cancelled, but it was taken up by the U.S.A.

NEW SEA ROUTES

Barnes Wallis’s latest idea was put forward at the 1965 meeting of the British Association.

The nuclear submarine Nautilus had successfully travelled under the polar ice cap, and Barnes Wallis recognised that this feat opened up completely new sea routes.

Larson could be reached by way of the Bering Strait and the whole journey would take a fortnight off the time taken by a ship going round the conventional sea route.

What made the idea particularly attractive to Barnes Wallis was the fact that sea transport is much cheaper than land transport.

This meant that it was cheaper for shipping companies to carry raw materials to a factory, and finished goods away, by sea than by land, this in turn meant that countries with extensive natural resources did not necessarily have insuperable advantages over small islands.

There are two problems.

One is that submarines are not fast under water, but Sir Barnes the was knighted on June 8, 1968) is sure he can solve the problem and he is also sure that he can solve the problem of propulsion. Nautilus was nuclear-powered, but nuclear-powered submarines are not economic for commercial use.

Any conventional fuel has to be burned and exhaust must be discharged.

This makes the submarine operation expensive and also means that the long last has to be taken in as ballast.

When I saw him, Sir Barnes made it clear that he re-thought the problem and could solve it in a radically new way.

If he says so, he certainly can.

One of his colleagues told me that he was always a bit disturbed when Sir Barnes came to a design decision, as he was always likely to produce a novel idea that everyone else wished he had thought of.

The details of his containerised submarine fleet are bound to include a lot of ideas like that.
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 to 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".

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A BRIEF HISTORY OF THE PAKISTAN NAVY

Captain Rifat M. Shaikh, P.N.

Two decades ago, Pakistan inherited a small, inadequately equipped Navy. Our young Navy's inheritance comprised a meagre, ill-assorted share of ships, Naval equipment and personnel. Training institutions, which fell to her lot, were very few and still in their infancy, while docking, repair, logistic and maintenance facilities were non-existent. To crown all these deficiencies was the acute shortage of officers in the Service; there were only four Muslim officers who had 8 years of service and all the 50 Muslim officers of the service had joined the Royal Indian Navy during the Second World War.

Though time has travelled a comparative short span of 20 years, the Pakistan Navy has come a long way. Today, the Navy comprises a modern, well-equipped fleet, compatible with the resources and defence requirements of the country, and a closely knitted shore organisation, containing adequate docking and repair facilities, and training institutions imparting highly specialised and skilled professional knowledge to the Naval Personnel.

A cursory glance at the peculiar geographical position of Pakistan makes it amply clear that the Navy is destined to play a major and vital role in the development, integration and progress of the country. Pakistan has two distinctive features, judged from the point of view of naval strategy. The two wings are separated by 3,000 miles of sea and a large measure of Pakistan's prosperity is inevitably bound up with the seaborne trade, flowing through different regions. These outstanding factors actually influenced the role of the Navy. Some of the important functions this Navy is designed to perform are as follows—

(a) Maritime Defence of the Country.
(b) To maintain East-West link over the ocean.
(c) To assist the Army in the riverine defence of East Pakistan.

The development and expansion of the Pakistan Navy has, therefore, been effected with an eye on its role in times of national emergency. The development plans envisaged a steady balanced expansion of the fleet, training of officers and ratings, particularly of the more technical branches; establishment of well-equipped supply and shore base, and construction of a modern dockyard, which could cater to the docking and repair requirements of the fleet.

During the first three years of its development, plans were made for the expansion and integrated development of the Navy. During this period, steps were taken to set up small organisations of logistic supplies, and the building of a Naval Dockyard, complete with all the requirements. This phase saw the conversion of P.N.S. HIMALAYA, the Gunnery School into the Combined Training Establishment. The training for all categories of seamen, specialising in Guns, Torpedo and Anti-Submarine Navigation, Radar, Signal and Communication Branch personnel; Supply and Secretariat and Electrical Branch personnel, were started as early as December, 1947. Other measures adopted were the setting up of the Mechanical Training Establishment, P.N.S. KARSAZ, in the BOR's Rest Camp at Manora and the training of officers in HIMALAYA. A Cadet Training School was also started where cadets were trained for a period of one year at pre-cadets before sending them to the United Kingdom for further training as substantive officers with the Royal Navy.

By the end of the first phase of the development period the Navy was able to overcome some of its initial handicaps. The manning and training position started looking satisfactory. The bulk of the ships that we had at that time were made operational. It was during this period that a multi-purpose plan for the future size and shape of the Pakistan Navy was formulated. The object of the plan was to modernise and expand the Fleet in order to be able to perform various roles; and to provide fully developed Naval Bases, shore facilities and installations at Karachi and Chittagong for achieving self-sufficiency in repair, maintenance, logistic support and all training and administrative requirements of the Fleet.

After the consolidation of the Service, which always precedes the expansion of the Fleet, other measures were taken to augment the defensive and offensive potentials of the Navy. At the time of Independence the Pakistan Navy had only a few frigates.

NAVAL HEADQUARTERS

The Command is exercised by the Commander-in-Chief through Naval Headquarters. He is assisted by Chief of Staff and four Principal Staff Officers, i.e. Deputy Chief of Naval Staff (Operations), Deputy Chief of Naval Staff (Pers.), Deputy Chief of Naval Staff (Technical) and Deputy Chief of Naval Staff (Supply Services).

NAVAL OFFICER-IN-CHARGE, CHITTAGONG

The Naval Officer-in-Charge, Chittagong, is the C-in-C's representative in East Pakistan. He exercises operational control over the ships and craft placed under him.

AFLOAT ORGANISATION (COMPAK)

The Commodore Commanding P.N. Flotilla is responsible to the C-in-C., Pakistan Navy, for the operational readiness and training of ships placed under his command, which is divided into three main groups, viz., the Destroyer Squadron, the Frigate Squadron and the Minesweeping Squadron. Each Squadron Commander is responsible to COMPAK for the fighting efficiency of his ship.

BASES AND BUILDING FACILITIES

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The Battle Of The Coral Sea
May 4-8, 1942

THE STORY OF THE CORAL SEA BATTLE AND ITS SIGNIFICANCE IN AUSTRALIAN HISTORY

In 1942 Australia's fate was being decided by the battle of the Coral Sea, the turning-point of the Pacific war. But for American aid we should have been defeated.

The full significance of the joint American-Australian Naval and Air victory in the Coral Sea Battle was not generally realised until its historical and geographical importance became evident in the march of events towards the downfall of Japan. Even today, its proximity to the Australian coastline, and the possibilities involved had the Japanese plans succeeded, are not appreciated by many.

The Coral Sea Battle was the first serious check to the amazingly rapid series of Japanese successes, which had advanced Japanese power well south of the Equator. The margin between victory and defeat was extremely small. Reliable authorities have stated that had the Japanese been successful, our position in New Guinea would have proved untenable and the whole of the north-east Australian coastline would have been open to invasion.

The Coral Sea Battle is now rightly recognised as a landmark in the history of Australia. It marks the nearest approach of hostile forces in strength to the coast-line of Australia and our deliverance from threatened invasion.

The Japanese plan and the following extracts are taken from the full documented U.S. Naval History of World War II by Samuel E. Morison.

Basic Japanese War Plan
Following Japanese successes in 1941, three new conquests were planned:

1. Tulagi and Port Moresby, in order to secure air mastery of the Coral Sea;
2. Midway Atoll and the Western Aleutians, in order to bring the United States Pacific Fleet to a decisive engagement;
3. New Caledonia, Fiji and Samoa, in order to cut lines of communication between the United States and Australia.

All three moves were in the Japanese Basic War Plan, as stated in Japanese Combined Fleet Operation Order No. 1, promulgated Nov. 1, 1941. "The Areas which are to be rapidly occupied or destroyed, as soon as the war situation permits," were (1) Areas of Eastern New Guinea, New Britain, Fiji and Samoa; (2) Aleeutian and Midway Areas; (3) Areas of the Andaman Islands; (4) Important points in the Australian Area. The whole of the "Op Order" is from the Nachi Documents (recovered from cruiser Nachi in 1945), translation by Capt. E. T. Layton from the original.

Japan's overall plan for the Coral Sea Operation was: "With the cooperation of the South Sea Army Detachment and the Navy, we will occupy Port Moresby and important positions on Tulagi. We will establish air bases and strengthen our air operations in the Australian area."

The Japanese Task Force for the Coral Sea invasion comprised:

The Port Moresby Invasion Group of eleven transports carrying both Army troops and a Naval Landing Force, screened by a destroyer squadron;
A smaller Tulagi Invasion Group;
A Support Group of one seaplane carrier and 5 other ships;

The Japanese Invasion Group of eleven transports carrying both Army troops and a Naval Landing Force, screened by a destroyer squadron;
A smaller Tulagi Invasion Group;
A Support Group of one seaplane carrier and 5 other ships;

A Covering Group consisting of light carrier SHOHO, four heavy cruisers and one destroyer;

The Striking Force of two big carriers SHOKAKU and ZUWKAKU, two heavy cruisers and six destroyers — a total of 62 ships.

The Task Force, which included Australia and HO-BART, consisted of two heavy carriers, LEXINGTON and YORKTOWN — 8 cruisers, 13 destroyers and 3 other ships — a total of 26. It was under the command of Admiral Frank Fletcher.

Tulagi was to be occupied first, on May 3; then the Support and Covering Groups and Striking Forces would cover the Port Moresby Invasion Group, which would leave Rabaul on the 4th and land a sizeable army at Port Moresby on the 7th. (A timetable that was never carried out!)

The Japanese expected the United States Navy and the Army Air Force to try to stop them. But once the Allied Task Force entered the Coral Sea, Admiral Inouye expected to destroy it by a pincer movement while the Invasion Group nosed toward Jamard Pass into Port Moresby. Then the carriers would proceed to smash up Allied planes and ships at the four Queensland bases, as they had done so successfully at Darwin.

Admiral Chester Nimitz and General Douglas MacArthur regarded this Japanese thrust as a major threat. Port Moresby was not simply a place to be denied to the enemy; it was essential for General MacArthur's strategic plans. He intended to develop this outpost as a major air base to block enemy penetration of Australia and as a starting point for his return journey to the Philippines.

Into the Coral Sea

At about 0800, on May 3, the Tulagi Invasion Group made an unopposed landing on the beaches, which United States Marines were to win back three months later.

By May 5 the Port Moresby Invasion Group was still anchored at Rabaul, scheduled to leave at 1800 next day.

On May 4, planes from YORKTOWN made three separate attacks on shipping in Tulagi harbour, damaging one destroyer and sinking a few smaller ships.

By May 5 the Port Moresby Invasion and Support Groups were steaming merrily along a southerly course aimed at the Jamard Passage through the Louisiade Archipelago. The Japanese Striking Force was beating down along the outer coast of the Solomons. By dawn on May 6 the enemy carrier was well into the Solomons. By the morning of the 6th, Intelligence confirmed that the Port Moresby Invasion Group was getting closer to the New Guinea through Jamard Passage, and that there would come through next day for the 8th, if not stopped.

At 0900, on May 6, Admiral Fletcher received a signal from the north-west to be within striking distance of the Port Moresby Invasion Group by daylight on May 7. The main action of the Battle of the Coral Sea should have been fought on May 6 and would have been if either Admiral had been aware of the other's presence.

By midnight on May 6 the Port Moresby-bound transports were closing Misima Island, almost ready to slip through Jamard Passage. The Covering Group was well into the Coral Sea. The Port Moresby invaders, SHOHO furnishing the combat air patrol until then.

This was the day, May 6, that marked the point of the low point of the war for the Japanese. General MacArthur was forced to surrender his forces in the Philippines. But on this day there were two events of new and brighter chapter in the Pacific war. The time had come for a turn of theLEAFs in the Port Moresby Invasion Group, which United States Marines were to win back three months later.

The decisive action was fought on May 7, 1942, in the Coral Sea. The battle began early on May morning of May 7 and continued through May 8.

The planes came in as aser in three waves. Three 500-pound bombs hit the destroyers, two exploded within a few minutes she buckled amidships and sank stern first. Another two bombs, one by a suicider who exploded against No. 4 gun station, caused extensive damage. Phillips ordered all hands "make preparations to abandon ship and stand by". She drifted for four days and was finally scuttled on May 11.

SINKING OF "SHOHO"

While the planes of the Japanese Striking Force were slaughtering "SHOHO" and SIMS, the Port Moresby Invaders, SIMS and NEOSHO, furnishing the combat air patrol until then.

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The big carrier battle was over by 1140 on May 8. But at 1247 a devastating internal explosion knocked LEXINGTON from stem to stern. More explosions followed, each more violent than the last. At 1707 abandoning all hope of ever getting out, LEXINGTON was sunk by her own destruction. The two opposing carriers of the Battle of the Coral Sea had met a fate that neither could have envisaged.

The invasion of Port Moresby was thwarted. But the enemy had retired; his main objective, the invasion of Port Moresby, had been thwarted. Before the end of May 8, Inouye formally postponed the Port Moresby invasion until July 31. But Midway settled that. One less than a month later, on June 4, Japan lost four of her best carriers at the Battle of Midway — which was the turning point of the Pacific war. Coral Sea was the end of the beginning — Midway was the beginning of the end.

Invasion Thwarted

But the enemy had retired; his main objective, the invasion of Port Moresby, had been thwarted. Before the end of May 8, Inouye formally postponed the Port Moresby invasion until July 31. But Midway settled that. One may well ask what prevented the Invasion Group from reversing course again and steaming through Jamard Passage to its original course again and steaming through Tulagi were a cheap price to pay for the capture of Port Moresby, was immeasurable. It was a story of cool efficiency, relentless action, determination and superb heroism.

The Battle of the Coral Sea will be ever memorable as the first purely carrier against carrier naval battle in which all losses were inflicted by air action and no ship on either side sighted a surface enemy. It was a tactical victory for the Japanese, but a strategic victory for the United States. The enemy inflicted relatively greater losses than he sustained; SHOHU and the few small ships sunk at Tulagi were a cheap price to pay for the great victory of Midway. The morale value of the battle to all Allied nations, coming as it did immediately after the surrender of Corregidor, was immeasurable. It was a story of cool efficiency, relentless action, determination and superb heroism. Less than a month later, on June 4, Japan lost four of her best carriers at the Battle of Midway — which was the turning point of the Pacific war. Coral Sea was the end of the beginning — Midway was the beginning of the end.

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