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JOURNAL OF THE AUSTRALIAN NAVAL INSTITUTE

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AUSTRALIAN NAVAL INSTITUTE

1. The Australian Naval Institute has been formed and incorporated in the Australian Capital Territory. The main objects of the Institute are:—

a. to encourage and promote the advancement of knowledge related to the Navy and the Maritime profession.

b. to provide a forum for the exchange of ideas concerning subjects related to the Navy and the Maritime profession.

c. to publish a journal.

2. The Institute is self supporting and non-profit making. The aim is to encourage freedom of discussion, dissemination of information, comment and opinion and the advancement of professional knowledge concerning naval and maritime matters.

a. Regular members — Members of the Permanent Naval Forces of Australia.

b. Associate Members — (1) Members of the Reserve Naval Forces of Australia.
(2) Members of the Australian Military Forces and the Royal Australian Air Force both permanent and reserve.
(3) Ex-members of the Australian Defence Forces, both permanent and reserve components, provided that they have been honourably discharged from that force.
(4) Other persons having and professing a special interest in naval and maritime affairs.

c. Honorary Members — A person who has made a distinguished contribution to the Naval or maritime profession or who has rendered distinguished service to the Institute may be elected by the Council to Honorary Membership.

4. Joining fee for Regular and Associate member is $5. Annual Subscription for both is $10.

5. Inquiries and application for membership should be directed to:-

The Secretary,
Australian Naval Institute,
P.O. Box 18,
DEAKIN, A.C.T. 2600

CONTRIBUTIONS

As the Australian Naval Institute exists for the promotion and advancement of knowledge relating to the Naval and maritime profession, all members are strongly encouraged to submit articles for publication. Only in this way will our aims be achieved.

DISCLAIMER

In writing for the Institute it must be borne in mind that the vews expreesed are those of the author and not necessarily those of the Department of Defence, the Chief of Naval Staff or the Institute.

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JOURNAL OF THE AUSTRALIAN NAVAL INSTITUTE (INC)

The front cover features a photograph of an RAN Task Group, consisting of *HMAS Melbourne*, *HMAS Supply*, two DDGs and a River Class DE, in South East Asian Waters.

CANBERRA CHAPTER

On Tuesday, 10 October the Canberra Chapter met in a combined meeting with the Naval Historical Society at the Australian War Memorial. About 12 members of the Institute attended, film clippings from the 'Anzac' series were shown to the interest of all. In the future it is hoped to make an annual get together of these organisations a regular event.

After the Annual General Meeting on Friday, 27 October, about 20 members of the Chapter heard Captain L.G. Fox's presentation on the Garden Island Modernization. A lively question time followed the talk and members were very appreciative of their former convenor's efforts in making his presentation so interesting. Our new convenor, Commander G. Nekrasov presided at this meeting.

Correspondence

Dear Sir,

I read with interest the article on Casey University in the August issue of the Journal and look forward to the author's foreshadowed follow-up discussion on areas of conflict in the planning phase.

May I at this stage make the observation that ADFA grew out of recommendations of the report of the Martin Committee established in 1967 and published in 1970. Since then the need and function of the academy has apparently not been reviewed in the light of general trends in Australian tertiary education.

During the same era another Martin Report (Report of the Committee on the Future of Tertiary Education in Australia) saw a need for a greater variety of teritary institutions. It was in the euphoria of the 60s that noted educaticnalists engulfed by the disease of credentialism set off a chain of unlimited university and CAE expansion.

Some of our many tertiary institutions are now fearful of the possible recommendations of yet another report on education (the Williams Committee) and hopefully this year we may have practical suggestions on how to cope with the chaos caused by plans based on incorrect assumptions.

The earliest date when the first graduates of Casey University could enter the Fleet is 1987 — exactly twenty years after the Martin Committee was established. Enough said!

M.H. DOWSETT

Dear Sir,

I thank Lieutenant Commander Daw and Master ned for their articles on ADFA. I, for one, have learned something from their responses to my plea for some enlightenment. May the Institute continue to generate debate in this manner.

Yours faithfully,

PLATO

Dear Sir

'What does anybody else think?' asked DJM in the August issue in advocating change to the resignation system and suggesting that the service would benefit if more officers were given 'twelve months off' to freshen up attitudes and widen prospectives. Well I for one think these are excellent ideas and I support him all the way.

The 'flexible resignation' suggestion, if adopted on its own, would probably increase the number tendering resignations — as many who are wavering take advantage of the opportunity it offers them to sample life outside; it would cause even more headaches for the posters and planners (with inevitable consequential effects for many). But the advantages would be manifold and I believe it would do much for the morale and attitude of the many who see the service system as locking them in, with resignation ('the one way ticket to freedom') as the only possible escape.

The 'One year off' suggested in the latter part of DJM's letter would have immense therapeutic value but one wonders if it is practical in a Navy the size of ours and suffering the shortages and restrictions we do. For such a scheme to be workable would require that there be a margin, over and above the number of established billets, to absorb the ineffectives. And in the present climate there seems to be about as much hope of gaining approval for that as there is for replacing *MELBOURNE* with a nuclear carrier in 1985.

So, desirable though it may be, let's keep the latter suggestion in the pending basket for now and concentrate on the former. Does anybody else besides me like DJM's suggestion — or are we all so apathetic that we can't be bothered to offer an opinion. We can't take a poll; let's see how many will put pen to paper and declare themselves for or against it. Failure to do so will probably be interpreted by our Lords and masters as an indication that we're all overjoyed with things the way they are. If that's the case then fine; if it's not, how about making your opinion known through these columns.

BJ

Dear Sir,

From a financial point of view it makes little sense to build another university when there are campuses already available to the Services. One is tempted to consider ADFA's roots are founded in other than a logical approach to the needs of future officers and fertilised by someone experienced in mushroom farming.

Master Ned's article (August 1978) emphasised the need for both social and academic intercourse between the civilian and Service communities. Without the balanced view of the Australian community that such contact encourages and the place in that community of both himself and his chosen profession, the Service officer is ill-equipped to discharge his responsibilities to a more informed lower-deck, and meet the challenge of staff appointments. The recent reduction in salary of our junior Steward sailors illustrates an inability on the part of uniformed Naval Officers to avoid a situation which one expects could not have eventuated in the civilian sector. One has little doubt of the effect and final result if a similar salary reduction were attempted within the civilian work force.

ADFA can only perpetuate the insulation inherited by the majority of today's officers. The current RAN scheme of broadening our junior officers' horizons by tertiary education and exposure within an established University (awarding recognised degrees) should continue. ADFA can offer little that is not already available, save insuring its issue will be as ornamented in the corridors of power as the majority of past and present officers have found themselves.

Yours faithfully

C.R.F. Stephens

President's Report

It is very gratifying to be able to report another successful year of growth and development. That indisputable barometer of growth, our membership, has risen by a nett 55 to 343 since the last Annual General Meeting.

You will have observed, I hope with some satisfaction, a steady improvement in the quality of our Journals. The Editorial Sub-Committee, so ably led by Dick Perryman, who has been a member of the team since the very first issue and Editor for the last two years, has been expaned to include David Green, a former Naval Director of Public Relations, and John Mortimer, whose name will be familiar to you from your reading of Jane's. The addition of these professionals — if I may call them that — has greatly helped the other devoted members of the editorial team who give up many hours of their own time getting each Journal together and ready for the printer; they have themselves learnt the business the hard way and have become very professional in the process. In any sense the Journal is our main activity and the principal means by which we have become known, world wide. We've even had a query from a Moscow library! I cannot speak too highly of the Editorial team and I am sure you would want me to thank them on your behalf. And to round off the Journal aspect, of course, getting it editted and printed would seem nothing without Barbara MacLeod who has gone through the quarterly drama of distributing it; I should mention, too, that man of many parts, Harry Julian, who took over Advertising from Robin Pennock. Among other things, that painstaking penmanship on your membership certificates, belongs to Harry. If you think its easy, try writing out 400 names without spilling the ink.

Our Treasurer, David Campbell has not only kept the Council on the path of righteousness financially — so much so that we've shown a healthy profit over the year — but he has also investigated and successfully introduced the Institute's cuff links, crests and Journal covers. All three innovations have proved highly successful and welcomed by your members to judge by the response we have had. Furthermore, David has also found additional time to assist Adrian Cummins with the organisation of the Seminar — which I'll return to later. If only all of us had David's energy, the looming energy crisis would be a breeze.

Chris Barrie, our secretary has also helped to keep the Council in order, collected the mail, and done any number of other jobs not specified in his terms of reference, including affixing the seals and mailing out the membership certificates, all time-consuming and seemingly endless tasks.

And finally, Adrian Cummins, our Seminar Director, has got us set fair for a most professionally organised Seminar which we will be hearing about in more detail later. The brochure is indicative of the thought, care and organisation which has gone into it. I think we benefitted from our first abortive attempt to hold it in May, and we should now be in good shape for what I can only believe should be

a national event of some moment. To date we have already got over 100 seats booked out of a total of 280; but to be worth the trouble we need to have as full a house as possible, so I would urge you all to encourage everyone you know to attend. I am sure the two days will be professionally rewarding, raise the Institute's standing, and give us valuable experience for seminars in the future.

In the Council itself Geoff Cutts prodded us into action to reform the organisation of our Sub-committees, arranged to store our growing volumes of records, and our collection of books. As a result of all these actions our administration is now in much better order.

Among his many other tasks Chris Barrie wrote to Rutgers University and we now have reprint rights to Admiral Wylie's book 'Military Strategy', and for what seems to me to be a reasonably modest fee. But on balance the Council decided that there is some financial risk for a while, and has therefore decided to dwell a pause before taking on an additional role for the Institute as a book publisher. But I am confident that too will come in time.

Altogether then, I can report that it has been a year of progress and innovation; the expanding membership, the rising standard of the Journal, our cuff links, Journal covers, crests, membership certificates, the organisation of the Seminar and the streamlining of our administration in Canberra, all give clear indications of purposeful development over the year. In the various capitals the Chapters have had only a patchy time but again, people have come forward and taken it upon themselves to revitalize the Chapters. So I have hopes for growth in that aspect next year; not least of these developments was the establishment of the Melbourne Chapter.

Last year I quite purposely refrained from mentioning anyone by name in my report in case I offended by some inadvertant omission. I hope that this year by not mentioning every one of our selfless enthusiasts by name that they will not feel that the Council and our members are not grateful for their work and dedication. That would be far from true, and I would ask you to express your appreciation of all those who in this report are the nameless ones but whose less obvious contributions have been just as important in making 1978 another year of measurable progress.

As you will know, the idea of a national headquarters was put on the backburner last year, and there it has stayed; I suspect it will remain quiescent for some time. However, I have some ideas and will try to progress them next year when, I expect to have a little more free time, but please don't hold your breath. Our best hope would still appear to lie with a generous philanthropist, if we can find one.

Finally, you will know that I am not standing for the Council again because, on the 2nd February next year I will no longer be eligible for regular membership. Our rule about serving members only being eligible for regular membership still bothers quite a number of people but I am sure it is absolutely right and I would recommend to you in the strongest terms that you never change it.

Since our earliest beginnings less than five years ago the Institute has lived up to its aim to advance the cause of professionalism in the Navy by providing an open forum for discussion. But it would be less than honest not to state that there are still large citadels of raging apathy still to be attacked — we are not exactly overwhelmed by contributions to the Journal, or for support of the Chapters, and a membership of less than 400 in a Navy of over 16,000 is hardly cause for too much self-congratulations; at the same time, it has been most gratifying to see the growing response and the support the Institute has received, particularly from some of our younger members, and from some enthusiastic and able associates. Taking everything into account, I cannot help but feel pleased about our steady advances, and I am supremely confident about the future of the Institute. So tonight I won't wish you continued success for the future, because to do so might appear to doubt it. The Institute will grow, and it will change in the process, but you can be assured of my continued support and interest in what, I believe, has been a most exciting and necessary venture. I think we have not only demonstrated that the Institute was needed, we've also shown what can be done, and by 'we' I mean all of us as members.

If I can be forgiven one last self-indulgence on this occasion I'd like to close by publicly recording my special thanks to one of the founding members from those pre-establishment days in 1974 and one who was a purposeful force in getting the Institute started. Despite a pretty crushing personal work load he has done a great deal as a founder, as a Councillor, as a Sub-Committee Chairman, as Vice-President, and as Canberra Chapter convenor — I refer of course, to Les Fox. We owe a lot to Les and if I may say so, he has done it all with a self-effacing grace which says far more about him and his character than any words of mine could.

I leave the Institute in good hands. Thank you for the very great honour of having had me as your President.

FROM THE EDITOR

In this edition there is a wide range of articles covering many subjects, all of which are connected in some way with Seapower. Subjects covered include aspects of Australian naval history, both in the last century and personal accounts of more recent events; officer training; the current topic of the aircraft carrier replacement; the impact of technology; nuclear propulsion; and maritime strategy.

Several articles should lead to a lively debate of the subjects covered and we look forward to hearing from members in the form of further articles or letters to the editor.

Several non-members have contributed and we are fortunate to have a first hand account of the recovery of HMAS Perth's bell by the well known diver, David Burchell.

Two of the articles on technology are by distinguished American ex-military officers, Vice-Admiral J.T. Hayward, USN Retd and Major-General R.L. Edge, USAF Retd, who addressed the Canberra Chapter in July. The officers were acting as consultants to Sperry Univac whose Defence Systems Division (International) recently gave a series of presentations on the subject of the Computer Based Command Centres associated with the higher levels of Military Command.

This issue also contains the President's Report presented at the Annual General Meeting on 27th October 1978 and the audited figures of the ANI's financial transactions for the twelve months ending 30th September, 1978. It has been a very successful year and we stand on sound financial ground. Our activities will be able to continue their steady growth without any increase in membership fees, which, it should be noted in these days of inflation, have not risen since the Institute's inception in 1975.

The happy state of affairs is no licence for forgetting to pay the 1978/79 dues, which are payable now. Each year we have to remind some delinquents and our Treasurer's patience wears thin — if you have not already done so, please forward your payment ($10) before the end of December. (A subscription form is enclosed.)

Final arrangements for Seapower '79 are in full swing and the registrations are coming in at a very pleasing rate. Some vacancies still remain and members are encouraged to "recruit" other members of the community to attend this very important function. (See the notice below.)

SEMINAR REGISTRATIONS

Registration forms were included with the August edition of the Journal, and others have been despatched around the country in a big mailing campaign. Inevitably though, someone will have been missed; if you know anybody who would be interested, additional registration forms are available from:

The Registrar,
Seapower '79,
Australian Naval Institute,
PO Box 18,
Deakin, ACT 2600

The President and Council

of the

Australian Naval Institute

take pleasure in inviting you to attend

Seapower '79

at the

Australian Academy of Science Canberra

on

2nd and 3rd February, 1979

THE AUSTRALIAN NAVAL INSTITUTE SEMINAR

Mahan wrote of the United States in the late 19th Century, 'The eyes of the country have been turned from the sea for over a quarter of a century'. This could also be said of Australia today, except that the period would be much longer. It is a curious fact that Australians, generally, regard seapower as a matter for others to exercise, yet, as has been said often enough, the nation is a child of seapower, born, protected and sustained by it to this day and for the foreseeable future.

With this in mind the Council of the Australian Naval Institute considered it appropriate to examine the subject of 'Australia and Seapower', for our first national seminar.

One of the reasons why there appears to be a reluctance to take seapower as a serious concern for an island continent is the kind of thinking which begins with the suggestion that resources for Defence are limited; therefore, it is said, certain maritime combat forces are beyond our purse; therefore, the argument runs, military seapower is not a strategic option for Australia. To put this inverse logic into perspective, the proceedings have been structured to consider the three interacting aspects in their proper logical sequence, *strategy, combat technologies and resources.* To avoid any kind of parochialism most of the speakers are distinguished men who have no former connection with the Institute, so that we may have the benefit of seeing the subject and its aspects through their eyes.

To conclude the proceedings, Admiral Zumwalt, a distinguished and innovative former Chief of Naval Operations of the United States Navy, has kindly consented to draw the three aspects together for us. It will be recalled that, during his time in office, he faced the perpetual problem of democracies in peacetime, that of bridging the gap between limited resources and a perceived strategic need; and he tackled it with characteristic imagination, clarity of thought, daring and vigour. We believe that we can learn a great deal from this intellectual Admiral, as Dr Kissinger once described him; and we hope that you will join us in our search for a better understanding of Australia's need for seapower as we approach the end of the century.

The proceedings will be conducted at an unclassified level throughout, and discussion will be unconstrained by any considerations other than good manners; the Institute seeks to follow the Biblical advice, 'and the truth shall make you free'.

SEMINAR PROGRAMME

Opening

Friday, 2nd February

1400	Introduction to the Seminar	President of the Australian Naval Institute
1405-1420	Opening Address	His Excellency, Sir Zelman Cowen, AK, GCMG, KSTJ, QC — Governor-General of the Commonwealth of Australia and Commander-in-Chief of the Defence Force

Strategic Factors

1430-1515	Australia's Dependence on Sea Transport	The Honourable P.J. Nixon, MP — Minister for Transport
1630-1645	Tea/Coffee	
1645-1730	Australia as a Regional Seapower — An External View	Professor Michaeil MccGwire — Dalhousie University, Canada
1830-2015	Buffet Dinner at the Academy of Science	
2030-2115	After Dinner Address	The Honourable E.G. Whitlam, AC, QC — Visiting Fellow of the Australian National University and former Prime Minister of Australia

Maritime Combat Technologies 1980-2000

Saturday, 3rd February

0930-1030	Panel Presentation — Comparisons of Available Maritime Combat Technologies and their Costs	Major Peter Young — Editor and Publisher of the Pacific Defence Reporter
	• Preventing the use of sea approaches to Australia by others	Commander Tony Grazebrook, RANR — Naval Editor of the Pacific Defence Reporter
	• Securing the use of Australia's sea lanes and vital sea areas	Mr Nat Gould — British Aerospace Mr David Burke — Australian agent of Litton Industries
1030-110	Discussion	
1100-1115	Tea/Coffee	

Resources

1120-1200	Money for Defence	Dr Ian Story — Management and Economics Consultant
1230-1355	Buffet Luncheon at the Academy of Science	

Putting it together

1400-1445	Balancing Strategy, Technology, and Resources — A Personal Experience	Admiral Elmo R. Zumwalt, Jr, USN (Ret) — Chief of Naval Operations, 1970-74
1500-1510	Closing Address	Rear-Admiral N.E. McDonald, AO, RAN

THE QUEENSLAND MARINE DEFENCE FORCE and POLICE ACTION AGAINST NAVY IN QUEENSLAND

by Captain P.H. James, RAN

In the 1870s and early 1880s the Russian scare focussed the attention of all Colonies on matters of defence and, at the request of the Queensland Government, which had come into being in 1859 following separation from New South Wales, Sir William Jervois submitted proposals for the defence of Queensland including:

a gun battery and torpedo defences at Lytton in the Brisbane River;

a gunboat and one or two torpedo boats, plus floating defences and infantry ashore in Moreton Bay;

torpedoes and barge mounted guns in Maryborough and Rockhampton supported by infantry; and

additional telegraph stations on the coast and another gun-vessel for the general defence of the coast.

The gun-vessel, estimated to cost £27,700, was envisaged to be armed with one 8 inch and one 6 inch breech loading gun and capable of steaming at 10 knots for 200 hours. The total manpower was envisaged at 1,060, 50 of whom would be ship-borne, and the recurring annual expenditure was estimated at £13-15,000.

There was considerable Parliamentary debate on this vast expenditure and one member remarked that for some time those in charge of the Naval Defence of the Colonies had forgotton that Brisbane existed and that Queensland, in fact, had a coast — a remark that some parliamentarians could well make in 1978!

Accordingly in 1883 orders were placed with Sir W.G. Armstrong, Mitchell & Co of Newcastle-on-Tyne for two gunboats, of the 'alphabetical' type to be named *GAYUNDAH* and *PALUMA*, similar to the *ALBERT* under construction for Victoria. The only compromise was that the endurance was limited to some 7-800 miles. The origin of the names *PALUMA* and *GAYUNDAH* is from the aboriginal language meaning 'thunder' and 'lightning', respectively.

Although ordered later a second class torpedo boat, the *MOSQUITO*, was the first ship acquired in mid-1884, achieving 17.21 knots on trial and being shipped to the colony aboard a British India steamer.

The *PALUMA* under the command of Lieutenant Richards, RN sailed from England in November 1884 for survey duties which were to last the next 10 years, thus the basis for perpetuating the name *PALUMA* in the RAN Hydrographic Service.

THE AUTHOR

Captain James has commanded HMA Ships *CURLEW*, *STUART* and *TORRENS*. In his present posting he describes himself as 'Naval Officer Commanding, Queensland' in deference to the Governor, His Excellency Commodore Sir James Ramsay, and in case the State authorities suspect history could repeat itself.

HMQS PALUMA in the Burnett River, Bundaberg, circa late 1890s.
by courtesy of N.S. Pixley MBE, VRD, RANR (Rtd)

The *GAYUNDAH*, under the command of Captain H.T. Wright, RN, arrived in Brisbane on 28th March 1885, Captain Wright also being Senior Naval Officer, Queensland Marine Defence Forces.

The 'Brisbane Courier' evinced disappointment at the *GAYUNDAH's* lack of beauty, aptly stated the limitations of the 8 inch gun which trained only 7 degrees off the bow, and emphasised the pneumatic communication from the conning tower which permitted one man to control the ship in action.

Estimates, as is not uncommon nowadays, were lower than reality and in 1885/86 rose to £10,972 for the Marine Force alone which included 3 Boys at £1 per month, 12 seamen at £3 a month, and the Senior Naval Officer at the princely sum of £600 per annum.

A fourth vessel, the *MIDGE* was acquired in 1887 as a picquet boat. She was diagonally built of teak with an inner lining of mahogany, top speed of 11 knots, and armed with torpedoes, a 3 pounder Nordenfeldt gun and two machine guns.

The Government Steamer *OTTER* and five steam propelled hopper barges were equipped with gun mountings as Naval auxiliaries and together with the Naval Brigades at Brisbane, Thursday Island, Cairns, Townsville, Mackay, Rockhampton, Bundaberg and Maryborough constituted the part time forces to support the permanent Marine Force.

Following an offer by the Government of Queensland, *GAYUNDAH* was accepted by the Admiralty in 1885 for service on the Australian Station with the Royal Naval Squadron, subject to all laws and regulations applicable to the RN, and granted the privilege of flying the White Ensign. All costs of the *GAYUNDAH* were borne by the Queensland Government, but to all other intents and purposes *HMQS GAYUNDAH* was one of HM Ships, especially as she was also commanded by Captain Wright, RN.

However, towards the end of 1888 a peculiar situation arose when Captain Wright's appointment was drawing to an end and he sought, from the Colonial Secretary, leave and pay to the end of his term. Correspondence indicated that there already existed some friction, and no wonder when the financially responsible Queensland Government no longer had control over *GAYUNDAH*. Captain Wright was advised that his leave was approved but as he was not departing from the Colony his pay in advance was not approved. Furthermore Captain Wright was advised:

> 'you will be good enough to at once hand over the gunboat *GAYUNDAH*, together with all stores belonging to that ship, and to the various other branches of the Marine Defence Force, to Lieutenant Taylor, First Lieutenant of the *GAYUNDAH*'.

Captain Wright was then formally advised by Lieutenant Taylor of his intention to implement the 'Peremptory instructions from the Government ....', and he responded by placing Lieutenant Taylor under arrest, and advising the

Chief Secretary that his actions contradicted the authority held by virtue of his Commission from the Admiralty, and that he was representing his case to the Lords Commissioners of the Admiralty through the Rear Admiral, Commanding-in-Chief, Australian Station.

The Colonial Secretary placed the facts before the Executive Council who promptly dismissed Captain Wright and gazetted their decision.

Meanwhile Captain Wright was not idle and had coaled and provisioned *GAYUNDAH* without having passed the requisitions through the Queensland Government Paymaster. The response was immediate in that the Commissioner of Police was directed:

> 'to remove Captain Wright from the ship and hand over charge to Lieutenant Taylor'.

The Commissioner proceeded to the Brisbane Botanical Gardens where he left his twenty armed police and proceeded on board. Previously Captain Wright in the heat of the moment, though with probably no grant seriousness, had consulted with his Gunner as to the best point of aim if it were decided to open fire on Parliament House. However, after some initial protestation Captain Wright acceded to the Commissioner of Police, he having threatened the use of force, and left his ship reiterating the illegality of the action as his Warrant was from the Admiralty and his ship was part of the Imperial Squadron.

Subsequent discussion in the Queensland Parliament endorsed the action by the Colonial Secretary but the Brisbane Courier in a long article stated:

> 'there is a difference between a ship wearing the Blue and White Ensign. The former may be, as Victorian vessels are, under entire control of the Colonial Government except in time of war; the latter is unreservedly at the disposal of the Admiral Commanding-in-Chief in times of peace and war ..... the Queensland Government had no more right to go onboard *GAYUNDAH* while she flew the white Ensign and Pendant, and forcibly bundle Captain Wright off his quarter deck, than they would to go onboard *CALLIOPE* (the Flagship) and order the Admiral ashore .... whilst entirely approving in fact of what the Government did against specious Imperialism, we feel the last has not been heard .... if it took two years of correspondence to obtain the privilege of wearing the White Ensign, how many years and how many reams of despatches will be required to settle the awful indignity of removing by the force of a policeman's baton, a Captain in the Royal Navy, in full uniform too, from the protecting shadow of the White Ensign and Pendant?'

The lighter side of the Wright incident was seen as a Gilbertian situation as reproduced at the end of this article.

PALUMA continued with her important but unrecognised survey work until 1895 when she reverted to the Queensland Government. Her only notoriety was when, on 5 February 1893, she was deposited almost on the roadway of the Botanical Gardens by the disastrous flood. Fortuitously a second peak to the flood permitted her to be kedged off the next day.

Meanwhile *GAYUNDAH* paid off in 1893 as a fully manned ship, thereafter only being manned for the Easter period under the Blue Ensign of the Queensland Government for annual training of the Naval Brigade.

Lieutenant Taylor, who had relieved Captain Wright under such intriguing conditions as Senior Naval Officer was relieved by Commander Drake in 1892, who in turn was relieved by Captain W.R. Creswell, RAN in 1900, who afterwards became Admiral Creswell and First Naval Member. Other notable Queensland Naval per-

Excavation of one of GAYUNDAH's 8" guns at Kangaroo Point
— by courtesy Defence Public Relations

sonalities were Commander S.A. Petheridge who became Secretary to the Department of Defence, and Mr George Macandie from the civilian staff of the Naval Staff Office who became Secretary of the Australian Naval Board.

In 1901, at Federation, the Queensland Marine Defence Force had 11 ships and 1,165 personnel, the largest fleet of the Australian Colonies. After Federation *GAYUNDAH, PALUMA, MIDGE* and *MOSQUITO* were transferred to the Commonwealth Navy and were used mainly for training the Naval Brigade, and from 1911, with the exception of *PALUMA* who was sold to the Melbourne Harbour Trust in 1907, were used for training the large influx of compulsory Naval trainees when universal training was introduced.

MIDGE was sold in 1912 and was seen as a private pleasure launch in Moreton Bay for a few years, her engines finally being sent to the RAN Engineering School, *HMAS CERBERUS*, where they appear to have faded into obscurity.

GAYUNDAH, having fired her first and only shot in anger across the bows of two luggers poaching on the pearling grounds off Broome in Western Australia continued service throughout World War I during which she had the forward 8" gun removed and a raised forecastle built to replace the turtle back in order to make her more seaworthy. After World War I *GAYUNDAH* was sold, and served as a sand and gravel barge on the Brisbane River, finally being sunk as a breakwater at Woody Point off Redcliffe in Moreton Bay in 1960 after 76 years afloat.

Today the name *GAYUNDAH* is perpetuated as the Naval Reserve Cadet Unit *TS GAYUNDAH* in Brisbane, and also as the Reserve Training Vessel *TV GAYUNDAH* (ex-Motor Refrigeration Lighter) for the Brisbane Port Division, RANR.

Recently excavation on the site of the old Queensland Maritime Defence Force Establishment at Kangaroo Point resulted in the finding of one of *GAYUNDAH's* 8 inch guns which is presently being restored for erection as a permanent reminder of Queensland's early Navy.

Only in 1977 did the Naval Officer Commanding, Queensland finally vacate the original Naval Staff Office in Edward Street, Brisbane. Whilst originally earmarked as a historical building the Naval Staff Office has been

Naval Staff Office, Edward Street, Brisbane completed 1900 and vacated 1977.
— by courtesy Defence Public Relations

removed from the gazetted list, and regrettably remains vacant and may be allowed to deteriorate before demolition in the name of progress, probably for a riverside roadway. The original name board of Senior Naval Officers is perpetuated in Naval Headquarters in Brisbane from the contentious Captain Wright to the present incumbent.

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PALUMA and GAYUNDAH in the Burnett River circa late 1890s
— by courtesy N.S. Pixley MBE, VRD, RARN (Rtd)

NAUTICAL NAUGHTINESS
or
THE WRIGHT EDITION OF PINAFORE

(Published by Queensland Figaro 3 November 1888)

ACT I.

CAPTAIN CORCORAN (Wright):
I am Commander of the Queensland Fleet
(And Captain Wright you're too).
While the Ensign White I fly,
I the Government defy,
And I do what I please to do.
I bounced Ah Sam by flying that White Flag,
In the name of the Admiraltee.
My expenses I collect,
And they never dare object
To the vouchers signed by me.

CHORUS: What, never?

CAPTAIN: No, never!

CHORUS: What, never?

CAPTAIN: Well - er - hardly ever.

ALL: They hardly ever object to $\frac{he}{me}$

SIR JOSEPH PORTER (Morehead):
You're not the monarch of the sea,
For you've got to consult with me;
The leave you applied for the Government grants,
Go home to your sisters and your cousins and your aunts.

ACT II

CAPTAIN:

Most things are not what they seem,
Skim milk masquerades as cream;
Here's insult to Navy sailor,
In command's Lieutenant Taylor;
Guard, place Taylor in arrest;

And the Admiral shall know
How colonial cheek can show,
How it scoffs at naval might,
Laughs to scorn the Ensign White.

JACK RACKSTRAW (Lieut. Taylor):

Farewell mine own, Wright of my heart farewell
For crime unknown I go to a dungeon cell.

SIR JOSEPH PORTER (Morehead):

Put your head inside a bag,
We care nought for your White Flag,
Though you played it low on Sam
You can't fool us with your sham.
Tell the Admiral, alack!
That we've given you the sack;
Oh! we mean it straight, you bet,
Here's the 'Government Gazette.'
You, instanter, are dismissed,
Struck out of our naval list;
For the servants whom we pay
When we order must obey.
'Sacked' you are, since you persist,
And 'you never will be missed.'

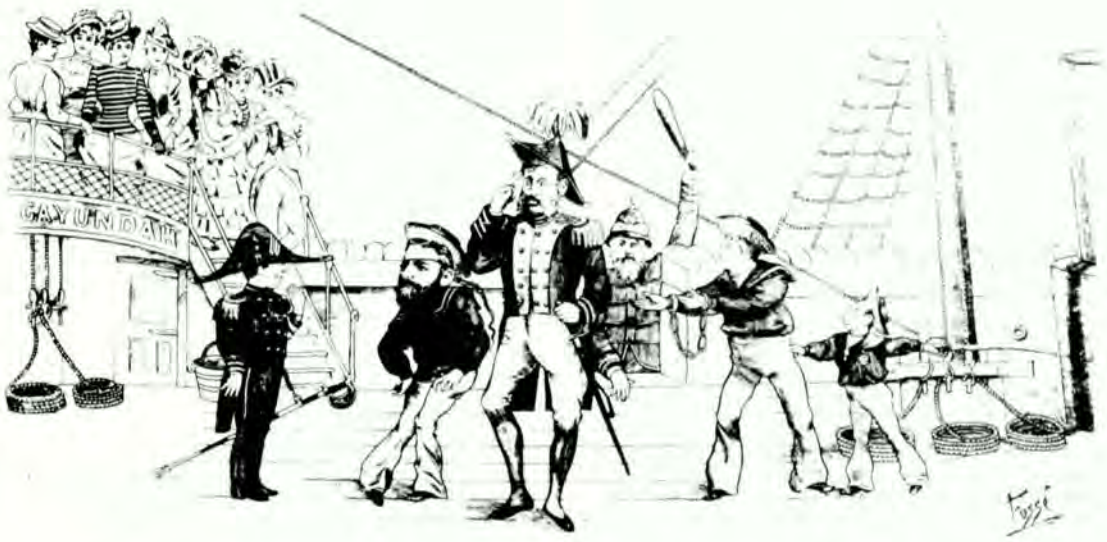
POLICE (Heard singing):

When the Captain with his gunboat would skedaddle
Would skedaddle,
It devolves on us to boldly board his barque,
Board his barque,
And to cover all the perils of the paddle,
Of the paddle,
Twenty bobbies wait to pot him from the park,
From the park,
By superior force we opposition smother,
-ition smother,
Though we're gentle as a maiden in our fun,
In our fun;
Taking one consideration with another,
With another,
A policeman's life is not a happy one,
Happy one.

CAPTAIN:

I'll be revenged — I'll get the Admiraltee
To straightway bombard the colonee.

(Curtain)



Nautical naughtiness or the Wright Edition of Pinafore. The dismissal of Captain Wright as seen by Queensland Figaro

THE LILLIPUTIAN FLEET

by Ross Gillett

Between May, 1884, and June, 1914, four Australian colonies operated four unique second class torpedo boats, each constructed by Thornycroft and Company of Chiswick, England, and designed for harbour defence purposes. The first of the four to arrive in Australia was the Tasmanian vessel, named simply *TB No. 1*, followed by the *LONSDALE* and *NEPEAN* (Victoria) and finally *MOSQUITO* (Queensland). Each of the twelve-ton craft was delivered via steamers from England and cost between £3,300 and £4,600 per boat.

The four torpedo boats were manned by approximately seven to ten men. This number comprised an engineer, a coxswain, a forehand boat man, a stoker, an electrician plus torpedo officers and gunners.

LONSDALE and *NEPEAN* reached Melbourne on board the *SS PORT DARWIN* on 7th July, 1884. "The Argus" reported on the two boats the next day; "Their hull is divided into watertight compartments and the forward part contains the space to be occupied by the crew and the torpedoes launching tubes and gear. The boiler is of the locomotive type having a working capacity of 130 pounds per square inch. The engines are compound surface condensing having cylinders of 8¼ inch and 13½ inch diameter respectively with 8 inch stroke and are of 100 indicated horse-power. There are also an air pump, feed pumps and donkey pump. The fan is 2 feet 3 inches in diameter and makes about 1,300 revolutions per minute. Abaft the engine room is a cabin for two officers fitted similarly to the larger boat. (i.e. *CHILDERS*).

"The conning tower in these boats is fitted with a telegraph communicating with engine and boiler rooms as in the larger boat. Their armament consists of two 14 inch Whitehead torpedoes. They are also fitted with an arrangement by which steam from another boiler can be introduced among the water in the boiler of the boat so as to heat it quickly and get up steam in a few minutes."

"These boats are also fitted with a ram bow, strengthened so as to be useful as a means of offence in action between boats. The second class boats, although seagoing, are not intended to keep the sea, but they are provided with lifting links and gear and as they weigh only about 11 tons they can be transported by either larger vessels or by rail."

SPECIFICATIONS

Each boat displaced 12 tons. Principle measurements were; length 63 feet pp and 67 feet oa, beam 7½ feet, draught 1-1/12 feet fwd and 3¼ feet aft. Maximum speed was 17 knots and economical speed about 10 knots. Two sets of dropping gear for 14 inch torpedos was carried by each boat.

THE AUTHOR:

ROSS GILLETT is a public servant employed in the NSW Department of Education. He is the author of the book Warships of Australia and has recently become the Secretary of the Naval Historical Society.

BASIC INFORMATION

	T.B. No. 1	LONSDALE	NEPEAN	MOSQUITO
Ordered	30th March 1883	1883	1883	1883
Yard No.	191	190	189	193
Launched	1883	1883	1883	16th July 1884
Completed	January 1884	1884	1884	July 1884
Arrived Australia	1st May 1884	7th July 1884	7th July 1884	1884
Cost	£4,524	£3,300	£3,300	£3,800
Fate	Hulked 1910	Hulked June 1914	Hulked June 1914	Hulked 1913

BRIEF CAREERS

TB No. 1

The Tasmanian boat was towed to Battery Point for fitting out shortly after arriving in Hobart. She ran her first trials on 10th October, 1884, when she was commanded by two officers from *HMS NELSON*. On 15th May, 1885, *TB NO. 1* proceeded to Ralph's Bay and carried out surveying duties. She was paid off in 1895, and transferred to the South Australian Government. The latter colony's gunboat, *PROTECTOR*, called into the Tasmania capital between 23rd and 28th April. *PROTECTOR's* crew were employed preparing the torpedo boat and taking on board stores and gear from the Hobart depot. With *TB No. 1* in tow *PROTECTOR* set sail for Adelaide on 28th. However, the next day rough weather was met and the torpedo boat overturned. Fortunately, she was well battened down and little water found its way inside. *TB No.1* was righted in Port Arthur, and the pair continued their passage. Adelaide was reached on 3rd May, 1895. Under new ownership the boat saw even less activity and in 1910 was finally hulked in the Adelaide harbour Board Dockyard.

LONSDALE and *NEPEAN*

The Melbourne "Age" reported on 8th July, 1884, that *LONSDALE* and *NEPEAN* were to be handed over to Captain Thomas "who will at once have the boats placed in commission". One of the pair's first duties was to provide an escort with the gunboats *ALBERT* and *VICTORIA* and first class torpedo boat *CHILDERS* for the Victorian Governor aboard the *SS SIR HENRY LOCH* from the Heads to *HMVS NELSON*.

LONSDALE and *NEPEAN* exercised regularly with *CHILDERS* and later *COUNTESS OF HOPETOUN* as well as other units of the Victorian naval force. Each Easter the boats would perform dummy attacks on the "enemy" entering Port Phillip. Approval was given on 6th July, 1912, for use of the two torpedo boats as targets. They were slipped at the Williamstown Dockyard and dismantled of their fittings. However, this proposal was not proceeded with and on 16th July, 1912, *LONSDALE* was towed by *CHILDERS* to Swan Island. The next day *CHILDERS* in similar fashion delivered *NEPEAN* alongside her sister. *CHILDERS'* crew beached and secured both boats on the shore.

On 9th May, 1914, approval was granted for the sale by tender of *LONSDALE* and *NEPEAN*. No tenders were received by 18th June and it appears that with the outbreak of war no further attempts were made to sell the boats. However, photographic evidence points to the fact that both boats were subsequently removed to the banks of the Yarra River near Melbourne and broken up piecemeal on shore.

MOSQUITO

The first record of service of the Queensland second class torpedo boat occurs during April and October, 1886, when she was alive within the confines of Moreton Bay. *MOSQUITO* exercised regularly with the gunboats *GAYUNDAH* and *PALUMA* and picquet boat *MIDGE*, and often undertook sailings to the naval magazine. On 27th March, 1900, she carried out speed trials over the measured mile; steaming with the tide she reached 16.36 knots and against it 12.40 knots.

MOSQUITO spent a vast period of her career on the slipway inactive. She participated in the Easter cruises and made dummy attacks on the gunboats. The boat was active for the final occasion in January, 1913, and, on 8th March, was docked for the last time. Shortly after her final docking *MOSQUITO* was towed into the Brisbane River and hulked, some claim on the river's edge, while another school of thought claims at Bishop Island.

Conclusion

Details and events pertaining to these torpedo boats are very rare, for the craft themselves

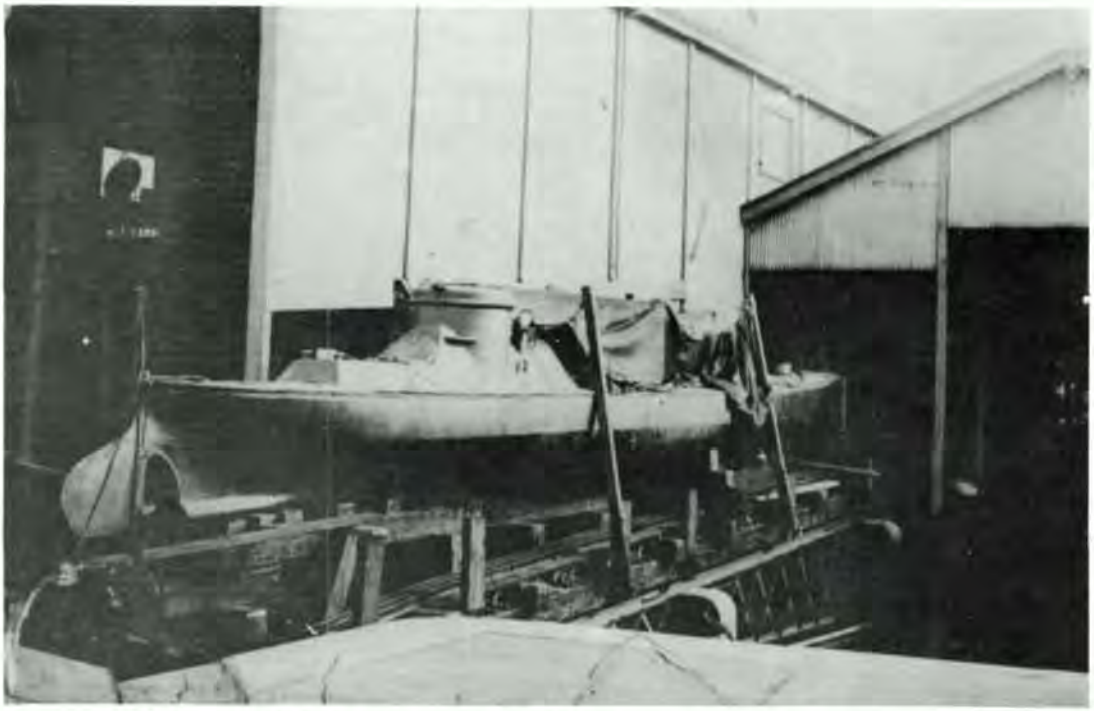
were unique. They represented an era of boat-building when naval designers were still believing that a twelve ton second class torpedo boat could casually approach an adversary, ram her and with just as much alacrity quietly sneak to safety. One can only imagine the catastrophic results if *TB No. 1*, *LONSDALE*, *NEPEAN* or *MOSQUITO* had attempted such a feat.

None of the four boats saw war service and only *TB No. 1*, under tow across Bass Strait, experienced open sea conditions.

The launching of the boat's torpedo proved an art in itself. The vessel would steam at full speed in the direction of the enemy, levers would be released to drop the Whitehead torpedo, and the boat's engines come to a hault and then go full astern. As the torpedo was dropped a tripping lever would release compressed air to the engine so by the time the weapon had gained momentum the torpedo boat would be moving astern, clear of any danger.

The craft in fact were purchased to meet a mythical Russian naval threat, a scare which also saw Victoria and Queensland order two gunboats each, while South Australia ordered one larger "cruiser" type gun vessel. Excepting *LONSDALE* and *NEPEAN* none of the colonial Thrpny-craft boats exercise together. New South Wales also constructed two similarly designed second class torpedo boats. The pair were in fact built in Sydney some seven years earlier. Named *ACHERON* and *AVERNUS*, they commenced service in April, 1878, and were disposed of by sale in December, 1902. One can only imagine the Royal Navy's opinion of these local defence boats in comparison to the British men-of-war based on the Australian Station.

Most surviving photographs of the four boats are broadside, port and starboard quarter views. Only when a dead stern shot is viewed can the tininess of these craft be appreciated. A beam of 7½ feet does not lend itself to spaciousness and the sailors manning this Lilliputian fleet of craft must have suffered in this respect. In spite of their small size, and obvious lack of attacking ability, *TB No. 1*, *LONSDALE*, *NEPEAN* and *MOSQUITO* served for almost 3 decades each and were a tribute to the fine shipbuilding of Thornycrofts to be retained in service for such an extended length of time.



T.B. LANSDALE on the slipway of Williamstown Dockyard in 1890.
— R. Gillett Collection

AUSTRALIAN NAVAL INSTITUTE FINANCIAL STATEMENT 1977/1978

INCOME & EXPENDITURE ACCOUNT FOR THE 12 MONTHS ENDED 30TH SEPTEMBER, 1978

EXPENDITURE:		INCOME:	
Printing & Stationery	4,655.75	Advertising	1,610.00
Bank Charges	28.43	Joining Fees	410.00
Audit Fees	35.00	Subscriptions	3,185.51
Postage	241.54	Donations	63.15
Advertising	55.60	Journal Subscriptions	764.39
Art Work	110.00	Journal Sales	38.40
Prizes	95.00	Interest	195.00
Canberra Chapter Grant	20.00	Gross profit —	
Sydney Chapter Grant	50.00	Insignia Trading	7.94
Net Profit for the year	983.07		
	$6,274.39		$6,274.39

STATEMENT OF RECEIPTS & PAYMENTS FOR THE 12 MONTHS ENDED 30TH SEPTEMBER, 1978

RECEIPTS:		PAYMENTS:	
Cash at Bank 1/10/77	603.25	Printing & Stationery	4,655.75
Interest Received	195.00	Bank Charges	28.43
Advertising	1,080.00	Audit Fees	35.00
Joining Fees	410.00	Postage	241.54
Subscriptions	3,585.51	Advertising	55.60
Donations	63.15	Purchase Cuff links	
Journal Subscriptions	787.99	Badges Crests etc	1,307.09
Journal Sales	38.40	Art Work	110.00
Insignia Sales	842.90	Prizes	95.00
		Canberra Chapter Grant	20.00
		Sydney Chapter Grant	50.00
		Cash on hand	1,007.79
	$7,606.20		$7,606.20

AUSTRALIAN NAVAL INSTITUTE
BALANCE SHEET AS AT 30TH SEPTEMBER, 1978

ACCUMULATED FUND:		ASSETS:	
Balance as at 1/10/77	2,721.85	Sundry Debtors	925.00
Plus Net Profit for the year	983.07	Subscriptions in Arrears	10.00
	3,704.92	Commonwealth Bonds	2,000.00
		Cash at Bank	1,007.79
Liabilities		Stock	472.13
Subscriptions in Advance	710.00		
	$4,414.92		$4,414.92

SEA POWER 79
INCOME & EXPENDITURE ACCOUNT FOR THE PERIOD JULY 6, TO SEPTEMBER, 30, 1978

INCOME:		EXPENDITURE:	
Subscriptions	1,610.00	Postage	80.00
		Printing	269.10
		Bank Charges	2.00
		Balance	1,258.90
	$1,610.00		$1,610.00

BANK RECONCILIATION STATEMENT AS AT 30/9/78

BALANCE AS PER BANK STATEMENT: $1,258.90

G.P. Mann, Reis & Associates
Public Accounts
AUDITOR

D.J. Campbell
Lieutenant-Commander, RAN
TREASURER

INSIGNIA TRADING ACCOUNT
FOR THE 12 MONTHS ENDED 30TH SEPTEMBER, 1978

Purchases	1,307.09	Sales	842.90
		Stock 30/9/78 (at cost)	472.13
Gross profit	7.94		
	$1,315.03		$1,315.03

THE FUNDAMENTALS OF MARITIME STRATEGY

by Commodore J.A. Robertson, ADC RAN

Strategy is a slippery word and an even 'slipperier' concept. It means different things to different people. There are at least seven definitions given by seven different well respected writers on military strategy, and there is always the Oxford Dictionary definition for an eighth. So that, for anyone to presume to discuss any aspect of strategy, is to enter into a minefield of misunderstandings from the outset.

The Defence Department uses expressions such as 'Equipment Acquisition Strategy' to describe the course of action proposed to be adopted for the purchase of hardware. Games players use the word 'strategy' to describe their method of play. Businessmen and economists talk of 'business strategies'. The word has a wide currency and needs pinning down.

No doubt everyone has his own idea of what strategy means but a generally accepted definition of military strategy is 'The art and science of applying the armed forces of a nation to secure the objectives of national policy by the application of force or the threat of force.'

Maritime strategy is, of course only one of the four classic 'schools' of military strategic theory. And it is as well to mention the others briefly so as to make it clear that they are not ignored; to refresh your minds, the classic schools are:

Continental strategy
Aerospace Strategy
Revolutionary Warfare Strategy
Maritime Strategy.

The first school, the 'Continental', is principally after Clausewiz and is about land warfare. It is, naturally, concerned, with terrain, but most importantly, this school concludes that outcome of war is decided by the defeat of the opposing Army, which in turn causes the loser's Government to surrender. This final and major battle has been likened by Clausewitz to the presentation of the bill after a cash transaction.

The 'Aerospace' school is after Douhet and, arguably, began with the RNAS, was developed by the German Zepplins, and was stated as a concept in the 1920's. The principal idea behind it is to either pose such a threat of annihilation of the civilian population and the industrial base of a country, or to conduct actual bombing of them, so that the victim Government would sue for peace. It has now been brought to a high pinnacle of importance in world strategy by the nuclear weapons delivered by missiles or manned aircraft, or even from satellites, but there could be occasions when it could still be applied using conventional explosives, or even, God forbid, bacteriological or chemical weapons.

The 'Revolutionary Warfare' school has a long history, and those who have an interest in such matters will know of many ancients who have advocated it, or something like it. Leo the Wise of Byzantium, for one, expressed its essential principles in the Middle Ages, but the

THE AUTHOR

Commodore John Alan Robertson was born at Melbourne in 1926. He graduated from the RAN College in 1943 and saw service in the Royal Navy on the East Indies Station and in the English Channel. After the war he took part in the Post-War Mine-clearances of the Barrier Reef and New Guinea Islands areas. He specialised in Communications in 1952 and, after RN exchange, joined *HMAS Melbourne* (CVS 21) for her commissioning in 1955. As a communicator, he has also been, variously, Fleet Communications Officer, Officer in Charge, NAVCOMMSTA Darwin, and Director of Naval Communications. After passing the RN Staff Course in 1963 he had a further two years exchange service in Singapore as a Joint Planner on the staff of the CINC Far East. Subsequently he was posted as Executive Officer *HMAS Melbourne*. He has commanded *HMAS Duchess* (DD 154) 1967-69, *HMAS Hobart* (DDG 39) 1970-72 and *HMAS Stalwart* (AD 215) 1975-76. He is currently serving in Navy Office as Director General Naval Policy and Plans.

high priest today is Mao, and his theories of guerilla warfare which have been practised so successfully in recent years. In some ways it could be considered the antithesis of the 'Continental' school, though that is not strictly true.

The last school listed is the 'Maritime School', which, as theory — as opposed to practice — first began to be enunciated by Mahan in the late 19th century. Before expanding on it, one could also consider Herman Kahn's 'On Escalation' as a generalised strategy. It is quite possible to develop a deliberate policy of escalation in order to win a war, militarily. Deliberate escalation is, of course, hard to sell in a non-aggressive democracy, but it should not be overlooked. It is better than losing.

One other point should be made plain; it has been suggested by Admiral Wylie (1) that we should not be doctrinaire in our approach to the subject of stategy, and it is simple commonsense to agree with him that we need to be able to amalgamate all the appropriate aspects of all the recognized schools to suit our purposes and the occasions of needing them. That said, let us now turn to Maritime Strategy.

Mahan called it 'Seapower' but he was not, by my reading of him anyway, entirely clear about what he really meant. He knew that Seapower had played a large part in influencing history, and the conduct of war, and quoted a great many historical precedents to support his view of strategy. But he did not really penetrate to the logical end of the subject, nevertheless his writings set off a wave of warship building at the turn of the century. A number of people developed Mahan's views into more precise theory, notably Julian Corbett in his lectures and writings before 1914; the concept of the Fleet-in-Being for example, was derived from him, alas, he too was not properly understood. The Fleet-in-Being concept had great vogue and tied up huge resources which ultimately met at the tactically inconclusive Battle of Jutland, while Britain came perilously close to losing the submarine war in World War 1.

It is perhaps oversimplified, but one cannot help getting the impression that Mahan, and other writers, referring back to major historical naval battles had brought to the fore an idea that the clash of the major naval forces decided the outcome of the war at sea. After all, look at the precedent of Trafalgar. It will be recalled also that Jellicoe was described during World War I as the only man who could 'lose the British Empire in an afternoon'. It is a sort of Clausewitz-taken-to sea approach to naval warfare. Yet Corbett was much more enlightened than his readers. He had offered the opinion that the sea had never been 'commanded' but could only be controlled in specified areas. Francis Bacon had been on the right track perhaps, but had overstated the case, possibly due to Elizabethan exuberance. (2)

The very word 'seapower', which Mahan had coined, also seemed to blind its more ardent advocates and, despite all the evidence of World War I they continued, in the main, to think in terms of seapower as the majestic ships of the line. This was also true of virtually every other nation, so that, if Britain's example is examined further it is not with any intention to single out UK as the only nation at fault: in Britain's case, however, a failure to appreciate the real basis of maritime strategy then, and between the wars, appeared to make that country to go off in the wrong direction with almost disastrous consequences.

By 1929 the UK could not see an enemy in sight and consequently there was no clear central strategic policy, so the Services invented plausible situations to provide a strategic basis for their force development. The Army prepared for a land battle to defend India against Russia; the Air Force prepared to bomb France into submission, and the Navy prepared for a major sea battle to defend the Empire in the East — including the South Pacific — against Japan. (3) It might be noted that two Japanese naval officers also wrote a book on the same theme in the early 30's; it was called 'Japan Fights Britain'. The USN directed its thinking to the big sea battles to come with Japan — though it is understood that the US Army turned its thoughts to fighting Britain in a land war in Canada. The lack of a perceived threat does seem to create problems for strategists in democracies doesn't it?

When the prospect of war with Germany started to become more apparent from 1932 onwards, the British Defence juggernaut tended to roll on on the lines already established, except that, as far as the Navy was concerned anyway, its idea of defence of the Empire in the East could not be sustained with the resources available. The Fleet, which had been developed principally around the battleship, would be required in European waters for home defence. Only by about 1937 did the Admiralty turn its thinking to the defence of the Atlantic life line. However Air Ministry opinion at that time was that convoys would make such easy targets for air attack that they would not be a practicable proposition. As a compromise then, it was agreed that, mercantile convoys would be instituted only if Germany began unrestricted submarine warfare. At that time Britain's economy was almost totally dependent on imported food, minerals and oil, and the export of manufactures. Luckily for Britain, and in contravention of Hitler's orders, the 'Athenia' was torpedoed the day the war began, and then attention was turned seriously to

antisubmarine warfare measures and defence of the Atlantic sea line of communication. Regrettably, sonar had been only marginally developed since World War 1 and ships' ASW weapons remained at the 1919 standard of depth charges. The RAF's Coastal Command had never exercised with submarines, and when its aircraft found U-Boats on the surface, the weapons available were quickly proved ineffective. There had not been one mercantile convoy exercise in the 20 years from 1919. ASW had to be developed from where it had been left, over twenty years before. (4)

This sorry tale of disaster may appear to be irrelevant to today's problems, and it must be admitted that it omits a lot of other detail, but this brief outline does have a relevance to an understanding of the fundamentals of maritime strategy, particularly, and, in a more general sense, to what it is believed military strategy is all about.

Maritime strategy is concerned principally with two aspects. One is to prevent the enemy, real or potential, from using the sea for his purposes; the other is to be able to use that part, or parts of it, which you need for your own purposes. It is as simple as that.

Modern thinkers on maritime strategy, or seapower if you like, have sometimes called these two aspects 'Sea denial' and 'Sea assertion'. There are those who would suggest that 'denial' is too strong a word and prefer some other word such as 'prevention'; others would prefer some word other than 'assertion', but it is not necessary to quibble about the words, the idea conveyed is the important point. If anyone wishes to use the sea for his own survival, then sea denial is what you need to be able to exercise for your maritime strategy. If you need to use the sea for your own purposes then maritime strategic thinking would call for forces to permit you to assert your use of the sea. You could, of course, need both, and some maritime forces could be used to fulfil either of these two major roles.

These essentially simple facets of maritime strategy are, surprisingly, not readily understood I find — even, apparently by some Naval officers. To many, the whole idea of seapower still concerns itself with the Clausewitzian idea of the major Fleet action. One fairly senior Government official quite recently asked what the Navy would do with an aircraft carrier, and he postulated an enemy surface force somewhere in the surrounding ocean and the carrier at its base. His idea, apparently, was that, alerted to the threat, it would dash out from its base, attack the enemy, and having disposed of it, the carrier would return to the comfort and protection of a convenient harbour to await the next call on its services. This is both what could be called Clausewitz-gone-to-sea, and a fixed idea that maritime strategy is concerned mainly with sea denial. It is a matter for some considerable dismay, that the vast majority of Australians appear to share this sort of elementary thinking about maritime strategy.

There are refinements of the two major facets of seapower. An ability to assert one's use of the sea makes it possible to project power ashore against an enemy. There are some writers who regard this as the oldest use of seapower, quoting the Danish invasion of Britain as an example. A more modern application is the use of ballistic missile submarines, the use of aircraft carriers as in Korea and Vietnam, or the use of amphibious forces. The latter of course can range in scale from raiding parties launched from say, submarines, up to the assault capability of the US Marine Corps or the Soviet Naval Infantry. There are those today who suggest that modern warfare makes amphibious warfare virtually impossible, (5) and maybe it is for all except the super powers. It is possible, though, to get an uneasy feeling when it is remembered that the British Amphibious warfare school was closed on the outbreak of World War II on the grounds that 'there would be no combined operations in this war'; one is entitled to wonder about people who make such unproven assertions with such alarming certainty.

The other refinements of maritime strategy are what are called the peacetime or deterrent functions, and the war fighting or, if you like, combat function of each aspect. Some may regard this as too fine a distinction but it is important to appreciate that military strategies ought to be able to function in peace as well as in war, flowing from one into the other. If the peacetime strategy works, then, with luck, there would be no need to go to war. (6)

No one can ever expect in peacetime in democracies particularly, to have all the forces which might be needed to fight some unforseen war at some unspecified time ahead. So the deterrent aspect of seapower is interpreted to mean that one acquires and maintains in peace a demonstrable capability to conduct certain forms of maritime warfare with forces which might have to be expanded if that became necessary. The possession of appropriate combat technologies in peace is then a signal to any potential aggressor that it may not be worth attacking you or your interests in that fashion. Take sea denial; a modern range of combat technologies for sea denial could include, for example submarines, maritime patrol aircraft, surveillance systems and which can detect, and associated weapons to destroy, cruise and ballistic missile firing submarines which might be used against you, air

and surface maritime strike forces to prevent an enemy using the sea to attack you in, say, a seaborne invasion, and, at the last ditch, defensive minefields around your own coast. The list is not exhaustive and does not include, for example land based anti-ship missile systems, such as some nations install on their coasts.

A prime example of a maritime strategy heavily slanted towards sea denial was the Russian Navy of the 1950s. It incorporated submarines, surface ships from cruiser size down to missile firing patrol boats, and it backed them up with land based aircraft for reconnaissance, strike, and fighter cover, and a formidable capability for mining. As a nation fairly well self sufficient, and not dependent for its survival on maritime trade it had, and still has, little need for sea assertion, and structured its maritime forces accordingly. Russia's maritime forces structured in this way made a big signal to the rest of the world not to try to attack her across her maritime frontier. She was prepared to repel attack from the sea, and invasion in particular.

As an aside, it is, of course, just the type of maritime force most people understand, and one which many of our public commentators on Australian defence strategy see as the only way to go for this country. For those who take a land bound view of maritime strategy it is all that is needed. Technology, such people believe, can solve the problem of preventing the enemy from using the sea against our island, and that is all we require. It is the maritime component of a 'Fortress Australia' outlook on a national strategy.

For a nation or an alliance which sees the need to be able to use some parts of the sea for its survival will also acquire a representative range of sea assertion forces. NATO, which begins with the premise that it is dependent on reinforcement and resupply across the Atlantic for its corporate survival, is much more heavily oriented towards sea assertion for this reason. So NATO maritime forces cover a range of combat technologies beginning with minesweepers and rising up through the scale of antisubmarine warfare forces to maritime air defence systems. Of course they do not expect representative governments in peacetime to provide them with all the resources needed to go to war with the Warsaw pact today, but they incorporate representative combat technologies to signal to their most likely opponent that they possess the skills needed to put up a pretty stout defence of this vital interest, and so hope to deter the threat from ever materializing as actual attacks. Certainly some, perhaps a lot of ships, would be sunk if it ever got to a shooting war, but even so, NATO clearly hopes that enough could be got through to survive.

These then are examples of how the deterrent aspect of maritime strategies have been demonstrated in peacetime. As noted earlier, some maritime combat technologies may be used for either sea denial or sea assertion as circumstances require at the time.

So far these comments have been confined to military seapower, but it should be quite clear that seapower as a general term is not restricted to combat forces. Seapower, particularly for its sea assertion aspect, requires the merchant shipping to carry those bulk cargoes by which nations survive. How often do you read in histories, of World War II that it was shortage of shipping which affected the operations which could be undertaken? There is no known substitute at present for those big hulls to carry the quantity of stores of all kinds which allow a national economy to survive and, if necessary, wage war. Oil is only one example but heavy industrial machinery, many weapons of war, food, and minerals simply cannot be transported any other way in any practicable quantities. So a national merchant fleet, or access to friendly nations' merchant ships is an important element of the seapower a nation can command. This factor is unlikely to change in any substantial fashion. Peacetime economics dictate the use of ships to move bulk goods. Professor Sokol in his 'Seapower in the Nuclear Age' quotes a rough rule of thumb ratio for the relative costs of sea, land, and air transport of bulk goods — and I stress the word 'bulk' since it is quantity which counts — as 1:5:50. In thinking of seapower then the importance of merchant shipping must be kept in mind. Strategically, as far as Australia is concerned, you might also bear in mind that by 1985 we will need to import about 150,000 (7) tonnes of oil a day to support our economy and our way of life in peace. This represents about 70% of our predicted national needs in the mid 80's. Of the national total a very high percentage would be needed to sustain our Defence Forces in any sort of war we might be in. Since we can expect to produce only about 30% of our requirements locally by 1985, the rest will probably have to cross the Indian Ocean. Without oil our economy and our war effort would collapse so it makes an attractive strategic target. There are quite sizeable areas of the Indian Ocean, to take only one example, in which it makes no sense for a merchant ship to be there at all unless it is bound for Australia. Some writers on these matters are quick to reassure us that, since neary all our trade is carried in foreign bottoms, it will be safe. It is a nice pious hope to set against the consequences of it not being realized. The recent history of merchant ships not going to Israel is a salutary reminder that it can still happen; the Beira patrol blockading Rhodesia is another, and British actions in 1939 to institute contraband

control, all provide different examples of how we could be left stranded. Putting faith in some other nation's generosity if survival was an issue seems to me altogether too Pollyanna. I believe we need to be able to demonstrate that we possess the sort of skills neeced to protect that shipping which would be essential for our survival. We may not own the merchant fleet we need but if we cannot make a show of protecting those who provide it there could be a marked lack of enthusiasm on the part of merchantmen to continue to come here. It is an element of seapower Australia does not own and therefore only has access to by the national cheque books but it is a major strategic interest.

Having presented the main aspects of maritime strategy, it is worthwhile to return briefly to military strategy in a more general sense. To provoke you, if you need provoking, it is suggested that strategy is about winning, or alternatively about not losing, because, to win, it may be enough simply not to loss (8) And military strategy therefore should, in the first instance, be about not losing (9)

John Collins in his 'Principles and Practices of Grand Strategy' has analysed the United States strategic approach to the Vietnam war, and one of his more important conclusions is that it got off on the wrong foot because there was no vital US interest at stake. National survival was not an issue. Now this is not intended to begin an argument about the rights and wrongs of the Vietnam war, but it is suggested that a peacetime military strategy should concern itself first of all with the security of vital national interests. Of course the selection of vital national interests could make for a fairly lively debate, but the thought is offered that if your military preparations in peacetime make it abundantly clear that you have a demonstrable ability to defend your vital national interests then you could probably be on a winning military strategy. To revert to British experience in the 1920s, the apparent absence of discernable threats led them down the wrong path as they graped around to find a strategic basis for their force structure design. No one can be expected to predict the sort of war he is likely to get into with any accuracy, but, had Britain in the 1920's begun by considering its vital national interests, I believe it would have been in a much better position to go on and develop its forces to meet the German threat when it arose in the 30s.

The point being made is that the longstanding tradition of looking around for threats before developing the analysis gets bogged down when no threats are to be found; of course if a threat is evident then so much the better; it sharpens the analysis very satisfactily. But where no nation can be seen to have either the intent or the capability to attack you or your interests it seems that it is all too difficult. This approach to developing a strategy could be likened to a Platoon Commander-writ-large. If there is no situation then there is apparently no basis on which to develop the appreciation — and so the peacetime military strategy has no precise object except to defend against a wide range of possible contingencies.

The idea of not being able to devise a more precise military strategy without a discernable threat seems to me to be fundamentally wrong. It is based, in essence, on the world as seen from the home base. It is suggested that we in Australia might be better advised to look at the country and its strategic weaknesses as they might be seen by others. The world seen from Canberra leads us into opinions and judgements about what others might or might not do in a variety of circumstances; examination of our strategic position through the eyes of others could be revealing. Put yourself in the role of a potential aggressor — disregarding for the moment the military means you would need to accomplish your purpose.

If you wanted to strike at something, if not juguar, then at least neuralgic, what would you do? Having decided that, would it be practicable and could you acquire the means to do it? If so you could have a basis for a military strategy to attack Australia and its interests, and, by implication, the basis for a military strategy to defend Australia and its interests, both in peace and war.

To recapitulate, seapower is concerned with two main aspects, sea denial and sea assertion; and as a particular element of sea assertion one may seek to project power into an enemy's territory. In peace the acquisition of capabilities to prevent others from using the sea against you is the deterrent function of that aspect; as was the deterrent function of that aspect; as war approaches it can be developed as the combat function. Similarly the acquisition in peacetime of the capabilities to secure the use of that part of the sea you need for your own purposes is intended to deter the threat from emerging. If it does not deter it may have to be expanded, and put to the acid test of actually fighting. It is, of course, well established that it is much cheaper to prevent war, however expensive in peacetime, than to go to war.

It will be noted that any weapon system or capability used to achieve the object of either securing or preventing the use of the sea is engaged in maritime strategy. It is quite possible to use soldiers, if they operated land based anti-surface ship missile systems, or if they were to capture or hold some territory, for instance, if it

was needed to help secure the use of some part of the sea. It must be quite clear that a maritime strategy does not just imply naval forces alone. On the contrary, any combat system may be employed to support such a strategy.

Finally, it is worthwhile repeating that, like all good ideas, the concept of seapower is disarmingly simple; one may comfortably forget all the fine academic distinctions about sea assertion, sea denial, power projection, and combat and deterrence aspects; indeed too widespread a discussion of these niceties can lead to instant expertize and fruitless arguments. The mission of Australia's military seapower remains unchanged and may be stated quite simply as:

'To secure control of those parts of the sea the nation needs for its purposes at the time.'

FOOTNOTES

(1) Wylie 'Military Strategy'
(2) 'He that commands the sea is at great liberty and may take as much or as little of the war as he will.' Bacon.
(3) This is all recorded fact quoted by Michael Howard in 'The Continental Commitment'.
(4) Roskill 'The Strategy of Seapower'.
(5) Michael Howard among others.
(6) See Adelphi Paper No 124, article by Admiral Stansfield Turner.
(7) Corbett 'Energy for Australia'.
(8) Collins 'Principles and Practices of Grand Strategy'.
(9) One must, of course, avoid the Maginot Line outlook.

TECHNOLOGY AND CHANGE

The seaman who carefully studies the causes of success or failure . . . will observe that changes of tactics have not only taken place after changes in weapons, which necessarily is the case, but that the interval between such changes has been unduly long. This doubtless arises from the fact that an improvement in weapons is due to the energy of one or two men, while changes in tactics have to overcome the inertia of a conservative class; but it is a great evil . . .

A.T. Mahan
The Influence of Sea Power Upon History

THE IMPACT OF TECHNOLOGY ON STRATEGY

by Vice Admiral J.T. Hayward USN Retd

Does technology have any relationship to strategy? There are many who see little or no relationship between them. It would appear that an historical review, as well as a consideration of the present day would show otherwise. First, it is necessary to try and define in detail what is strategy and what is technology.

It might be said that strategy is the process of planning to make the most of one's assets to accomplish one's objective while, at the same time, minimizing one's weaknesses. Strategy concerns itself with large issues: Should the Allies of World War II concentrate first on Germany or Japan? If the former, should they strike first at Germany directly across the Channel or by means of the Mediterranean? If the latter, should they strike at Sicily or Sardinia?

The assets of a strategic planner may include, among many others, geographical position, industrial power, natural resources, and naval strength. A strategist must employ such assets to dominate, or respond to, a specific condition or set of circumstances. Three examples of the use of one of these assets — geography — quickly come to mind. The first is Russia's regular employment of her great size in response to the invasions of her enemies; Charles XII, Napoleon, Kaiser Wilhelm, and Hitler. The modern theory of Chairman Mao, in which the countryside is conquered in order to isolate the cities, is another example of geography put to use as a servant of strategy. And, until the 20th Century an appreciation of the sea which surrounds her was the basis of England's approach to strategy.

It may be appropriate to say that a strategist should maximize his country's strong points and minimize her weak ones, but in practice it is a hard thing to do. The problem of actually doing these things becomes apparent as one sees what modern technology has done to the weaknesses and strengths of various nations. The United States, for example, once subject to invasions from abroad, became relatively immune to such dangers as her navy became strong and her relations with her immediate neighbors became good. But the development of very long range bombers, and then of missiles, armed with nuclear explosives, stripped away that immunity.

When one comes to a modern definition of national strategy, it can be broadly defined as the art and science of developing and using the political, economic, psychological, technical and military forces of a nation in peace as well as war to support to a maximum the national policies, in order to increase the probabilities and favourable consequences of victory and to lessen the chances of defeat.

Modern strategy, therefore, has many non-military phases, so one can expect many civilians to be mixed up with it. Strategy is an inherent part of statecraft and in only its narrowest sense limited to the military side of life. One can readily see from Machiavelli to Hitler that certain well-defined themes are ever present. People have tried to use them as principles of war. They range from the concept of lightning war to the war of annihilation.

One sees the war of maneuver, the war of position, plus all the other facets, such as the relationship of economic power to military strength. One can even see one of the problems that face us today, which is the question of the professional army versus the militia. One must realize ideas and ideologies are related to war. The life of a nation depends upon its national interests and an understanding of these by its citizens. They must then understand the fundamentals of strategy. War and conflict are everyone's business, so it is imperative we all have a very broad comprehension of all the facets of national strategy and our objectives.

Technology, simply defined, is society's skill in inventing, developing, and manufacturing the instruments it needs. Before addressing technology's relationship to strategy, let us look at a bit of history first.

An interesting, if simple, example of the influence of technology on strategy stems from the Punic wars between Rome and Carthage. The Romans were good soldiers, but they were out-classed afloat by the more seaman-like Carthaginians. However, when Rome developed, produced, and issued to her fleet the corvus, a device which permitted men to board one ship handily from another, she could bring her powerful infantry into play on the enemy's decks. Thus, through the use of what technology they possessed, the Romans were able, not merely to bring about the triumph of a hitherto obsolete style of tactics, boarding, over the more advanced naval tactics of the Carthaginians — that is, ramming, breaking the enemy's oars, and assaulting with flying missiles of various sorts — but were able to make the best use of their assets, their infantry, and to minimize their weaknesses, in this case mainly their clumsiness as ship handlers.

The result was that the warships of Rome cleared the sea of the ships of Carthage and, instead of Carthaginian soldiers fighting on Roman territory, the war became one where Roman soldiers fought on Carthaginian soil: Carthage, rather than Rome, disappeared; Rome, rather than Carthage, ruled the Mediterranean for centuries more; and eventually it was a Roman, rather than a Carthaginian, heritage which was to underpin the civilization of Europe and the Americas.

In 1588 AD, about 1,800 years after the Romans crushed their North African foes, the Spaniards, strong cultural descendants of Rome, attempted an invasion of England with a mighty armada filled, as were the fleets of Rome, with a brave and able soldiery. But the English defenders, using their highly maneuverable ships to capitalize on another development of technology, the shipboard gun, were able to thwart that invasion. The smaller British ships, able to stand off at cannon range, fired into the bulky ships of the armada, while the soldiers of Spain, armed with sword, pike, and musket, and committed to the tactic of boarding, could do nothing. The Spanish attempt at invasion failed and Spain's efforts at defeating her island foes had to be pursued by other means.

In both cases, that of Carthage and Rome and that of Spain and England, the use of a new technology led to new tactics which in turn yielded new grand strategies. Carthage could not maintain her armies any longer in Italy; Rome could at last place armies on the North African shore. Spain could no longer think of invading England but thereafter England could, and did, attack Spanish convoys, Spanish colonies, and the Spanish mainland itself.

Interestingly, one can see that strategy has an influence on technology, too. To make the Northern blockade of the Southern ports effective in the Civil War, Chief Engineer Benjamin Isherwood of the Federal Navy had to make his steam engines more reliable than they were; otherwise Southern blockade runners could elude the Northern blockading squadrons. And the need to be able to re-enter Europe in World War II led to the development of entirely new types of ships and craft, such as the Landing Ship Tank (LST) and Landing Ship Dock (LSD).

As Captain Mahan has pointed out, however, people are slow to change their tools or their tactics even when technical progress makes it possible to make such changes as would improve their chance of strategic success. This may be mainly because technical advances are made by relatively small groups of people, while to change the nature of the tools used, or the method by which they are used involves many people in a large organization, with the inertia inherent in such a mass. Some people say our present preoccupation with the attack carrier is an example of such inertia.

Another possible cause of slowness to change is that a great deal of money, time, and skill are involved in the creation and maintenance of any important tools or tactics of war. For years before 1941, the battleship was considered the primary naval tool; the United States had a great investment in such ships and her officers were highly skilled in the maintenance and improvement of those ships and the tactics to which they were central. This material wealth and these personal and institutional skills could not easily be discarded. It was only when the Japanese deprived us of those ships at Pearl Harbor that we were freed from their mesmerizing influence.

Clearly, technology often is a controlling factor in developing a military strategy. At the close of World War II, Russia saw that the United States was supreme in two specific and decisive technological areas: naval power and 'strategic air power,' and that our superiority in both areas rested on our superiority in the technology of aviation.

Rather than attempt to develop similar systems for themselves, they followed entirely different routes. One was the long-range missile, a recent German development; the other was the submarine, which had been an important part of Soviet armaments for years. These, combined

with the fission-fusion weapon, were the tools they needed.

They went to work on the key technical problems. The more thrust and better specific impulse that a rocket engine could have, the greater could be the payload and the range. This required the development of materials which could be used with high temperature rocket exhausts, and it made work with cryogenic and storable liquid fuels necessary, for liquid fuels had basically greater specific impulse than solids had.

The other important field was guidance, and here the Soviets started with the early work of the Germans on integrating accelerometers. How well they have done this is attested by the fact that they shoot their missiles with great accuracy into a small impact area thousands of miles out in the North Pacific.

The Russians follow an interesting pattern of development, first creating the components basic to systems, and making them as well as science and engineering will permit. When the rocket or aircraft engine is as good as they can make it, they decide what system the component will be used in. This is a lot faster than the ponderous paper process the United States employs. Looking at the many new types of fighter aircraft and submarines that the Soviet Union has created recently, it is apparent that their system works.

If one looks at some of the broader military strategic questions such as sea power, air power and land forces, one can quickly say that the weapons were merely the tools of these forces, but strictly of minor consideration. This may have been so prior to the 20th Century, but modern technology has overtaken that parochial look at our present problems of a national strategy. The advent of fission and fusion weapons, plus the advances in propulsion and guidance, now shape our national strategy whether we like it or not.

These advances are based on many technical innovations besides the warhead. The systems have aircraft, nuclear submarines and even the use of space vehicles as components. Our placing of men on the moon on 20 July 1969 employed our technical innovations across the entire spectrum of not only the physical sciences, but of all the sciences. This was a culmination of billions of dollars of effort and the work of thousands in the research and development laboratories of our country.

No one can deny this brilliant achievement nor its impact on the world. It may perhaps be best identified under the components of national strategy in the political and psychological areas. No one can fail to see its military implications to the world in the mere fact of the flawless performance. A nation which can do this surely can make an Intercontinental Ballistic Missile (ICBM) system work effectively.

If one doubts the influence of technology on strategic thinking, let us examine in detail the nuclear posture of the US and the arguments surrounding the Anti Ballistic Missile (ABM).

Well, over a century ago Alexin de Tocqueville in his famous book, Democracy in America, said 'Almost all the natural defects of a democracy are to the fore in the conduct of foreign policy, whereas its good qualities are hardly to be seen'. One has only to listen to the arguments in the media and the halls of Congress today on our Vietnam experience to see the truth of this. There is one national objective, however, that I believe all Americans would accept. This is that we do not desire a nuclear war or exchange of such weapons.

We thus came to the strategy of deterrence. This strategy is the product of technology and it is aimed at achieving our national objective of no nuclear exchange between the Soviet and ourselves. It is based on the belief we can deter war by having sufficient strategic systems that would permit us to destroy our enemy under any set of circumstances.

TITAN II ICBM

It is a different strategy than we had before the advent of fission and fusion weapons. It is the product of several factors and if any factor is zero, the answer is zero deterrence. One must have a reliable weapon system. One must have the will to use it. The enemy must know you have it and it does work and you will use it. When you do use it, one must be convinced it will destroy or cause unacceptable losses on the foe.

He must believe this also. This is complex in that our values and those of the enemy are different. What may be unacceptable to us as a nation may be acceptable for the opposition. This whole strategy and problem arises out of technological progress and is the best example of the impact of technology on strategic thinking.

A glance at the ABM debate is of interest. If you accept the idea our objective is to prevent an exchange of nuclear weapons, you ask yourself will this system help me attain that objective? If you say no to that, you are against the system. If your answer is affirmative, you are for it.

Frankly, I believe the answer is a loud and clear no. First, it doesn't have to be a target USA, and this puts us on the bullseye. The facts are that we cannot prevent the destruction of these sites. Should we fire our defensive missiles or the offensive ones? One can't do both and the command and control problem is a difficult one. If you believe in deterrence and you must these days, you fire the offensive missiles.

Technically, the progress can alleviate this problem by having the system so one could use it offensively as an ICBM as well as an ABM. One then has a much easier choice with a great deal less complication in the command and control area.

Our strategy, once again influenced by technology, should be the maximum use of the sea and skies for our deterrent systems. This makes for assured destruction of the enemy and puts no premium on a first strike. Surprise loses a lot if our system is at the far corners of the ocean.

Such systems are dependent on reliable communications and here the modern communication satellite has made such coverage practical. It is a spin-off of the technology that placed those men on the moon.

One could in truth define deterrence as the use of latent military power as a form of political persuasion. This definition takes it out of just the nuclear arena and places it across the spectrum of the challenge against us. It must be related to the opponent's capabilities as well as his intentions. The dilemma of deterrence is how to mix our knowledge of what an enemy could do, with our judgement about what he might really do.

Political intentions can change overnight while true capabilities in a military sense can take years to acquire. The standard US military approach is to just equate the capabilities. This is essentially a safe approach and one with the large interests at stake, a wise one.

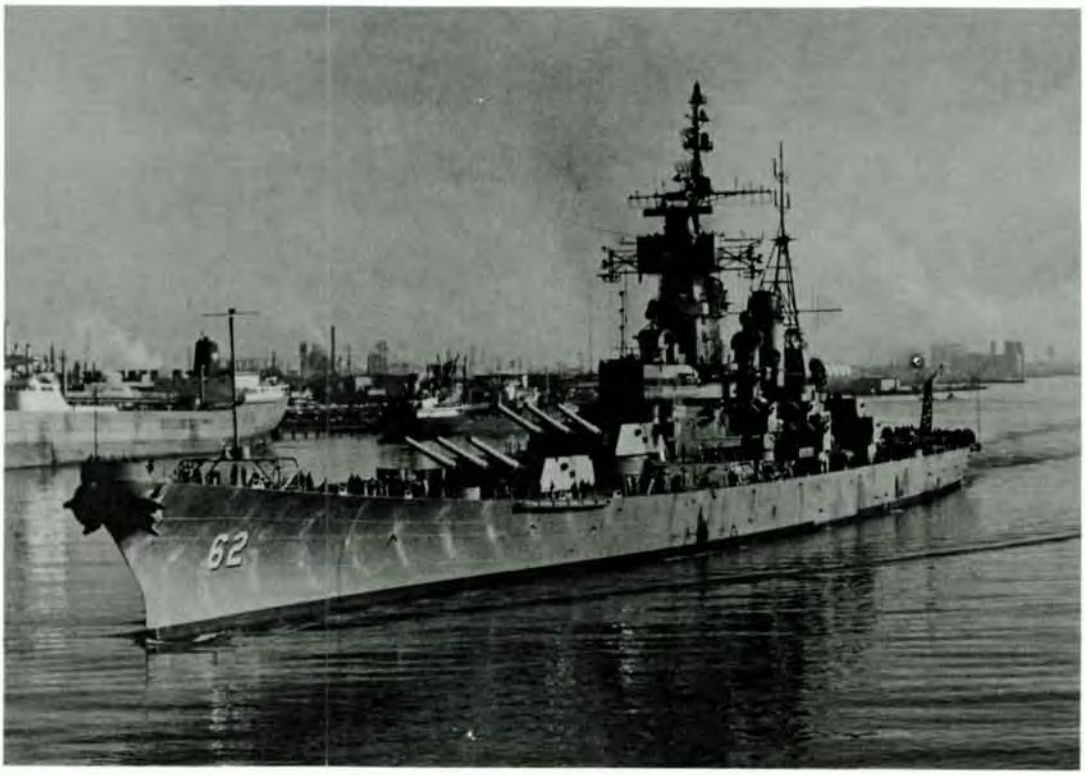
So one quickly comes to the conclusion if it ever becomes necessary to employ our nuclear arsenal in an exchange, that our deterrent system in reality has failed of its objective to deter.

One can also see that if positive deterrence is obtained, it will not prevent the Soviets from engaging in local military activities, nuclear or non-nuclear; in fact, it may serve as an inducement. This means we must not only have a positive nuclear deterrence posture, but an improved means of fighting small wars. It is also quite apparent that the whole theory of deterrence as a strategy rests on the rational behaviour of all nations that are involved. Rationality being defined as a state's deliberate avoidance of acts which inevitably invite national destruction.

If you accept the premise that the basic strategy of the US rests on its nuclear weapons and their delivery systems to attain the objective of deterrence to a nuclear exchange, one immediately comes to the rest of the spectrum of the challenge to us. This area is more difficult to assess in many ways. The clear-cut national objectives are hard to find. It is harder yet to get a clear national agreement. The present situation in Southeast Asia is a good example of the problems we face.

Let us look at technology and its impact on naval strategies of the future. The sea and its control and use will always be vital to our interests. Nuclear propulsion both for submarines and surface ships has already given us capabilities not known before. The impact of this is still to be realized, or let me say, understood by our planners.

To take one example, the ability of a surface ship to move rapidly is vital if she is to succeed in combat against a submarine. Yet, our new DE-1052 class of ocean escorts can, at best, steam at 27 knots — and that only if both boilers are on the line. If they aren't, the ship must be content with some lesser speed for an hour or so until the second boiler is able to contribute fully. How can such a ship combat a submarine which can steam at will at 27 knots, or 30 knots? Gas turbines might have permitted the escort better speeds more quickly attained — perhaps as much as 40 knots. Why were they not included in the design of the new DEs? Thus came the FFG-7, Perry Class Ship.

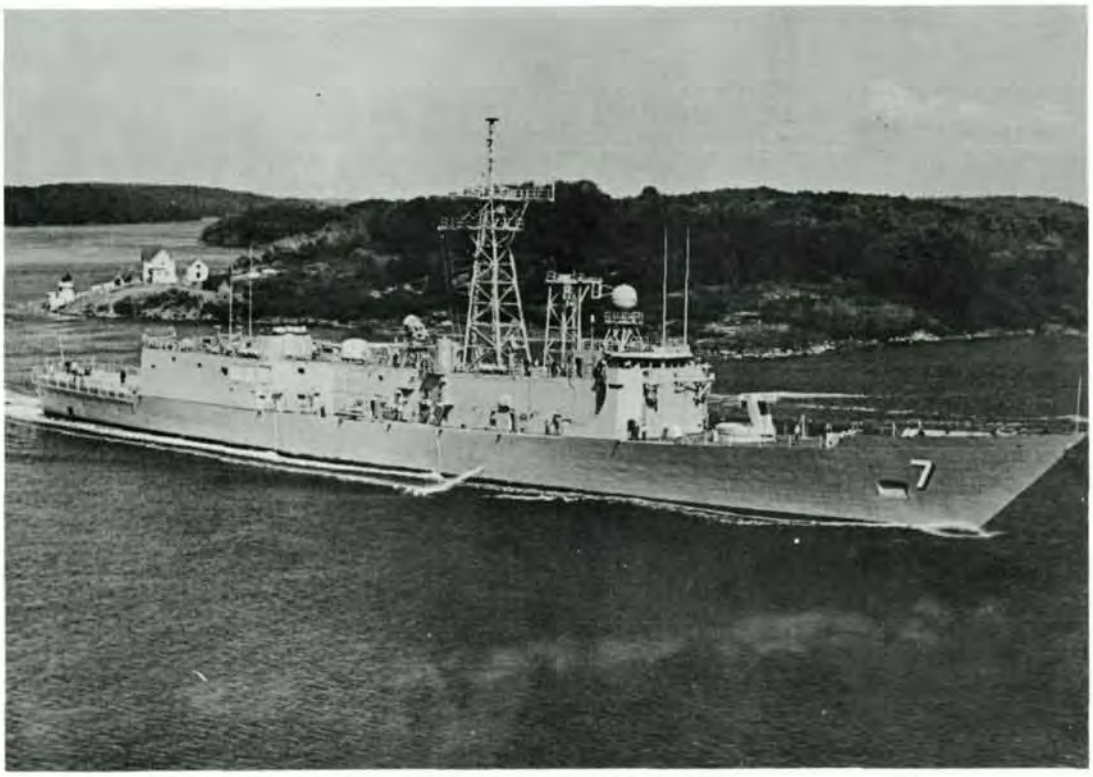


The Battleship Era, USS New Jersey
— USN official photograph

World War II vintage escort. USS Agerholm, a Gearing Class Destroyer after a FRAM 1 modernization

— by courtesy of Chris Gee

DE1052 Knox Class. USS Francis Hammond.
— by courtesy of Chris Gee



FFG 07 Class, USS Oliver Hazard Perry undergoing sea trials.
— by courtesy of Defence Public Relations

The quick reaction of a gas turbine would permit an escort, even one steaming slowly, to leap ahead so as to get quickly within weapon launching range of the enemy submarine. A nuclear power plant would permit the same thing, though so far, technology has been unable to reduce either the bulk or the expense of such a plant so as to permit small ships to have them.

So far so good, but technology also permits the opposing submarine to launch a missile from a distance of a couple of hundred miles. What would a DE with any kind of power plant do against this threat? Even if the missile were shot from only 15 miles away? This means that, in order to protect a carrier or a convoy, the air must be controlled out at least as far as the enemy can fire a missile, so that the enemy submarine cannot surface to launch her weapon.

Technology has obsoleted the old escort of convoy as we knew it in World War II. A submarine can shoot missiles at a convoy up to at least 150 miles away. What would a modern DE do against this threat? Even if the missile were shot from only 15 miles away? IR homing and semiactive radar guidance make this a relatively easy problem. The impact is to accentuate the control of the air within the missile radius of the convoy. It is already unnecessary for the submarine to surface and shoot its missiles. An air weapons system is the only counter to this dire threat.

Modern sensor technology will open the seas to the enemy. Satellites today and in the future will be able to spot large convoys or task forces almost by the minute. The information fed to computers and further refined may soon lead to the ability to shoot large warhead ballistic missiles at such targets. This is particularly true if nuclear weapons are envisioned. A task force with a speed of advance of 30 knots will cover only 15 miles in 30 minutes, which is the flight time of a ballistic missile 5000 miles away. Multiple warheads are here, so the future will certainly focus efforts in this area.

When one sees the advances in the space sensors that can be obtained today, it is clear that sea surveillance will be an important factor in naval strategy. Folded optics, multiband cameras are capable of taking several 'tone pictures' simultaneously in wave lengths of the visible light and infrared portions of the spectrum. Optical mechanical scanners, which are actually special cameras, are able to 'see' and record heat variations from long distances. Microwave devices, such as side looking radar, can take detailed images through clouds, darkness and even dense foliage. There are problems to be solved before these tasks can be efficiently performed, but many of the technical problems already have been solved, so I am sure sea surveillance from space will be a reality faced in the future by all naval planners.

The ability of the guerrilla in the recent Southeast Asia War gives one pause as to the possibility of a guerrilla war at sea waged by submarines. People may be skeptical but as the modern submarine becomes a part of the Navy of many countries, it could happen.

The other components of national strategy play as important a role in our struggle to attain our objectives as the military. We, for years, have said the economics of raw materials are vital to our economy in peace, as well as war. An American study and proposed design for a 250,000-ton nuclear submarine tanker already has been completed. It will carry 50 million gallons (1,220,000 BBLS) of oil and operate normally at 700 feet. It will have a speed of 18 knots. It takes little imagination to see the military applications. In England a 50,000-ton nuclear submarine for carrying ore has been proposed (1) These systems can be completely put under water at the port as well as at sea. Advances of this technology will most certainly influence our strategy. The areas of food, such as miracle rice and hybrid corn are other examples of technical progress that assist us in our national strategic approach to our objective in peace as well as war.

What we are saying is that the strategy of the United States depends on its technological leadership in the world. The broad definition of National strategy makes this apparent for it applies to all the components that go into this definition. Our strength has been built upon the foundation of advanced technology.

Let us take a short tour of the world and see the problem from a strategic point of view with some of the impact of technology on our future action. Europe is our first area. The Atlantic Alliance will need constant tending. The years and their affluent economy have dimmed fears of the Soviet Union. This is 33 years after the end of World War II. (Our problems in Southeast Asia and involvement at home raised the question of withdrawing our forces from Western Europe.) This does not mean the area is of less strategic importance, but the proper use of the technical avenues open to us — such as the air and the sea properly exploited — offer new defense considerations.

The Middle East will have a diet of everyday warfare as has been going on for years. Is Israel vital to our national interests? What is our strategy? If it is to keep a balance of power in the area, our technology must be superior in its products. The advent of modern Russian technology in the form of surface to air missiles plus other modern aircraft may turn the tide.

Israeli air superiority has been the key to their continued success and existence. As Soviet seapower builds up in the Mediterranean and they give massive aid to the Arab nations we may have to reconsider our strategy for the Middle East. It is a natural desire for this to continue as a strategy of peace. It would appear that our best technology in the form of modern weapons systems to the Israeli may be necessary to prevent the destruction of Israel.

Regardless of where we stand on this question we must make some strategic decisions now on the matter. These decisions to a great extent will depend on the available tools which are the product of our technological base. Our strength rests on this cornerstone. It consists of our industrial capacity and ability to produce workable useful hardware systems out of these technical advances. It also depends on the continual Research and Development push into the broad spectrum of all the sciences. The understanding of our people of the complexity of this problem is a must if we are to remain a world leader of the free nations. The strategic option open to the leaders of our country in the years to come will rest on how well we do our technical work. Africa will be a plethora of civil wars and tribal feuding. It has low priority for the US.

Asia will be the continent of decision between the East and West. There will be renewed attempts to reach an understanding with Red China. Taiwan will not be sacrificed but it will not be permitted to stand in the way of a US-Red China agreement. We are enmeshed deeply in the struggle in Asia. Ferdinand Marcos, President of the Phillipines, predicts Russia, not the US will become the block to Red Chinese domination. With two primary motives, history and economics, Russia is moving into Asia with a determination unmatched since the Czar expanded across Siberia in the last years of the 19th Century.

Latin America is a place we speak of in many ways with preconceived ideas. Our policies have not been credible over the years. Western European influence has shaped this part of the world to a greater extent than has the US.

This quick tour around the world and the problems we face in these areas accentuates the importance of the sea to us in any strategy we employ. Our power to use the sea is now and will be in the future, dependent on our technology and our use of it in modern weapon systems at sea. As we have seen, the use of space surveillance systems may rob surface task forces of the ability to hide in the vast ocean spaces. This coupled with advances in guidance and homing may make it vulnerable to long-range missiles. High speed computers and data links are components of such a system. It is apparent technical progress can alter our strategic uses of the sea. New large submarine capabilities give one pause for thought on the uses of the depths of the sea. It is such technological progress that will make an oceanic strategy practical as well as credible to the world.

The world is a dangerous place. This century certainly cannot be called one of peace. Five major wars, two of which were world-wide, have occurred. The violence in Asia, the Middle East, or, closer at home should make people pause who believe an appeal to reason will move men away from violence and bloodshed.

The belief that all nations are rational in their actions can be fatal. Our strength has to be such that whether it be the Russians of Chinese they must see that a nuclear exchange would be an irrational act on their part assuring their destruction. Hitler was willing to accept a Gotterdammerung and there may be some of this type existing today. One must not forget the wargaming equation.

Utility of something = Value — the Cost.

Each nation puts different numbers in this equation, particularly the cost. China has said it can lose 200,000,000 citizens and survive. It is obvious we could not put this number in the equation. A look at the numbers show that 67% of our population live in urban areas, 46% of the Soviet while only 6% of the Chinese. There are 156 Soviet cities with over 100,000 people. If one hit 1,000 Chinese cities 89% of the population would survive. The numbers above show the choices one has in the above equation. It is because of this we must understand our requirement for overwhelming strategic forces to accommodate for the range of these variables.

In conclusion we can see that our technological base covers the whole spectrum of challenge against the US. It is also clear it supports all the components that go into the definition of national strategy. Is it strategy in itself? No, not really, but without it our ability to survive as a free nation would be in serious jeopardy. We must look at the whole problem and not at separate parts. The black and white definition of strategy and tactics relating to the military alone have become as obsolete as the biplane. We must accept the challenge to our creativity across the board in order to meet our National Objectives.

FOOTNOTE

(1) This proposed submarine is 604 feet long with a maximum diameter of 72 feet and a 150 megawatt boiling water reactor, giving 50,000 SHP for a submerged speed of 25 knots.

IMPACT OF COMMAND, CONTROL AND COMMUNICATIONS (C3) ON NATIONAL DEFENCE POSTURE

by Major General R.L. Edge USAF Retd

INTRODUCTION

This paper discusses the 'impact of C^3 on National Defence Posture'. Included in its topics are summaries that address:

a. Some of the key technological changes in weapons and delivery systems since World War II.

b. Some parallel technological changes in the tools available for C^3.

c. Certain changes in Rules of Engagement which may spring from these changes.

d. Examples of how selective use of available C^3 tools is a force multiplier.

e. Three major classes of C^3 systems; some top level criteria for discrimination among, them; and the value of such a discrimination.

f. An examination of existing and planned C^3 configurations to see how they may limit effective employment of the Defence establishment; and a rational approach to quantification of benefits from selective use of computers.

TECHNOLOGICAL CHANGE IN WEAPONS AND DELIVERY SYSTEMS

Physicists have made great strides, since World War II, in mathematical description of fundamental physical processes at the molecular and sub-atomic level. From these mathematical descriptions, they have derived mathematical models which have proved very useful for engineering advances in chemistry, science of materials, and electronics. The result of rapid engineering advance has been a dramatic increase in weapons yield versus cube and weight (both nuclear and conventional), greater weapon reliability, faster means of delivery over longer ranges (jet aircraft and missiles of various propulsion classes), greater reliability of delivery (lower abort rates from mechanical failure, weather or darkness), and smaller average delivery errors (resulting from more capable platform avionics and for some weapons, closed-loop terminal guidance).

The combination of higher yield, greater accuracy and improved reliability leads to greater probability of target destruction or severe damage per weapon committed. Longer ranges and faster means of delivery imply less constraint resulting from static location and disposition of forces; at the same time these factors can significantly reduce the time available for reconsideration of a provisional commitment.

The higher capability built into each unit weapon and its delivery system has dramatically increased unit cost. The high unit cost often leads to lower production quantities, forfeiting economies of scale and leading to even higher unit cost. This often leads to a smaller (in terms of manpower and munitions quantities) combat force, but one of higher potency, and a rationale of: if not 'all of our eggs in one basket', at least 'more of our eggs in a smaller basket', and a corresponding desire 'to watch that basket very closely'.

The demand for 'better' ability to command and control the newer, more capable and more expensive weapons is a natural result of the higher impact of a force employment decision: more certain damage to our adversary, and the depletion of our limited force inventory.

PARALLEL TECHNOLOGICAL CHANGE IN TOOLS AVAILABLE FOR C^3

The engineering advances in chemistry, science of materials and electronics were not, of course, the exclusive province of those who develop weapons and delivery systems. Computer, telecommunication and sensor technologies have, perhaps made greater strides than the weapons and delivery system technologies. Without the strides forward in computers and sensors, weapon and delivery system improvements would have been limited. But here we will concentrate on these strides as they may apply to tools available for C^3.

THE COMPUTER

Computers of a sort were used during World War II. Most were mechanical analogue computers. Some, such as the USAAF Norden bombsight, were used rather widely, but they were usually single-purpose units with a very limited repertoire even for that single purpose. The few electronic computers used were also analogue, with a very limited repertoire. Furthermore, they virtually required the skills of an electronic engineer to set them up and use them.

Even the first digital computers in the 1950s were crude by today's standards. They used thousands of vacuum tubes (more efficient at converting electricity to heat than in switching small electronic currents). They were bulky, they failed often, and not even many electronic engineers understood how to use them or what made them work. One had to learn, literally, a new language in order to command these computers, or else the instructions were 'hard wired', so that they could not be easily changed. Although rapid compared to other computer machines, those early digital computers were feeble and snail-like compared to today's computer.

The early exploitation of solid-state, semiconductor devices (diodes and transistors) simply aped vacuum tube design concepts on a device-for-device basis. Even so, the improvements in compactness, head avoidance, speed and economy were dramatic. The ability to produce inexpensive mass memory, monolithic circuits and, later, to exploit large scale integration, would not have been possible without using some of the earlier generation computers to assist in the design and manufacturing process.

Today, we are presented with an almost bewildering assortment of computers from which to choose. They range in size from a small microprocessor-on-a-chip smaller and lighter than a small coin to very large machines which can be ganged together for especially large applications. From the low mid-range on up, they are easily reprogrammable by a reasonably intelligent person with a bit of training, provided the program has been tightly defined.

The combination of hardware architecture and software which enables reprogramming is, perhaps, a more sophisticated technology than the fundamental digital computer. Certainly

software technology has lagged that of hardware technology. Most of the problems encountered in contemporary exploitation of computers result from deficiencies of one kind or another in software or firmware development.

Computer technology will continue to progress. But the potential presently exists (choosing the right combination of hardware and soft-ware), to exploit computers profitably for tasks ranging from small processes up to huge and complex processing jobs.

TELECOMMUNICATIONS

The design of telecommunications equipment also exploited the great strides made in materials science and electronics as well as those made in computers.

Since World Ware II, vacuum tube technology has increased useable frequencies for transmission by a factor of about a thousand; useable bandwidths by a factor of about fifty; and power output by a factor of about one hundred. Perhaps as importantly, the ability to use these factors in combination, and to modulate transmitted signals in a variety of ways, has provided a wide array of choices for telecommunications for Command and Control. Development of low-noise receiver power amplifiers has lent even greater versatility.

Coding advances, made practical by digital computers, provide yet another dimension to telecommunications versatility. Some typical applications of coding techniques include:

a. Lowering of useable signal-to-noise thresholds while improving fidelity.
b. On-line encryption.
c. Conversion of analogue signals (such as voice or facsimile) to digital bit streams in real time, permitting online encryption and decryption of these signals.
d. Providing additional margin against noise or jamming, compared to margins achievable by effective radiated power alone.

Computers are also used to replace manpower-intensive repetitive telecommunications functions, such as switching and relay. Speed and accuracy of performance are improved, and the cost of operation is reduced significantly.

Using satellite platforms and suitable earth terminals, which themselves exploit some of the features just described, wide geographical coverage for two-way communications with and among transportable/mobile force elements can be provided. Wide-band communications between very distant points can be provided relatively cheaply.

Telecommunications now serves the users of computers in a number of ways. For example, users of computers can be connected directly to a host computer, at a great distance, and yet use the computer as if it were in the same room.

RADAR

The same technology advances exploited by telecommunications — vacuum tubes, low-noise receiver, power amplifiers, coding and switching — have been exploited by radars, as well. Digital computers made possible an entirely new concept in radar — distributing the power output and received signals across an array of smaller, fixed antennae, and steering the beams electronically instead of mechanically. This reduced dependence on relatively slow-moving antennae and servo mechanisms.

Today, the most interesting part of a radar is signal processing — modulating and steering the transmitted signal and processing the return signal. The payoff from signal processing comes in many forms. Some examples:

a. Better trade-off curves for probability-of-detection versus false-alarm-rate, even under adverse conditions of clutter.
b. Better pattern recognition and display labelling.
c. The feeding of digital data links, permitting faster, more accurate, less manpower intensive cross-tell, forward-tell and reward-tell.

OTHER SENSORS

The technological advances which allowed the improvement of radars made possible the invention of a family of sensors working across a wide range of phenomenology: seismic, infra-red (heat), visual and olfactory, for example.

CHANGE IN THE RULES OF ENGAGEMENT

Two general principles of international conduct, especially among civilised Western democracies, seem to be constant:

a. Don't strike the wrong nation, through inadvertence (ignorance or lack of control).
b. Don't use more force than is appropriate to the provocation.

With the modern trend toward smaller but more potent forces, a corollary to the second axiom may be:

c. Don't do more damage than is appropriate to the provocation.

These principles imply the need for careful selection of a fitting response — especially the initial response. This need is reinforced by the relatively high economic and operational consequences of weapons expenditure: the high

dollar cost and, perhaps more important, the reduction in our limited munitions inventory coupled with a relatively long lead time for replenishment of depleted inventory.

With modern sensor systems, our ability to sense the existence and size of an intrusion is often greater than our ability to positively identify the intruder, and almost always much greater than our ability to determine the intent of the intruder. Often, intent must be inferred from observation and stronger inference may come from longer observation. The desire for stronger inference may lead to deliberate (even if temporary) withhold of potency, especially if the intrusion is not large. It can lead to long withhold periods, especially if the intruders move slowly.

Force reaction-time ability is usually relatively fixed. Delay in directing reaction shrinks the time available in which to react, in the limit, delay can prevent reaction. Hence, it should come as no surprise that those who must control modern forces insist on 'better' C^3 — more alert and less ambiguous sensors/intelligence, fast and meaningful assessment of 'own force' capability, selection from precast options when feasible, fast communication procedures and transmission to the force elements who will react, and good feedback (at least of the 'big picture').

But 'better' C^3 cannot be designed in isolation from the infrastructure in which it is to be imbedded, or in isolation from the structure which it is meant to control. If the terms of reference for commanders, Command and Control procedures and telecommunications responsiveness are optimised relative to sensors/intelligence, weapons and the Rules of Engagement, then the following may result:

a. A wide range of alternative responses from which to choose.
b. An opportunity for a better informed response selection.
c. Speedier application of power, once ordered.
d. Improved precision and effectiveness of the result.

If the terms of reference for commanders, Command and Control procedures and telecommunications responsiveness are not optimised relative to sensors/intelligence, weapons and the Rules of Engagement, then the range of choice for cogent responses may be very narrow, and forces may become totally ineffective.

SELECTIVE USE OF AVAILABLE C^3 TOOLS AS A FORCE MULTIPLIER

Many examples of possible uses of C^3 tools could be given. The five selected here (two using synergy and data links, and three which concentrate on computers) were chosen because they seem to offer high payoff in operational utility or economy or both.

Surface-To-Air Missile (Air Defence) Example

Typically, SAM battery radars have limited surveillance volume against low flying aircraft. This limits the time available to them after initial detection in which to identify, make a firing decision, fire, and watch the missile fly-out. Time compression is worsened by multiple concurrent targets, especially when they appear at opposite azimuths.

With no external cross-tell, response is doctrinal (eg, in normal peacetime conditions the battery remains passive); in simple alert — with only strategic warning, it may shoot only (for example) westbound targets, as they appear, with limited effectiveness; at advanced alert, they may shoot all targets who appear, but still with limited effectiveness against the enemy and with some fratricide if friendly aircraft do not avoid SAM positions.

With netted ground radars and/or AWACS and/or ESM data link cross-telling enemy arrival direction, time and altitude to SAM air defence batteries, the batteries may make earlier detection and identification. With suitable Rules of Engagement, this may improve effectiveness against the enemy and avoid fratricide, while providing greater route flexibility for friendly aircraft. In case of communications failure, the batteries can fall back to the doctrinal response.

F-15 (Air-To-Air) Example

The F-15 fighter has superior radar range, looking down, for detection, tracking and firing. But if the Rules of Engagement require positive visual identification before firing, the F-15's potential superiority is reduced; every engagement becomes a dog-fight. With netted ground radars and/or AWACS and/or ESM data link cross-telling and ground or AWACS direction, plus a suitable modification to the Rules of Engagement, the F-15 may exploit its potential superiority. It can fall back to the doctrinal response if communications fail.

Data Processor as a Filter Example

In large scale maneuvers, there are many reports, from many sources and many levels in the defence organization. These reports may be relayed several times before reaching the addressee. Often, the multiple relay and lack of early receipt acknowledgement results in multiple redundant reports arriving at different times. Updating, based on time of message arrival alone, can be worse than no updating. There are several alternatives for coping with a flood of

messages which may be redundant or may not be properly sequenced.

a. On one end of the scale, we might require that no reports or messages be forwarded past the next higher echelon of command. Each echelon is required to digest, prepare an abstract or summary and forward this to its next higher level of command, and to lateral commands. This method can very effectively limit the volume of messages to higher echelons; it must certainly add delay and error at each intervening echelon. It also requires wider terms of reference in this reporting scheme, the rhythm and momentum of our forces cannot be sustained in a look-shoot-look scenario.

b. On the other end of the scale, each echelon sends its reports (all or some) to each higher echelon in parallel. Automated assist to received message processing is exploited for some or all of the following:
   - — Eliminate unnecessary redundancy/ duplication.
   - — Filter out static elements (concentrate on 'what's new?').
   - — Local addressing and routing.
   - — Prepare updates for posting to displays.
   - — Post updates to displays.

The rapidity with which conversion from manual to automated assist can be implemented is directly dependent upon the degree of format rigor in messages; the greater the rigor, the more quickly automation can be profitably invoked, and the more useful it is likely to be. Free flowing narrative does not generally benefit from automation assist except for message routing. Formatted message headers on free flowing narrative messages are required to support this benefit. Even with high rigor of format established, careful adherence to defined protocols, formats and procedures is required in program development and, later, in operational practice. Computers are notably intolerant of ambiguity; 'almost right' is never good enough when communicating with a computer. If format rigor and companion protocols and procedures have not been already established, then this must be done as one of the first steps in detailed system design.

Automated assist can provide a large pay-off in decreased delay and error, without increases in staff; but having implemented automated assist, it is virtually impossible to retreat quickly to a purely manual mode of operation.

Data Processor for Message Composition Example

As with use of a data processor for message processing of incoming messages, there are various degrees or levels of implementation which one may undertake. Again, the rapidity with which one may implement them and their operational utility are directly dependent on the degree of formatting rigor used, and the degree to which rigor and discipline have already been established in operational practice.

The most fundamental capability is usually a tutorial check list, in a conversational mode with the computer. One is forced to consider every critical element in a message format. Those entries which are defined to be 'illegal' will be rejected by the computer. Corrections are relatively easy compared to other methods. The result can be improved completeness, speed and accuracy.

An optional capability of abbreviated entry with text expansion may be added. For example, a statement may be constructed of fixed and variable elements. The operator is required only to fill in the variable elements and the computer than transmits the full text. This feature can provide further improvement in completeness, speed and accuracy. If the message expansion is performed only at the receiving station, it can also reduce message length for transmission, conserving link capacity and reducing transmit time.

Some command control systems require authentication for every order. The process of preparing an authenticator is one more step where delay and error can be introduced. It is also a step which can be performed very readily by a computer, providing even further improvement in speed and accuracy.

Date Processor as a Communications Switch Example

There are three major commonly defined types of automatic switches.

The first type is called a circuit switch. As its name implies, it simply makes a circuit from one party to one or more called parties. Most often used for telephones, it can also be used for messages or data. In usual practice, however, message or data traffic can be more efficiently switched by other means.

The second type is called a message switch or store-and-forward switch. The transmitted message is divided into fixed length portions, usually called line blocks. These line blocks are transmitted from a terminal one at a time, with the switch acknowledging receipt of one line block before the next line block is transmitted. The switch stores each line block until the final one has been received. It then assembles the line blocks in the correct sequence and sends them, one at a time, in the same manner they were

received, either to another switch or to the addressed terminal(s).

A store-and-forward switch can also be used for data and facsimile, but the overhead penalties can be severe under some circumstances. Store-and-forward switches are particularly useful for handling messages to multiple addressees. The switch can store the message until each individual addressee is ready to receive it.

The third type of switch is called a packet switch or hold-and-forward switch. It operates much like a store-and-forward switch, except that it does not wait for a full message to be received before beginning to forward it. As soon as it has received and acknowledged receipt of a single packet, it begins to forward it, while in the process of receiving the next packet. Assembly of the packets in correct sequence must be accomplished by the receiving station. Packet switching systems are usually optimised for data users, but they can be designed for narrative messages or digitized voice.

The United States government operates two separate circuit switched systems and two separate store-and-forward switched systems. A packet-switched system has been in operation for a number of years, under the auspices of the United States government, chiefly inter-connecting laboratories of government and universities. The US Department of Defense is presently acquiring a packet-switching system for computer communications, which has been named AUTODIN II.

US experience with its operating switched systems has been very good. Thousands of Teletype machines, at user locations and at manual relay centres, have been discarded; thousands of people have been relieved from tedious jobs as switchboard operators or tape tearers to pursue more interesting and rewarding endeavers. Service to the customer has dramatically improved, while reducing operating costs. The capacity of the transmission system has been used more efficiently.

But, once again the computer is a tyrant. Circuit switches will not connect to the right party if the number dialed is merely almost right. Message switches will reject messages which do not comply exactly with the specified message header protocol. Most computer users have yet to learn that packet switching computers will be as demanding in rigor as the computers they now use for data processing.

THREE MAJOR CLASSES OF C^3 SYSTEM

We will, rather arbitrarily, define three major classes of C^3 systems, and then use these definitions to help examine the degree to which computers may improve each of these.

The first class tends to be bounded and deterministic.

a. Bounded in the sense that it deals with a well defined geographic area and scope of activity and/or a well defined (*a priori*) range of scenarios and responses.

b. Deterministic in the sense that the bounds of activity are limited by well understood and unalterable laws of physics or mathematics. Changes in state are not discrete, but continuous. Cause and effect are well understood. The range of responses to a specific provocation is very small and the range of applicable provocations is itself small. The narrow limits may be imposed by force inventory or force disposition.

Examples of bounded and deterministic systems are: the C^3 system associated with a single weapons system, or an Air Defence Ground Environment.

This class usually implies purely military action. The benefits of pre-casting provocations and alternative responses to each, and of rigorous message formatting, are usually readily available.

The second class tends to be bounded but non-deterministic.

a. Bounded in the same sense as the first class.

b. Non-deterministic in the sense that it is difficult or impossible to think through a likely series of events in advance. Changes in state may take large discrete jums which do not obey any well understood law of cause and effect.

Examples of the second class are: those which control forces dealing with terrorist actions or other actions where human psychology may dominate the provocation and response, even though the scene of action may be quite localised.

The third class tends to be both unbounded and non-deterministic. Unbounded in the sense that it does not deal with a well defined geographic area, or the scope of activity and range of scenarios cannot be well defined in advance. The semi-infinite range of scope, by itself, makes determinism difficult or impossible to apply; hence it is both unbounded and non-deterministic.

Although no single system may exactly fit any of these classes, the definitions are useful for examining subsystems or processes contained within systems and subsystems, especially when initially estimating the opportunities for exploitation of computers. Unless a process has a high

degree of boundedness and determinism, then describing the process by a logical flow diagram cannot be done. If this cannot be done, we cannot command a computer, a priori, so that it can respond usefully when needed.

Note that we began by discussing the boundedness and determinism of C^3 *systems* and ended by discussing the boundedness and determinism of *processes*. This distinction is important. Bounded and deterministic *systems* are rather rare. Bounded and deterministic *processes* already exist in most well managed systems, and with some intelligent attention can be formed out of what may now be unbounded or non-deterministic processes. The benefits of forming such a process may be largely realised by this formation alone, without ever later automating the process; or the potential for profitable automation may be increased significantly by such formation.

EXAMINATION OF C^3 CONFIGURATIONS

With limited resources available for providing improvements to C^3, one would like to be able to quantify the deficiencies that presently exist, so that he can concentrate on those that are most bothersome. He would like to use the same quantification method for examining proposals for improvement, both as a measure of the payoff by implementing a specific proposal, and for evaluation of competing proposals.

Unfortunately, no one has yet conceived a single 'measure of merit' for C^3 systems. There are, however, at least two true measures of C^3 system performance that can be applied to any C^3 system that can be defined and described as an 'end-to-end' process. These measures provide a degree of quantitative meaning to the qualitative demand for 'highly responsive' systems if, by 'highly responsive', we mean 'rapid, with high fidelity'. These measures are *time delay* (measured at nodes in the system and summed for the system) and *error contribution* (measured at nodes and along links and summed for the system). See Figure 1 for a simple illustration.

In our simple example, we would not worry about nodes 2 and 3; they contribute no delay and no error; similarly with link 2. Eighty percent of the delay is contributed at link 3 — perhaps an office distribution system — so we might concentrate most on this for delay improvements. Eighty percent of the error is contributed by node 1, so we might want to concentrate most on this for error improvement. Note that we must truly define 'end-to-end'. If we had defined the system as only nodes 1, 2, and 3 and links 1 and 2, we would concentrate on node 1 instead of link 3 as the greatest delay contribution, and this is probably a wrong priority for attention.

CONCLUSIONS

From the foregoing discussion, one can draw several conclusions:

a. As weapons systems change, the terms of reference, Rules of Engagement, communication systems Command and Control doctrine, Command and Control procedures and C^3 tools should be reviewed *together* (as a set), and modified as appropriate. Without balanced modification within this set, potential effectiveness of new weapons may be limited in realisation.

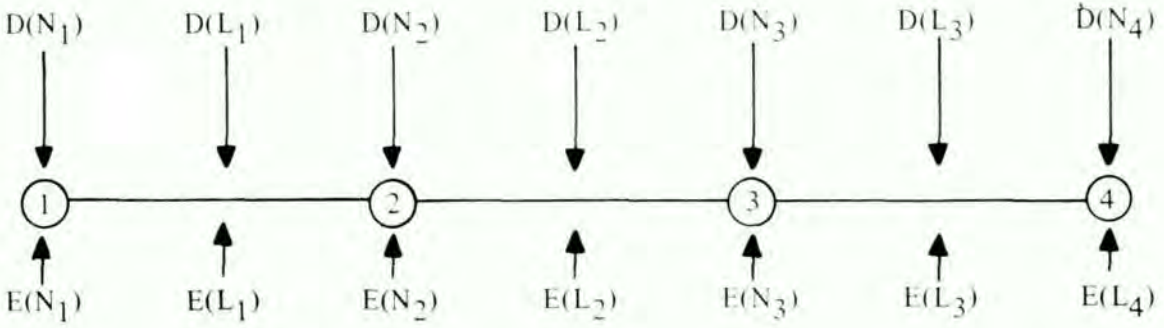
b. Modern C^3 tools, selectively applied, can reduce delay and error; and can improve effectiveness of force application, while improving economy. The force multiplier can be greater than unity.

c. Conversely, poor application of C^3 can limit effectiveness of weapons and forces and limit the range and precision of choice for cogent response. The force multiplier can be less than unity.

d. Opportunities for exploiting computers should be examined on a process — not system — basis.

e. An 'end-to-end' examination of each C^3 alternative is required to wisely allocate scarce resources for maximum improvement. Characterization by delay and error source may be most useful, since these can be measured and quantified. Concentration on worst delay and worst error sources may provide the greatest improvement in the least time and at the least cost. Marginal (high cost for little improvement) ventures can be more easily identified and avoided.

f. With limited resources available for defence allocation, a balanced apportionment for weapons and control is required for optimisation. If the budget is fixed before C^3 is defined, then top-level design of C^3 should be completed, and cost estimates and phasing developed before deciding on weapon system production buy quantities or other competing uses of capital which may be needed for properly balanced C^3. The internal programs should then be adjusted to achieve a more optimum balance.



Total delay = $\sum_{1}^{x} D(N_i) + \sum_{1}^{x} D(L_i)$ Total error = $\sum_{1}^{x} E(N_i) + \sum_{1}^{x} E(L_i)$

For this example,

Total delay = (10 + 0 + 0 + 20) + (0 + 0 + 120) = 30 + 120 = 150

Total error = (.0010 + 0 + 0 + .0001) + (.00005 + 0 + .00010)

= .0011 + .00015 = .00125

Figure 1. End-to-End Design Model

The circled numbers represent nodes: command centers or communication centers or relays. $E(N_i)$ and $D(N_i)$ represent error contributions and delay contributions, respectively, at the ith node. $D(L_i)$ and $E(L_i)$ represent delay and error contributions, respectively, along the ith link.

CAN THE NAVY OF A MEDIUM MARITIME POWER AFFORD NOT TO GO NUCLEAR FOR PROPULSION BY THE 1990s?

This paper by Lieutenant Commander G.L. Purcell RAN won first prize in the Officer Section of the 1977 Peter Mitchell Trust Essay Competition and is reproduced here by permission of the Chief of Naval Staff. The views expressed by the author are his own and not necessarily those of the Australian Government, the Department of Defence, the Chief of Naval Staff or the Australian Naval Institute.

INTRODUCTION

The world's first nuclear-propelled vessel was the US Navy submarine *NAUTILUS* which went to sea for the first time in January 1955. Three years later *NAUTILUS* made history's first polar transit from the Pacific to the Atlantic and in so doing revealed to the world the enormous potential of nuclear propulsion. The strategic implications of this voyage were as dramatic as the introduction of steam vessels in the nineteenth century and led quickly to a race for superiority between the USA and the Soviet Union in the production of nuclear submarines. Twenty years later the nuclear submarine equipped with Inter Continental Ballistic Missiles has become the cornerstone of the deterrent policies for both the USA and the Soviet Union. Great Britain and France have also developed their own nuclear submarine deterrent within this time.

The second phase in naval nuclear propulsion began in 1961 when the world's first nuclear-powered surface warship, *USS LONG BEACH*, was commissioned, followed shortly afterwards by the carrier *ENTERPRISE*. Since then the United States Navy has built (or is building) a further eight nuclear powered surface warships including three more carriers. Development of nuclear propelled merchant ships has lagged behind warship construction and, to date, only five ships have been built. These include the American research ship *NS SAVANNAH*, Russian ice-breakers *LENIN* and *ARTICA*, a German cargo ship *OTTO HAHN* and a Japanese research vessel, *MUTSU*. Another ice-breaker, *SIBIR*, is under construction in the Soviet Union and a cargo passenger ship *ZAN THAN* is believed to have been built in China with another similar ship under construction.

CURRENT TRENDS

Increasing interest by medium maritime nations, such as Canada and the Netherlands, is now being shown in nuclear powered merchant ships. Detailed studies have also been completed by the Department of Transport in the United

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Lieutenant-Commander Purcell joined the RAN in 1962 and graduated from the RANC in 1965. On completion of courses in the UK he was posted to *HMAS ANZAC* for Bridge Watchkeeping Certificate training followed by two years as Navigating Officer of *HMAS SWAN*. After a commission as Commanding Officer, *HMAS BOMBARD* he served on two years exchange service with the USN at the Naval Academy, Annapolis. On return to Australia in 1974, he served in *HMAS MELBOURNE* and in *HMAS SWAN* prior to attending PWO(N) course in the UK. In 1976-77 he served as the Navigating Officer in *HMAS BRISBANE* and is currently serving on the staff of the Navigating School, *HMAS WATSON*.

Kingdom but, as yet, no decision has been made to proceed with construction. The rapid escalation in cost of hydro-carbon fuels over the last few years and expectation of continuing higher fuel costs in the future are gradually making nuclear propulsion economically viable. With this stimulus, and the knowledge gained from existing vessels such as the *OTTO HAHN*, a merchant fleet of up to 200 vessels by the end of this century is feasible.

The acquisition of nuclear-powered warships by medium-size navies also seems likely as fossil fuel costs rise and supplies diminish. However, the timing of this transition to nuclear propulsion by smaller navies seems likely to extend over many years, as it will be dependent on individual defence needs and assets, which vary considerably from one country to the next.

The main variables affecting the adoption of nuclear propulsion by individual nations are:

(a) the availability of conventional fuels, preferably from own sources;
(b) the level of nuclear technology within individual nations;
(c) the national wealth;
(d) perception of the threat, or the role of the navy; and
(e) public acceptance of nuclear propulsion.

Japan with virtually no natural resources would on first assessment appear likely to commence a nuclear programme for her Maritime Defence Forces. Japanese technology is capable of producing nuclear ships economically, and lessons will have doubteless been learned from Japan's initial experience with nuclear propulsion. Furthermore the gradual weakening of the United States' influence in Asia is a stimulus to Japan to strengthen her Maritime Defence Forces and protect her vital trade routes. However, the overall hostility of the Japanese people towards nuclear power, and diplomatic pressure on Japan to keep her naval forces small, are presently decisive factors in delaying the development of nuclear propulsion in that country.

Canada is in contrast to Japan as she has abundant natural resources which enable her to defer the transition to nuclear power for some time. Although Canada has well established nuclear reactor and ship-building industries and has the wealth to support independent development of nuclear propulsion, her need to exploit this capability is less immediate than that of Japan. Another factor supporting this slower transition is Canada's geographical location and close defence involvement with the United States. Notwithstanding all of her advantages, Canada is considering construction of a nuclear-powered ice-breaker which, if it is successful, will provide invaluable experience and knowledge for follow-up nuclear ships when they are required.

The two large maritime powers in Europe, France and Great Britain, show divergent attitudes towards wider application of nuclear power in their navies which reflect their different defence policies. As the French maintain their own naval defence, independent of NATO, they see a need for a nuclear-powered helicopter carrier as a follow-on to their nuclear submarine 'force de persuasion'. In contrast the British perceive the role of the Royal Navy, within NATO, as being effectively carried out by large numbers of oil powered ships. The availability of North Sea oil and the high capital costs of nuclear surface ships must also be factors in the British decision.

West Germany and The Netherlands are approaching nuclear propulsion from the commercial rather than the military direction. The successful development of the German nuclear ship *OTTO HAHN* has been a learning experience which will be of great value in later development of naval vessels. Although the Dutch have not yet joined the small group of nations to have built nuclear ships, they have completed a detailed study on the cost-effectiveness of a Sea-Land container ship of 120,000 SHP and 30 knots [1] and seem likely to enter the field in due course. Both of these countries are heavily dependent on imported fossil fuels, although West Germany is moving rapidly towards reliance on nuclear power for her industrial and domestic needs.

The factors in the Australian consideration of nuclear propulsion are similar to most of those affecting Canada. Australia is not self-sufficient in oil but has enormous coal reserves, suitable for conversion to conventional liquid fuel, to meet her national power needs for the next one hundred years. Ironically Australia also has 27% of the world's low-cost uranium (recoverable at $15 per pound U308)[2] so has a choice of fuel resources available to few other counries. Nuclear technology in Australia is largely involved in experiment and research and, together with naval ship building, falls short of the level achieved in Canada. Her remoteness from powerful allies is a major difference from the Canadian situation, however, and this factor supports the case for Australia having some nuclear ships in the event of certain types of conflict. In both countries, early development of nuclear propulsion would probably be strenuously opposed by the public.

THE ENERGY GAP

The term 'energy gap' is interpreted in different ways by various groups within today's society. For example, the average motorist probably relates it to the 1973 'energy crisis' when the price of petroleum products soared, as a result of

the concerted efforts of the Organisation of Petroleum Exporting Countries (OPEC) to force up the price of crude oil. The ever increasing cost of petroleum is now so much a feature of life in the Western world that it is almost taken for granted and little attention is paid to the fundamental cause of this situation — diminishing supplies. The surprising thing about the oil situation is that the public will pay little regard to it at all until petrol is rationed or until industry starts to collapse for want of power. To some ecology groups, such as *Friends of the Earth*, the 'energy gap' does not exist at all or, at best, is a term used by governments or multinational corporations to justify development or profits, to the detriment of the overall quality of life of local communities. This group considers that fossil fuels are inexhaustible or can be replaced by 'clean' substitutes such as solar or wave energy.

At the other end of the spectrum are the advocates of nuclear power. In their view, the energy gap is the forseeable shortage in the world's energy supplies which, if not corrected, will lead to zero growth-rate of trade, increased unemployment, widespread hunger, terrorism and anarchy. This pessimistic outlook is based on the premise that the world's proven oil reserves, in the region of 93 billion tons, will be exhausted in 35 years at present rate of usage,[3] and that natural gas will last for only 41 years.

A graphical representation of this predicted energy gap, based on OECD figures, is shown at Table 1.[4] The uppermost curve represents an increase of 87.5% in energy requirements, which is the considered minimum to ensure world stability in the period 1975 - 2000. Since some theorists predict that a 400% increase in energy will be required for the same period, Table 1 might even be considered a conservative estimate.[5]

To achieve the necessary energy diet, all major sources of energy have been considered with the exception of wind and wave power. From 1980 the energy gap widens and can be filled only by nuclear power and, eventually, only by utilisation of fast breeder reactors. The last stage thus represents the transition of the world into the plutonium age, which is a contentious issue in current debates on nuclear safety. If the world could reverse its present industrial trend and adopt simple agrarian economies the energy gap would cease to exist. However, since this is not possible, only wishful thinkers can ignore the implications of exhaustion of the world's fossil fuel supplies or reject the kind of predictions represented in the Table.

ALTERNATIVE FUEL SOURCES

One encouraging aspect of the Table is the potential importance of coal. World cost reserves are still vast and are readily convertible to synthetic oil. However, the process of conversion requires large supplies of electricity which would be most cost-effectively produced in nuclear power stations. Other synthetic fuels which also may be exploited more fully in the future are methanol and liquid hydrogen. Methanol is produced from limestone and water but, as in the conversion process for coal, vast quantities of electricity are required. Another problem is that methanol is only about 50% as efficient as petroleum and would demand excessive storage space. Liquid hydrogen presents similar problems as it is expensive to produce, inefficient in volumetric terms, and requires that extreme safety measures be observed at storage sites.

The amount of energy consumed by world shipping is estimated at about five per cent, which is small in comparison with overall industrial energy requirements. Nevertheless, as hydrocarbon fuels become increasingly scarce, any reduction of this small percentage will be an important saving in fossil fuel reserves. In this context, the wide-spread use of nuclear propulsion for naval and merchant ships seems almost inevitable. The urgency of this change will vary according to the circumstances of each nation and with its supplies of conventional fuels. Thus the navies of some medium maritime powers may have to go nuclear by the 1990s; others may continue to be effective for many years afterwards, using synthetically produced conventional fuels.

THE TECHNOLOGY OF NUCLEAR PROPULSION

In its 1971 Report on the Nuclear Ship Study, the Department of Industry in the United Kingdom concluded that 'the techniques of building, operating and maintaining nuclear propelled ships are well established.[6] Most of this knowledge and experience in the UK has been the result of the British nuclear submarine programme. Additionally, papers published on successful prototype nuclear ships such as the *SAVANNAH* and *OTTO HAHN* have added to the store of knowledge on the subject.

The essential differences in construction of a nuclear vessel, compared with a conventional vessel, are a heightened requirement to reduce the risk and effects of fire, collision, explosion and flood, and the installation of a reactor. Improvements in damage-control, which were included in the design of *OTTO HAHN*, were an increase in water-tight subdivision, a double bottom from the forward collision bulkhead to the aft peak bulkhead and additional empty spaces along the side of the ship.

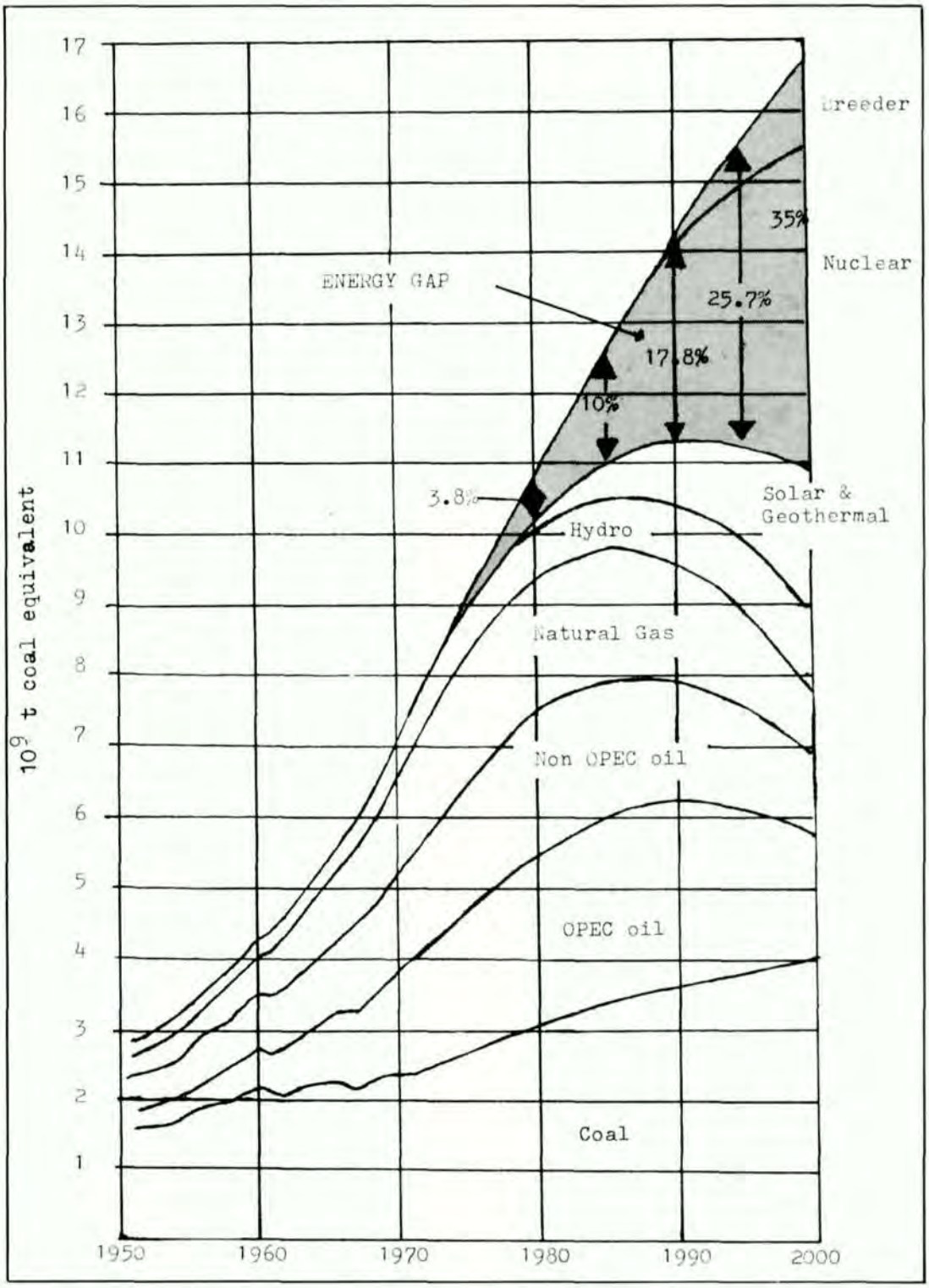

TABLE 1 — THE ENERGY GAP

In the reactor compartment the double bottom and side cells function as empty cells for collision and grounding protection. Elsewhere in the ship these compartments can be flooded with salt water to provide additional radiation shielding. Some of these damage-control features are already incorporated in the designs of larger warships. Application of all of them to destroyer or cruiser types necessarily implies an increase in displacement and cost.

The reactor compartment also makes a significant contribution to the displacement of medium-size ships. For example, the reactor compartment in *OTTO HAHN* accounts for 1,000 tons of the ship's total displacement of 25,812 tons — for a power output of only 10,000 SHP.[7] Much of this weight is caused by the containment vessel, which is a solid block of concrete, in which the reactor is located. Additionally, effective collision barriers have to be built-in, on either side of the containment vessel, and secondary shielding material around the reactor compartment has to be provided.

NUCLEAR REACTORS

Various types of Pressurised Water Reactors (PWRs) have been installed in all nuclear-powered ships constructed to date and steady improvements continue to be made in reactor technology. Contrary to the expectation of some, the power output from a fission reaction in a single reactor may be quite small. For example, the power output of the reactor in early generation nuclear submarines was of the oder of 15,000 SHP and the carrier *ENTERPRISE* requires a total of eight PWRs to produce the 280,000 SHP which will drive the ship at 35 knots.[8] As a comparison, the *JOHN F. KENNEDY*, which is conventionally powered but smaller in displacement than *ENTERPRISE* uses eight boilers to achieve the same power/speed output.[9] A further comparison, which reflects the increase in size and capabilities of marine PWRs is that *USS NIMITZ*, which matches *ENTERPRISE* in size and speed but was commissioned 14 years later, produces 280,000 SHP from two reactors.[10] In the commercial field, West Germany, Japan and the United Kingdom have confirmed the feasibility of achieving a power output of 40,000 - 80,000 SHP from an Integral PWR similar to the one fitted in *OTTO HAHN*.[11]

CONSTRUCTION AND MAINTENANCE FACILITIES

From this brief outline of some of the unique features of nuclear ships, it is apparent that special dockyard facilities are required for their construction and repair. In any discussion of the cost of nuclear propulsion, provision of these special facilities must be considered, unless individual nations are prepared to shelve their independence and have all construction and repair tasks carried out by a supplying nation. This situation would not be acceptable to most navies, nor would it be politically popular in most medium maritime nations. The specialised nature of nuclear ship construction is evident in the fact that the whole USN nuclear submarine force has been built in only five shipyards in the United

USS ENTERPRISE

— by courtesy Defence Public Relations

States.[12] An even smaller number of yards has been involved in the USN nuclear surface-ship programme, and now this taks is carried out solely by the Newport News Shipbuilding and Drydock Company in Newport News, Virginia.[13] In the UK, Vickers and Cammell Laird are the only two yards to have built nuclear submarines and the Cherbourg Naval Dockyard has been the only builder in France.[14] The reasons for this are several, but the most important is the high cost of upgrading shipyards to ensure that the stringent requirements of nuclear work are met. Extremely high standards of cleanliness, quality assurance and quality control must be attained, and some costly facilities such as high integrity electrical supplies and health monitoring systems must be provided.

BUILDING YARDS

As a result of its experience in building and operating nuclear submarines, the Royal Navy provides useful background on some of the special facilities required in building and repair yards. The items listed below would be needed to convert existing shipyards to make them capable of building nuclear vessels:

(a) high integrity electricity supply;
(b) nuclear monitoring and control facilities;
(c) primary circuit effluent/decontamination facilities;
(d) core storage and loading training area;
(e) shore steam supplies capable of running propulsion auxiliaries prior to criticality;
(f) non-destructive examination facilities for primary circuit welding;
(g) heavy craneage for reactor pressure vessel and large component lifts;
(h) core loading rigs;
(j) clean store for primary circuit components and associated control systems;
(k) pipe cleaning and fabrication shop to clean room standards;
(l) shielding material working shop;
(m) demineralised water production, storage and transport facilities; and
(n) health physics and radiation laboratory and personnel decontamination facility.[15]

In addition to these materiel requirements, shipyard employees involved in reactor work need a period of retraining to raise their standards to the highest level for nuclear work. Shipyard management may also require some re-organisation to ensure that high standards of quality control are met.

REPAIR YARDS

Three main functions have to be within the capabilities of yards carrying out repairs on nuclear ships. They must be able to carry out a nuclear refuel, survey or inspect the reactor plant and repair and maintain the conventional equipment. The first two of these tasks will require men to work in an environment where they will be exposed to radiation. Careful planning of work schedules and close monitoring of pesonal dosages is obviously essential if these tasks are to be completed without exceessive delay or risk to personnel. Repair yards require all the facilities required in building yards, although there may be some differences in scale according to the type of vessel and work being done. Additional materiel facilities will also be required, mostly related to nuclear refuelling. Modifications in management to include some type of quality-control organisation will also be necessary.

NUCLEAR TECHNOLOGY — CONCLUSIONS

The construction and repair of nuclear ships by medium maritime powers is feasible. The design concepts have been well proved over the last 22 years and engineering techniques are within the capabilities of most industrialised nations. Furthermore, continuing improvements in reactor design will partially overcome present weight/power limitations. However, existing shipyards will require some very expensive additional facilities plus some changes in management structure in order to cope with the exacting standards of nuclear work.

COSTS

The monetary cost of nuclear propulsion is high because it involves higher capital expenditure and increased costs for repair and training facilities. Nuclear ships are not economically competitive with conventionally powered ships except in terms of fuel costs. Examination of some of the known costs of nuclear ships which have already been built provides some perspective on this question.

CONSTRUCTION COSTS

During the twelve-year development programme for the *OTTO HAHN* the parent company spent $50 million. This figure included construction costs of $14 million for the ship and its first reactor core, without fuel. An additional $15 million was spent on development of a research centre and the remaining amount covered expenses for ongoing research and development. Although *OTTO HAHN* is considered a successful prototype vessel, it is not an economical ship in a commercial sense. In the USA, a study made on conventional and nuclear tankers of 130,000m^3 concluded that the conventional ship would cost

$132 million (1974 dollars) compared with $193 million for the nuclear ship.[17] The Dutch comparison for a Sea-Land container ship estimated costs of $82 million and $114 million for the conventional and nuclear ships respectively.[18] Some known warship costs also demonstrate this price difference as well as showing rapid increases in nuclear costs. For example, the *SKIPJACK* class SSNs, built in the United States in the early 1960s, cost about $40 million and the *VALIANT* class, built in UK a few years later, cost about $60 million(1962 dollars).[19] At today's prices both of these submarines would cost well in excess of $100 million, compared with the current price of $40 million for an *OBERON* class conventional submarine.[20]

Construction costs of nuclear surface ships are even more revealing. For example, the *USS ENTERPRISE* cost $451 million in 1958, compared with a cost of $277 million for the conventionally powered carried *JOHN F. KENNEDY*, which was built six years later. The proposed USN Strike Cruiser (CSGN), fitted with the *AEGIS* weapon system is estimated to cost about $1,000 million compared with $550 million for a similarly armed conventional destroyer of the *DDG-47* class. Costs of the two nuclear carriers, *EISENHOWER* and *CARL VINSON*, are expected to exceed $2,000 million each.[21] In order to see these figures in perspective, the total estimate for Australian expenditure on equipment and stores for 1977-78 is $616.5 (Aust) million, out of a total budget of $2,343 (Aust) million for defence.[22] whilst medium maritime powers do not expect to own nuclear powered aircraft carriers, the escalating costs of the new generation of smaller combatant nuclear ships may also be beyond their economic means.

TRAINING AND REPAIR COSTS

The need to maintain high standards and a high level of knowledge by all personnel involved in nuclear work necessitates effective recruitment and training programmes. (The importance attached to recruitment may be judged from the fact that each officer in the USN nuclear force has to be accepted by Admiral Rickover personally.) Training facilities are costly as they must provide highly qualified instructional staff, expensive simulators and, preferably, a small nuclear reactor. The Royal Naval College, Greenwich, fulfils most of the training requirements for Royal Navy personnel and teaches courses varying from one year in duration to several days. An important part of most of these courses is operation, by students, of the training reactor. In addition to crew training, facilities also have to be provided for the training of health-physics and radiological-protection staff, and refuelling and maintenance staff. The special requirements of nuclear ship repair yards have already been mentioned and are a further expensive component in any nuclear propulsion programme.

FUEL COSTS

The initial reactor cores for the USN cruisers *CALIFORNIA* and *SOUTH CAROLINA* cost $11,500,000 and are expected to give a range of 700,000 miles.[23] This is the same distance which would be steamed by a ship at an average speed of 14.6 knots for 200 days per year over a ten year period. Fuel costs for a conventional ship operating within the above parameters, which amount to a 55% 'at sea' employment, would be about $13 million at present prices,[24] assuming a fuel consumption rate of 70 tons per day.[25] If an inflation rate of 10% per annum were considered in the above calculation, fuel costs would be about $20 million. From these figures it is apparent that fuel costs will be less for the *CALIFORNIA* class than for comparable oil-burning ships even without the expected higher prices of fossil fuels being considered. The cost-effectiveness of nuclear power over oil power is even more significant for larger ships. Hence there has been considerable commercial interest in building large tankers and container vessels as, within large price criteria for oil and uranium ore, they can be economically viable despite extra costs of construction. Smaller classes of nuclear warships would be unlikely to offset their extremely high construction costs with savings on fuel, however, unless conventional fuels were nearing exhaustion.

NUCLEAR COSTS IN THE USN

Within the United States Navy, sharp divisions have occurred over the cost of nuclear ships and the impact of this cost on the size of the Navy. Former Secretary of Defence, Rumsfeld, made the following statement in relation to the debate of the CSGN versus the DDG-47 class: 'Our assessment is that the military value of an all-nuclear powered *AEGIS* ship programme does not warrant the increased costs or, alternatively, the reduced force levels.'[26] Former Chief of Naval Operations, Admiral Zumwalt, has voiced even stronger criticisms of the cost of nuclear ships, in a direct attack on the father and watchdog of the USN nuclear programme, Admiral Rickover. In Zumwalt's opinion, his own efforts to modernise the Navy were thwarted by Rickover, who used his Congressional influence to tilt the Navy towards exclusive reliance on nuclear power, to the detriment of ships needed for sea-control missions.[27] The counter opinion, by the supporters of the USN nuclear programme, is well summarised in the following extract from the United States Naval Institute Proceedings: 'With regard

to super-ships and a nuclear powered Navy Admiral H.G. Rickover is right and Zumwalt is wrong. Little ships are outclassed by big ships and oil is now as obsolete as sail was to steam. Zumwalt of the surface element is responsible for the procurement of oil-powered, mediocre surface ships, while the undersea and air elements were buying the best nuclear submarines and aircraft carriers they could get.' [28]

Regardless of which side is right in this acrimonius debate, one fact is implicit in both arguments. That is that the cost of nuclear ships is extremely high, which means that a navy which takes the nuclear propulsion option will have to accept an overall smaller number of ships. If the proposed USN Strike Cruiser is considered as an example, the Navy's cruiser/destroyer strength could be reduced by half if nuclear propulsion were adopted exclusively.

NUCLEAR COSTS — CONCLUSIONS

For a medium maritime power, quality of future ships may well be less important than quantity, particularly if national defence policies are geared to such miscellaneous tasks as protection of off-shore resources and local joint-service operations. The desirability of maintaining a navy which is capable of projecting seapower over a large ocean area may not, therefore, be compatible with the requirement to patrol a 200 mile Exclusive Economic Zone. 'Super-ships' are clearly required for achieving dominance in total war whereas a large number of simple ships can effectively conduct the surveillance of large ocean areas or intervene in limited military conflicts. The only factor which could dramatically alter the balance of this situation would be the premature exhaustion of fossil or synthetic fuels. In this contingency, the cost factors already discussed would scarcely be relevant.

TACTICAL CONSIDERATION

The opinion expressed earlier that 'oil is now as obsolete as sail was to steam' is probably only a slight overstatement of the tactical advantages offered by nuclear propulsion. The commander of a nuclear warship is freed of two of the major constraints inherent in conventional ships, namely, speed and fuel limitations, and can better fulfil such principles of war as surprise, concentration of force, economy of effort and flexibility. The capability of a nuclear ship to operate for long periods at high speed improves its chances of avoiding detection; also, time on transit is reduced for longer periods. In a more general sense, the constant availability of sustained speeds in excess of 30 knots enables a nuclear ship commander to meet rapidly changing circumstances and to seize fleeting opportunities as they occur. Similarly, the endurance of a nuclear ship enhances its operational ability, as well as reducing the period when it is most vulnerable to attack — such as during underway-replenishment operations.

Russian E II class nuclear powered submarine
— by courtesy of Jane's

In the undersea environment, nulcear submarines have developed their potential to an extent which was probably inconceivable at the end of the Second World War (1939-1945). In addition to their employment in the nuclear deterrent role, nuclear submarines are an extremely potent threat to shipping because of their speed advantages and because they can remain submerged indefinitely. This threat has been heightened by the development of improved submarine sensors and weapons, which enables attacks to be delivered from outside normal detection ranges of many current anti-submarine sensors. The Soviet *CHARLIE* class is a successful missile attack, while submerged, out to a range of 25 miles against a surface ship.[29] ASW ships and aircraft can help contain the threat posed by the *CHARLIE* class but the most effective counter is probably another nuclear submarine.

In any major conflict of the future, the protection of merchant shipping against nuclear submarines will be a high priority for any maritime nation. Although the odds seem formidably high in favour of submarines, variation of convoy tactics may keep vital sea lanes open. One feasible tactic would be the use of small groups of large-capacity merchant ships which would be routed at high speed over selected tracks. The use of high speed would greatly reduce the offensive options of submarines and would also force them to use speeds at which they are more easily detected. For commercial reason, some large container ships are already using passage speeds of 25-35 knots so the fast convoy concept is viable — even for conventionally powered ships. The most effective naval escort for these valuable convoys would need to be nuclear powered as the risks involved in refuelling oil-burning escorts, at regular intervals, would be unacceptable. Other applications of nuclear warships can also be readily suggested, as their tactical advantages over conventional counterparts are clear-cut in most situations. Although nuclear power may never replace oil to the same extent as steam replaced sail, the number of nuclear vessels operated by any nation is certainly some measure of its seapower.

NUCLEAR SAFETY

'The Soviet Union is believed to be facing a serious problem with some of its nuclear powered submarines as a result of the leakage of radioactive wastes from their reactors.' [30]

The above report, which is believed to have come from a reliable Norwegian source,[31] highlights one of the safety problems inherent in nuclear propulsion. The Japanese experience with the ill-fated *MUTSU* also focused attention on nuclear safety. Inadequate neutron shielding in that ship caused radiation leakages which aroused the hostility of Japanese fishermen and resulted in the early termination of *MUTSU's* operational career. Failure in this one instance has also delayed the continued development of other nuclear ships in Japan.

RADIATION LEAKAGES

In considering nuclear safety, the highest priority has to be given to the possibility of leakage of radioactive wastes. (This is a more realistic likelihood than the popular concept of a nuclear reactor becoming a bomb.) External radiation leakages in port would pose serious hazards to the local community. A typical situation involving release of fission products, following the accident to a nuclear ship in or near a port, could be expected to lead to a total number of 60 fatalities (over a number of years), a milk ban out to 90 miles and ground sterilisation, for a limited time out to about five miles.[32] The implications of a nuclear accident are indeed serious and necessitate extreme precautions in nuclear ports. These ports must be carefully selected to ensure that prevailing weather conditions are generally favourable and that shipping movements are rigorously controlled. Consideration must also be given to population densities and distributions, evacuation prospects and berthing. Additionally, ports must provide adequate radiation monitoring and emergency services.

Grounding or damage to a nuclear ship outside a well-equipped port may produce hazards for which there are no real solutions. This is a cause for concern, particularly as a recent survey showed that some 85% of all tanker accidents in NW European waters occur within five miles of the coast [33] .One such accident was the grounding of the *TORREY CANYON* off Cornwall in 1967 which resulted in tons of oil being spilled and widespread environmental damage. A similar accident to a nuclear ship would probably also involve long-term radiation dangers to local communities. In this event the effects of public acceptance of nuclear propulsion would be disastrous.

DISPOSAL OF NUCLEAR SHIPS

A further safety aspect to be considered is the disposal of nuclear vessels after they have been decommissioned. Little experience in this field has been gained to date, as the only ships to have been decommissioned are *NS SAVANNAH* and the USN submarine *SEAWOLF*. Three disposal options appear to be available: lay-up, entombment of the whole unit or piecemeal disposal by entombment. All of these options have inherent disadvantages, either because they pre-

USS Billfish — nuclear powered submarine
— by courtesy of John Mortimer

sent environmental hazards, or because they impose a great financial burden on the owner for many years after the ship has finished its useful life.

If the lay-up option is taken, the item of most environmental concern is the reactor pressure vessel which must be isolated for up to 55 years and monitored closely to ensure there are no radiation leakages from products such as plutonium, caesium and strontium.[34] Entombment, either of the whole unit or of components, is a more satisfactory method of disposal but is extremely complicated and expensive. International treaties presently ban the dumping of high-level radioactive wastes at sea, so wastes must be buried in some geologically stable area on land after being encased in concrete or other shielding material. Two obstacles to disposal by this method are finding someone willing to accept responsibility for the wastes on his land and the size of the units involved. For example, the reactor section of a ship's hull, filled with heavy concrete and ready for disposal by entombment is estimated to displace a volume of about 300,000 cubic feet.[35]

SAFETY — CONCLUSIONS

The safety aspects in the construction, operation and disposal of nuclear vessels are serious obstacles to widespread development of nuclear propulsion and must be resolved if progress is to continue. As the Japanese experience with *MUTSU* so clearly indicated, nations who go for

USS California — nuclear powered cruiser
— by courtesy of John Mortimer

nuclear propulsion without ensuring that rigorous safety standards are set, place their whole programme in jeopardy. For nations with less immediate energy needs than Japan, a failure such as *MUTSU's* would probably cripple nuclear development indefinitely.

POLITICAL CONSIDERATIONS

GENERAL

Despite some of its unique facts, nuclear propulsion is an integral part of the wider debate on nuclear power and should be examined in that context. Within this debate, opposition to nuclear power is based on three main arguments:

(a) fossil fuels will last indefinitely or can be replaced by solar energy, or other source, and there is no hurry to develop nuclear power;
(b) the existence of large amounts of plutonium is a risk to society as it could be stolen and used to make bombs for terrorist organisations; and,
(c) the unsolved problem of disposal of nuclear wastes will be a danger for future genera tions.

The proponents of nuclear power offer convincing answers to these arguments. In the first case, the exhaustion of fossil fuels can be fairly accurately predicted and, as outlined previously, widespread utilisation of nuclear power will be essential to fill the energy gap. With regard to plutonium risks, it is argued that this substance can be highly irradiated which would make it inaccessible to hi-jackers. Additionally, the use of plutonium for making bombs is not essential. The advent of new and simple methods of separating uranium isotopes enables many countries to produce Uranium 235, which is ideal for making nuclear bombs. The final safe disposal of radioactive waste is still to be resolved although temporary safety is achieved by glassification of waste materials. A satisfactory solution of nuclear power, to be more a question of politics than of technology.

POLITICS AND NUCLEAR WARSHIPS

Other specific objections can be raised with regard to nuclear powered warships. For example, the whole range of safety problems associated with nuclear power can be used to deny access to ports — including home ports. Objections may also be raised to the right of innocent passage through territorial waters, contiguous zones or narrow straits. In the face of bans on nuclear ships the important peacetime naval task of 'showing the flag' can thus be severely curtailed or else can contribute to unwanted political dissension within a host nation. The controversial visits by *USS TRUXTON* to Melbourne and *USS LONGBEACH* to Wellington in 1976, are examples of the latter effect. One other problem, of a political nature, is the present location of many naval dockyards close to large cities. Other facilities would have to be built in remote areas to carry out nuclear work or existing facilities would have to be relocated. Both of these options have political drawbacks as they are vastly expensive and they reduce employment opportunities in urban areas.

CONCLUSION

The world energy shortage is certainly a cause for concern to medium maritime nations and is a complex factor to consider in the planning of future naval forces. However, a short-term transition to nuclear propulsion appears too simplistic when other factors such as cost, safety and public opinion are considered. In the 1990s and beyond, medium maritime powers will have to carefully balance their naval defence needs against their wealth, technology and natural resources. A commitment to nuclear propulsion which is too early or too comprehensive would be counter-productive. Over-spending on too few ships may well impede the effective fulfilment of a navy's role — at a time when world stability may be in great jeopardy.

Nations who possess vast coal reserves will be able to provide synthetic conventional fuels for many years ahead, provided they use cost-effective methods of extraction and follow sensible conservation policies. While thus maintaining a position of strength, they can move gradually towards wider application of nuclear propulsion at a pace commensurate with their level of technology and with more likelihood of public support. Nations who lack raw materials will have to expand their nuclear power capabilities more rapidly, to meet industrial and domestic needs, as well as making a more rapid transition to nuclear propulsion for commercial and naval vessels.

In the meantime, no medium maritime power can afford to neglect research and development of nuclear propulsion. Additionally, consideration must be given to upgrading existing dockyards to ensure that they can meet the required standards of nuclear work. Nuclear training facilities must also be developed. In due course, construction of the first nuclear-powered ship could take place which, for reasons of economy, would preferably be a large oiler or support ship. Conventionally powered warships may never be extinct but their effectiveness by the twenty-first century will be limited. Medium-power status will require that the evolution to nuclear propulsion has commenced by then.

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RECOVERY OF SHIP'S BELL H.M.A.S. PERTH

by David Burchell

Back in 1967, with the assistance of the Indonesian Navy, I found the wreck of the first *HMAS PERTH* at the bottom of the Java Sea, just off the northern entrance to Sunda Strait.

She was lying flat on her port side in 200 ft of water with a 40 ft wide hole blasted by torpedoes in her starboard side and extensive shell damage to the bridge and compass platform.

Finding *PERTH* was the culmination of months of planning, disappointment and frustration, the usual format for such ventures, as her exact location had been unknown since she had been sunk by the Japanese over a quarter of a century before.

There were several motivations to attempt the search — interest in our military history was one aid — the fact that *PERTH* was the only RAN ship sunk in World War II that was thought to be in a diveable depth, was another. I also reasoned any relics recovered from her would not only serve as a permanent reminder of *PERTH* to future generations of Australians, but would also be representative of our other lost ships as well.

The aim was to recover the ship's bell and present it to the Australian War Memorial in Canberra for permanent safekeeping.

There was a strong need for urgency in 1966 as by then the Japanese had shown interest in the salvage of ships in the area, and whilst permission had been refused by the Indonesian Government, history has shown that what is politically expendient one day is not necessarily so the next. I felt it was imperative that the ship be found first by an Australian and the bell recovered.

And so the dive began.

Finding the ship was difficult enough but finding the bell amongst *PERTH's* 550 ft of battered superstructure was quite another matter. In vain I searched the places it should have been, but after 30 dives I had to accept the fact that the recovery of the bell was beyond me. I finally came to the conclusion that either it had been blown off its mounts during the ship's last action — or that it was stowed inside the quartermaster's lobby which I couldn't reach.

It seemed we would have to be content with the items that I had managed to recover, the most notable being the binnacle and other parts of the standard compass from the bridge. These items were brought back to Australia and duly presented to the War Memorial and are of course still there.

Some seven years later, in 1974, I received a letter from a friend, Lt. Col. R.I. Soemantri of the Indonesian Navy, advising that the bell of *HMAS PERTH* was in the office of a salvage company in Djakarta.

Soemantri who had been present throughout the diving in 1967 as liaison officer, was well aware of the importance we placed on the bell's return, and the purpose of his letter was firstly to let me know the bell had been recovered, and secondly to ask what was I going to do about it.

What was I going to do about it? Letters or cables would be a waste of time, and time was running out according to Soemantri, as negotiations to sell the bell to Japanese interests had already started. There was really no alternative. I decided to go to Djakarta and bring the bell home.

Years before, Soemantri and I had many disappointments during the dark days of trying to organise the search for *PERTH*. He was always a character and his sense of humour was one of the things that had kept me going. He nicknamed me 'Daddy' after he read one of my daughter's letters, and also invented a percentage system to mark our progress, or lack of it, in recovering the bell.

These percentage readings fluctuated with our fortunes, and on the day that we actually found the ship, his marking reached an all time high when he said with a wide grin "Feefty per cent, Daddy, feefty per cent."

When I arrived in Djakarta Soemantri was waiting at the airport and told me the situation as

HMAS Perth entering Sydney Harbour on her maiden voyage
— by courtesy of the Australian War Memorial (Negative No. 1226)

he saw it. Apparently an Indonesian salvage company, operated by a retired Major-General, had been licensed to work on sunken ships in the Sunda Strait area. The fact that *PERTH* was in the area and that the Indonesian Government had decided that, as a war grave, she would not be touched, had been overlooked.

In due course the *PERTH* bell had appeared amongst the salvage and it was then realised by the General that a mistake had been made. He was aware of the moral and political implications of desecrating the grave and had kept the bell under wraps until he decided what to do with it.

But the news of the recovery leaked out and now the matter was of considerable embarrassment to the General, so much so that unless the situation was handled with great care the bell could quite easily disappear.

When I met the General in his office the next morning I couldn't see any point in beating round the bush, so I said that I understood he had recovered the *PERTH's* bell.

He replied that he had, and later he acknowledged that he knew that I was the diver who originally had found *PERTH*. I went on to tell him that my purpose in returning to Djakarta was to ask him on behalf of the Australian people to give me the bell so that I could take it back to our War Memorial in Canberra. The promptness of his reply surprised me. "Yes", he said, "you can have it," just like that, and for a moment I didn't know what to say for I'd found in the past that this type of negotiation rarely was as straight-forward as this.

Cautiously I asked the General where the bell was now and if I could see it.

Again he surprised me. "Certainly you can see it", he replied "it's there on the floor behind you."

This stopped me in my tracks for a moment, after all, I had been trying to find this bell for seven years. When I looked round there it was, this totally honourable piece, still half covered in calcified marine growth but with the engraved lettering showing clearly, *HMAS PERTH* — 1939, and on the reverse side, *HMS AMPHION* — 1936. There was no doubt of its authenticity.

I asked the General if he would like to hand over the bell to the Australian Ambassador personally, and, being anxious to have the whole thing finalised, asked if it was convenient for him to make the presentation the next morning.

He appeared to be relieved at the way things were going and accepted the invitation, adding that it would be necessary, in order to take the bell out of Indonesia, to obtain permission from the Department of Marine which technically owned it. This apparently was just a formality, so Soemantri and I then went to the Australian Embassy to make the arrangements for the Ambassador to receive the General.

Our people at the Embassy knew nothing of the bell's appearance so I told Nobby Clarke (Captain), the Naval Attache, the story and he went off to relay it to the Ambassador. After a short time he came back looking worried. "His Excellency feels that if we accept the bell we will be condoning salvage operations on the ship," he said "As this amounts to the desecration of a war grave it could have serious political repercussions."

"Why is it" I thought "that whenever Governments become involved, simple matters immediately become complicated."

It was too late now to cry "desecration" and ask a lot of embarrassing questions, the deed had been done.

"Can't we just say that an independent salvage company was operating in the area and that the identity of the ship they were working on was unknown until the bell was recovered?" I asked Nobby.

This suggestion was relayed on to the Ambassador, and, to his credit, he accepted it and agreed to meet the General the following morning.

There was only one move left, to obtain the approval of the Minister for Marine, so the bell could leave Indonesia. With the faithful Soemantri I left the Embassy and we beat our way across the city to the Department of Marine and Salvage. I felt we were home and hosed, that the job was as good as done, and said so to Soemantri, but his muttered reply sounded a note of warning, "Only eighty per cent, Daddy, only eighty percent."

The Minister received us and politely listened to the request. When I'd finished he said he could see no reason why the bell shouldn't be handed over and that it was alright as far as he was concerned. Knowing how things can foul up with language and communication problems, I asked the Minister if he would telephone the General straight away and tell him that permission was granted.

As the Minister left the room Soemantri and I exchanged glances, he looked decidely glum and I got the distinct feeling that all was not well.

The Minister was gone for nearly half an hour, and when he finally came in I stood up and asked, "Well, is everything O.K.?" "Yes," he replied, "I think so, but before the General will hand over the bell he wants to know how much you are going to pay for it."

"There must be some mistake," I said, "I have just left the General, and he didn't mention anything about money."

The Minister was suave: "But he is a General," he said. "He doesn't discuss such things."

The hackles came right up, this was really too much. "He doesn't discuss such things," I snarled, "well neither do I. Pay for it! Christ man we have paid for it. There are over 300 of our chaps out there on that ship, they died helping to defend your country."

The Minister started back, surprised and embarrassed by the outburst. "Mr. Burchell," he said "I'm sure we can straighten this matter out."

Admiral Walugo Sugito, Deputy Chief of Naval Staff, had been a Colonel in Naval Intelligence when I was first in Indonesia seven years before. He had been very helpful and during the course of the project to find *PERTH* we had become good friends.

I had it down on my itinerary to call on him, more or less socially, but now I made a bee-line to his offices at Naval Headquarters to enlist his aid.

Still feeling outraged, I told Admiral Sugito about the happenings over the past couple of days, Walugo Sugito snorted, "David, David, your trouble is that you are too close to this thing. The moment somebody doesn't respond as you would like, you condemn them. The General is a businessman, he has something he can sell. It would be the same if it was an Indonesian ship he had salvaged. You will get your bell back, I'll guarantee it."

He was of course quite correct and it was good advice. I relaxed back in my chair and smiled at him, I think it was the first time I'd smiled at anyone for a week.

Over the next two days I saw everyone concerned again, telling each of them what had been said and arranged by the others, and then when there seemed nothing more I could do I came home.

A month or so later I received a letter from Nobby Clarke advising, that at a ceremony at the Australian Embassy in Djakarta, the bell of *HMAS PERTH* had been haded over for no charge by the Director of Sea Communications on behalf of the Indonesian Navy.

There was an interesting sequel to all this, when some months later I received a 'phone call from Channel 7 in Sydney. "We are doing a documentary on the new *PERTH*" the TV producer said, "and we would like you to come over as we feel you have something to contribute."

Naturally I agreed as anything to do with the Navy is a command performance as far as I am concerned. I told Channel 7 that I would pick the bell up in Canberra on the way, as it would make an interesting addition to their documentary.

The documentary had started, and I was talking with the Captain on the new *PERTH's* bridge when Mike Willesee popped out of the scuppers saying, "Dave Burchell, This is Your Life". It was then I started to realise what was really happening. It was a great night, the bell was there, centre stage, spot lit and draped with the Ensign.

The last guest to appear on the show was Soemantri; they had flown him down from Indonesia, and as we greeted each other he glanced towards the bell. He grinned and said something that was probably lost on everyone else, "One hundred per cent Daddy, one hundred per cent."

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THE AIRCRAFT CARRIER REPLACEMENT THE REAL REQUIREMENT

by 'Pegasus'

In many areas, including Defence (and even within the Navy itself), the real reasons for a replacement for HMAS MELBOURNE are misunderstood. Misunderstandings have arisen and the real reasons have been lost amid inter-service and political wranglings, emotional outbursts by 'one-eyed' aviators, and confusion over the guidance intended by Government strategic policy. And, to the uninformed, the 'Aircraft Carrier Replacement' can cause concern from its very title — 'Aircraft Carrier' conjuring up visions of an immense and expensive attack weapon (Power Projection), and 'Replacement' perhaps inferring that a previous capability is to be replaced for the sake of tradition (The Replacement Syndrome).

This article puts forward the writer's personal opinions of the essential requirement for a continued fixed-wing naval air capability in our expected strategic and tactical environment and argues that this requirement can be adequately met by VSTOL aircraft and a small carrier. It is hoped that some insight will be gained of this very real requirement, and that some often emotional and confused arguments surrounding the 'replacement' for MELBOURNE will be seen to be based on the wrong premises.

STRATEGIC AND TACTICAL ENVIRONMENT

The 1976 White Paper on Defence stated that the Government's aim is to arm the Defence Force with adequate equipment to counter low-level threats, and form a 'core force' of higher capability to ensure that the Defence Force has a basis for expansion to meet higher threats. Some idea of the expected tactical environment can be gained by analyzing the types of capital equipment now being acquired. For instance, the *FFG's* are armed with the surface-to-surface missile (SSM) *HARPOON* and are defended by surface-to-air missiles (SAMs) of the *STANDARD* variety which are capable of destroying incoming anti-ship missiles; these ships are also to be equipped with the Close-in Weapon System (CIWS) *PHALANX* — specifically designed to counter the anti-ship missile. We can therefore deduce that conflicts up to those which involve surface-to-surface and air-to-surface missile systems may be expected. It is against a strategic background such as this that arguments for the carrier replacement need to be examined.

THE PRIMARY ROLE OF TACTICAL NAVAL AIR

In the environment expected, the prime and essential role for fixed-wing 'organic' naval air in the RAN is in the availability, at virtually immediate notice, of a means of searching out and positively identifying hostile surface targets. Without a method of gathering this intelligence of enemy forces, the Naval Force Commander's hands are tied; he cannot plan his tactics effectively, nor use his weapons systems to full advantage. He must approach 'blind' the expected position of the enemy and perhaps await the opposition to take the initiative; thereby putting himself in a defensive, and probably irretrievable position.

In the scenarios that might involve Australia, over the next ten to twenty years, states of war might not formally be declared; more probably there would be sequences of political confrontations, states of increasing tension, and brief and localised medium-to-low level conflicts. In such circumstances it would be essential — and it

HMAS Melbourne in Straits of Gibraltar — *by courtesy of Defence Public Relations*

would be the Government's aim — to prevent any escalation and to contain the conflict. This type of situation would be expected before any 'battle area' has been declared, and other nations' ships and aircraft could well be pursuing their lawful course in the vicinity. There is no doubt that the Government would insist on the most stringent 'Rules of Engagement' before any general war were declared and it would be essential for the Force Commander to have a means of positively identifying a suspected hostile surface unit. Even with good communications and intelligence, it is difficult to make a positive identification of a belligerent enemy target by radar and EW means — positive enough to send a surface-to-surface missile on its way and be certain that a neutral merchantman is not to be the recipient. Medium range surface-to-surface missiles are certainly of immense value in a escalatory and political dangers. Thus the prime requirement is to have up-to-date and certain knowledge of the opposition's disposition and probable tactics; although this applies perhaps most significantly in missile engagements it is clearly also very relevant in lesser contingencies.

SECONDARY ROLE

The second most important role is that of surface strike. Surface strike follows naturally from the primary role but includes the striking of units identified in that role as hostile. If a suitable air-to-surface missile (such as *HARPOON*) is carried on the aircraft, then this can be used against major units. However, it is not a necessary function of the secondary role to take out major surface units — many millions of dollars have been spent on equiping the surface units with anti-ship missiles and there is no over-riding requirement for the tactical aircraft to be so provided as well. The essential task in the secondary role is to strike those targets which may not be 'suitable' for *HARPOON* — either being of such low radar return that the chance of success is low, or of such low value that the use of *HARPOON* would be not cost effective, or that are 'hidden' by other craft, islands, etc. Targets that are seen to be in this category include Missile and Torpedo carrying Fast Patrol Boats, Hydrofoils and Hovercraft. These craft would not be expected to be armed with sophisticated *SAM's*, nor stabilised AAA, and, at their attack speeds, would not be a major threat to a monoeuvrable high-speed fighter attach aircraft — such surface targets could be engaged by conventional weapons such as cluster bombs, rocket projectiles, FAE or cannon. It is essential that 'Goliath' has a more flexible and longer ranged weapon than previously if history is not to be repeated.

TERTIARY ROLE

The third most important role for tactical naval air lies in the investigation and identification

of airborne contacts, and in the destruction of hostile surveillance, targetting, jamming and missile launching aircraft. Long range maritime patrol (LRMP) aircraft (e.g. *ORION, BEAR, NIMROD*) are widely used for surveillance of the ocean, reconnaissance and identification of hostile forces, and the passing of targetting information to air, surface and sub-surface units — which may or may not be missile armed. These long range patrol aircraft may also have the capability of launching anti-ship missiles themselves. Since reconnaissance and identification and anti-ship missile firing can be expected to be achieved by these aircraft beyond the range of ship-based surface-to-air missiles, the lack of defence-in-depth by manned aircraft gives these hostile aircraft great flexibility in tactical manoeuvring. The position and disposition of the surface force can be established and updated, air-to-ship missiles could be launched, and the surface force commander would be impotent to counter the threat or conceal his movements and intentions. And even if a reconnaissance aircraft came within a ship's SAM range, the politico-military situation postulated earlier would not allow indiscriminate engagement by SAM's unless a positive identification were made — an identification that (with our present military technology) could not be made without the manned aircraft. It would be unacceptable if hostile surveillance aircraft (which could even be of the general aviation twin-piston category) were able to come and go at will and make the Naval Task Group's position and tactics an open book for the opposition.

OTHER ROLES

The prime reasons and roles of tactical naval air have been described — if these are accepted, then a multiplicity of subsidiary roles follow. Not to use these tactical aircraft in other roles, as the situation dictates, would be to waste expensive assets or to forego valuable opportunities. (The Government has announced that the primary role of the *TFF* will be air defence: but it would be a mis-use of the taxpayer's money if these aircraft could not also be utilised in the roles of close air support, photo-reconnaissance, interdiction, etc — particularly since the type of threat cannot be clearly defined for future years). Thus the role of naval tactical aircraft should be extended to encompass close air support, interception of conventional air strikes, ASW sonobuoy field laying, mining, electronic warfare. Although aircraft numbers would not be expected (nor required) to be high to fulfill the primar roles, and the carrier's capability in subsidiary roles could therefore be mediocre, the best use of available resources would be realised by equipping the aircraft for such roles. For marginal additional cost, the benefits would be considerable.

ORDER OF ROLE PRIORITIES

The order of priority of the roles suggested above may be questioned since many advocate the prime role as Air Defence of the Fleet. However, the first priority must go to that role which cannot be undertaken by any other means. The Fleet is, or will be, equipped with *SAM's, CIWS's, ECM*, and Decoys and therefore has a credible capability in the air defence area; but no capability exists for tactical surface surveillance. The *FFG* helicopters cannot qualify for this role and are seen to be but an extension of those ships' weapon systems; they cannot provide the required intelligence for the Task Group as a whole.

The prompt gathering of tactical intelligence has in the past, and will in the future, provide the local Commander with the crucial information on which the success of an engagement depends. The Commander's tactical decisions rely on this information; to attack at once, delay, redeploy, or retire. No single factor is more important to the Force Commander than up-to-date tactical information.

Surface strike is placed second in priority since, although a capability does exist in the Fleet against surface units in open waters, the threat of a small missile armed patrol boat is nevertheless very significant. These craft can hide themselves in groups of fishing vessels, wait ready for attack behind small islands, or merely lie alongside a suitable coastline — they are then immune to the *HARPOON* type of weapon and the relatively congested areas to the North are ideal for such subterfuge.

As discussed earlier, the major requirement of the tertiary role (Air Defence) is to deter or destroy, shadowing, missile firing and jamming aircraft. As the primary role (Surface Surveillance) is to gather tactical intelligence, so a requirement of the tertiary role is to deny this type of tactical intelligence to the opposition.

The advantages gained through the primary role would largely be negated if the tactics adopted by the Task Group Commander became known to the opposition.

ANTI-SUBMARINE WARFARE (ASW)

This article is aimed at pin-pointing the essential reasons for fixed-wing tactical aircraft in the RAN, but there is also the requirement to provide protection against submarines, and this is almost universally provided by the ASW helicopter — rotary-winged tactical aircraft. The USA, UK, Russia, Italy, India, France, Canada, i.e. all navies of any substance, acknowledge that the ASW helicopter is a necessary force element to counter the submarine threat — and no other

practical substitute is in sight in the foreseeable future for Australia. To provide ASW protection for a Task Group, a platform is required to carry sufficient helicopters to provide all-round protection 24 hours-a-day for specific periods. Although some surface units can carry one or two helicopters, it is generally acknowledged that these are an adjunct of the ship's weapon system and do not provide a capability for protecting a Task Group unless such units are present in considerable numbers. There is, therefore, also the requirement to provide a platform for ASW helos (for which role alone a 'carrier' could well be argued).

ANTI-SHIP CAPABLE MISSILES (ASCM's) — TACTICAL PROBLEMS

In order to visualise better the difficulties which beset an ASCM-armed force attacking a surface task group which is supported by organic tactical air, it may be worthwhile considering the types of problems that would face the RAN and RAAF (equipped with *HARPOON*) in this type of situation.

HARPOON-armed RAAF LRMP aircraft would gain contact with the enemy through ESM, radar or intelligence and then would have to close the force to launch range whilst making assessments of the primary target — probably by radar. The height required for identification and designation of the primary target, the slow approach speed, lack of manoeuvrability, the large radar return, and the (probable) electronic emissions would all aid the interception process by enemy organic air — and the chance of survival of the launch aircraft might well be judged as low (even though its destruction might occur after missile release).

Turning to the *FFG*, surveillance and recognition of the enemy could be via LRMP, ESM, radar, sonar, intelligence or local helo. On closing for engagement, the helicopter might identify the primary target out to a range of say, 40 n.m. The presence of enemy tactical air would make the helo's task daunting to the most interpid helicopter crew, and the requirement to emit, the close range, and the slow speed could well turn the engagement into a 'turkey shoot' for the oppostion before the surface ship could even close to firing range. Without the helo, the *FFG* will rely on bearing and range from radar, ESM or sonar, but if the enemy has tactical air, the *FFG's* position could well be known at the (relatively) close range of 100 n.m. and escape, evasive action, or attack by aircraft can be carried out. The *HARPOON* launching unit with the best chance of success would appear to be the submarine — though the presence of enemy ASW helos would pose major problems.

If we now take the case of an engagement with *HARPOON* when the enemy is without his own tactical air, the situation is changed completely. The LRMP remains outside SAM range, as does the helo; these aircraft can shadow and survey, discriminate and designate, with impunity. They can take their time to ensure the primary target is designated, and acieve the optimum firing parameters (release height, range, wind and wave direction, aspect, and whatever is pertinent to the missile); even a delay could be accepted while a hitch in the weapon system were fixes.

It is therefore clear that the problems of a successful engagement with a medium range anti-ship missile are not small if the opposition has organic naval air (even of modest capability); whereas if the enemy does not have this air support, the ASCM can be used to its full effect.

TYPE OF AIRCRAFT AND PLATFORM TO FULFILL THE PRIMARY ROLES

The requirement for naval tactical aircraft is for immediate reconnaissance, identification and attack; this implies the need for fast all-weather fighter/attack aircraft. There are several suitable naval aircraft available and the question arises; which contender is most cost-effective? But apart from the aircraft themselves, a Navy has also to consider the platform from which the aircraft will operate. These are inseparable issues, and together force consideration of the most cost-effective combination.

Conventional Take-off and Landing (CTOL) aircraft require relatively large aircraft carriers to accommodate the necessary catapults, wires, etc and all their extensive support. These suggest a minimum of 35,000 tonnes — the USN's proposed 'small' conventional carriers were planned to be in the order of 50,000 to 60,000 tonnes. Significantly, this minimum size applies however few aircraft are required to meet the primary tasks. And size costs money in capital, maintenance and manpower. VSTOL aircraft do not necessarily require a carrier of this size for operations, and tonnages as low as 8,000 have been proposed.

Although CTOL aircraft will, for many years anyway, provide a higher level of capability than their VSTOL counterparts on an equal cost basis, if the primary requirements can be satisfied by the latter (and a small ship), the acquisition of the former (and larger carrier) is surely not the cost-effective answer. It would appear that there are both suitable VSTOL aircraft available to satisfy the major roles and suitable small platforms to accommodate these aircraft; this combination should therefore satisfy Navy's specific need for 'sea control' around a Task Group at minimum

Harrier VSTOL aircraft

— by courtesy of British Aerospace

cost. The input of other Services' requirements, e.g. Army support or military lodgement, could of course create a need for a larger vessel but this article is aimed at identifying navy's essential requirements.

COMMON CRITICISMS OF A CARRIER AND VSTOL AIRCRAFT FOR THE RAN

Since the previous section has suggested that VSTOL aircraft and a small carrier can satisfy the essential tasks of naval air, it may be in order to discuss some common criticisms of the planned acquisition of an aircraft carrier for the RAN, and the use therefrom of VSTOl aircraft.

■ *'The aircraft carrier is a large strike weapon not in concert with strategic guidance'.*

The popular image of a carrier is a nuclear-powered behemoth with an awesome air wing of strategic strike aircraft. Such carriers do exist, of course, but for entirely different purposes to those envisaged for the RAN. In our strategic and tactical environment a small 'sea control ship' is adequate.

■ *'The planned aircraft carrier is a replacement for replacement's sake'*

Certainly, we cannot afford to indulge in maritime one-upmanship through membership of the 'carrier club', but it has been shown that the requirement for naval tactical air is in no way allied to 'one upmanship' or the 'replacement syndrom' — it provides an essential element of the Fleet in our expected environment.

■ *'An aircraft carrier is exceedingly costly and better use could be made of Defence resources by the acquisition of other equipment'.*

Virtually all weapon acquitions are expensive; but a carrier to meet the suggested requirements need cost no more than two destroyers. And no other equipment acquisition can match the essential capability of the aircraft carrier at equivalent cost.

■ *'An aircraft carrier is easily identified and tracked by surveillance satellites so her position is always known and she can be targetted by long range missiles'.*

This may be true of the larger aircraft carriers if one is opposed by a nation having the resources and technology to launch satellites for a continued surveillance operation. But the White Paper does not indicate that this type of opposition is likely — and in any event, it would be far more cost-effective for the other side to 'win' by taking out fixed installations that do not require satellite surveillance. This criticism also overstates the tactical reconnaissance capability of satellites.

■ *'The carrier is likely not to be available when required due to the time spent alongside in dockyards'.*

As with aircraft and tanks, ships are operated for as short a time as possible concommitant with training requirements and peacetime tasks in order to save money and keep them in the best possible condition for the contingency of war — peacetime maintenance cycles are no reflection of the availability of the carrier in wartime. Except in exceptional circumstances a ship can be made operational within a month anytime during a refit and warning time of a conflict situation would be expected to exceed this time by a considerable margin.

■ *'A large ship such as an aircraft carrier is vulnerable to enemy action, and the acquisition of just one carrier puts us in an "all eggs in one basket" situation'.*

All ships (and land-bases for that matter) are vulnerable, it is relative vulnerability that is the relevant issue. History has shown that large ships are in fact significantly less vulnerable than small ships and can withstain high degrees of damage without loss. A major advantage of the VSTOL carrier is that, even if it does suffer major hits, it is not inhibited from aircraft operations to the same degree as a conventional carrier. The CTOL carrier can be seriously disadvantaged by reduced or zero speed, lack of steering, list, flight deck and associated machinery damage, etc; but the VSTOL carrier, despite these handicaps, can continue to operate aircraft.

In the context of vulnerability, it is normally assumed that the carrier will be the prime target of the enemy; why should this be? Because the enemy recognises that it is a vital element of the Task Group.

If it should be argued that a carrier should not be acquired because it attracts too much attention by the opposition and therefore becomes vulnerable to attack, then surely the logical follow-on is to dispense with the next most useful unit and so on. To argue against the acquisition of a force element because it is highly capable is illogical.

As for the single carrier criticism, there are obvious advantages in numbers as with any equipment, but just one carrier provides the core capability in accordance with Government Policy and one carrier can adequately carry out the essential roles for an Australian Task Group. It is further suggested that the single carrier *MELBOURNE* has over the last twenty years made a significant contribution to the credibility and capability of the Defence Force.

■ *'Land-based naval aircraft of higher performance (CTOL) could adequately satisfy the requirement of the Fleet at lesser cost'.*

Even if the Task Force were within range of aircraft from land bases the essential requirements could not be met. The aircraft need to be an integral part of the Fleet's weapon system for them to be effective in the primary roles suggested: good communications and control would be essential particularly as the Fleet might be operating in a silent status or extensive hostile jamming may be in progress.

Immediate availability is a primary requirement and land based naval aircraft would have to maintain an airborne Combat Air Patrol (CAP) over the Fleet to meet this requirement. But the tactical situation might be such that the last thing the Force Commander would want is a group of aircraft circling overhead advertising his position on enemy radar; he wants them at instant readiness, fully fuelled and armed, and airborne when required.

Airborne air patrols (whether land or sea based) are also hideously expensive in resources (fuel, maintenance hours, spares) and though necessary in certain situations this policy goes against a principle of war that force concentration is required when the threat develops. Valuable resources should not be depleted by on-going contingency operations, if these can possibly be avoided, when they would be detrimental to the outcome of an engagement when 'battle is joined'. Land based air operations would necessitate continuous CAPs due to their inability to react sufficiently quickly from an airfield alert status. It is of significance that the UK has reverted from previous efforts to cover Naval Forces at sea with land-based aircraft even when these were supported by a dedicated fleet of thirty tanker aircraft and could operate from hard bases with full support facilities situated virtually every few miles around UK and Europe. How much more difficult the problem would be in our situation needs no elaboration.

■ *'The future of VSTOL aircraft is uncertain, and no suitable follow-on aircraft might be available in later years'.*

Considering that the UK, India, Spain and Italy are committed to VTOL, and the US is progressing down that track, it seems highly unlikely that future generations of

aircraft suitable for the primary tasks stated will not emerge. Tactical reconnaissance and intelligence is seen to be a continuing requirement and updates of present VSTOL aircraft will take the usefulness of present types of aircraft well past the turn of the century; better sensors and weapons will confer the necessary capabilities in the higher threat scenarios which might be expected in the future.

■ *'The capabilities of VSTOL aircraft are less than CTOL and are inadequate for the task'.*

This article has argued the requirements for tactical air, and that fighter/attack VSTOL aircraft can adequately fulfill these. For the major tasks, the VSTOL aircraft can in fact be considerably superior to the CTOL — for example, for deck alert, present VSTOL aircraft would take less time to identify a surface target 100 n.m. away than a Mach 2 supersonic CTOL.

■ *'A carrier is a high value asset which requires many additional destroyers to defend it'.*

This criticism is based on ignorance of the mutual support that carriers and other ships offer as part of an integrated force. The carrier supports the consorts as much as the consorts escort the carrier, if not more so.

CONCLUSIONS

The essential requirement for the Task Group Commander is to have ready access to tactical information of the enemy. Only by means of early surveillance and immediate reconnaissance can the optimum tactics be adopted to counter the opposition's moves. In Australia's likely strategic, tactical and political environment, it seems important that any politico-military situation should be contained. Early information on the opposition's tacical disposition and probable intentions is an important element in achieving this, and in the maritime environment it is essential. 'Organic' tactical naval air is seen to be the only answer to this reconnaissance problem. It has been suggested that Australia would most assuredly comply with stricter Rules of Engagement than any likely opposition and this, combined with the present medium range missiles being acquired by virtually all countries in the area, make the problem even more acute.

The real reasons for the acquisition of a carrier for the RAN have been clouded by statements based on wrong premises, by emotive outbursts regarding lack of capability, and perhaps also by arguments engendered by selfish interests. The prime reason for a 'replacement' for *MELBOURNE* is not to take over, in part, the strategic or maritime strike role of the RAAF, nor to support an Army invasion of a neighbouring nation, and neither to provide fixed-wing naval aviators with a continued career. **The prime reason is to provide a unique and integral supporting unit for the total Fleet Weapon System. This can be provided by a small carrier operating VSTOL aircraft; such a unit would enable the Fleet to be operated with maximum effectiveness, efficiency and flexibility in all those levels of threat which may be expected in the future.**

The LHA, one of the contending ships to replace Melbourne.
— by courtesy of Litton Ingalls Ship Building Division USN.

INDIAN EMPIRE

The fully rigged ship **INDIAN EMPIRE** (1515 tons gross) cleared the Nobbies (Newcastle NSW) on 19 July 1895 bound for Mollendo, Peru with a full cargo of coal. Five days later the ship passed Three Kings Island (NZ) on what promised to be a fast (45 day) passage. When 22 days out of Newcastle the whole crew still looked forward to an early arrival in Mollendo, but the glass started to fall and the weather turned dirty. By the next day **INDIAN EMPIRE** was hove-to under three lower topsails. At 11 p.m. that night sail was shortened to one lower topsail. Soon after disaster struck in the form of a mountainous wave. The remaining topsail blew out as the ship gave a tremendous roll, and at the same time pitched so steeply that it seemed impossible for the ship to survive.

INDIAN EXPIRE was a stoutly built iron hulled ship 30 years old, and survive she did. However, the coal cargo had shifted and the lee side of the deck was some twelve feet under water. When daylight came the real damage could be seen 3 of the 4 lifeboats had disappeared, the foc's'le and deck house had been gutted, the galley was gone but the stove remained, and all navigating instruments, personal belongings and clothes had gone. Further battering by the wind and sea pushed the ship further over on her beam ends and by the second day the lower yardarms were in the water.

At this stage the only course of action was to cut away the masts and rigging in a desperate effort to keep the hull afloat. all the rigging was of iron and the masts were iron and steel. Working non stop the crew cut away the maximum amount possible leaving only the lower foremast, lower mainmast and a bare lower mizzen. They could not reach the leeward rigging (it was still under water) thus it was still secured to the ship and pounding the lee side.

Four days after the initial disaster another gale sprang up and leaks were discovered in the hull. No amount of shovelling the coal trimmed the list, and there was now eight feet of water in the hold. A passing ship failed to see their plight so the ship's Master, Captain Johnson, decided that a maximum number of the crew should take to the remaining lifeboat for safety. Seventeen of the crew of 28 took to the boat and were rapidly set down away from the shiop by the wind and sea.

Some 48 hours later this same lifeboat came up with the **INDIAN EMPIRE** once again and the seventeen men reboarded the ship.

A further inspection of the hold took place and it was found that the flotsam in the hold had plugged the leaks and the hull was nearly water-tight. The fight to save the ship was now on with a will! Working 20 hours a day the crew pumped out the hold, cut away the lee rigging and dumped coal over the side to bring the ship upright once again.

In the midst of all this tribulation it was found that the fresh water had been contaminated by salt, so the poop railings were connected to the donkey boiler and a condenser (of sorts) was able to supply fesh water once again. The only food available was slat beef and biscuits.

Once the ship was upright two old sails were hoisted and the ship moved before the wind at 3 knots. Once in the trades the ship was steered northeast in the hope of coming up with South America. They had no sextant, books, charts or chronometer but Captain Johnson was confident that they would reach land safely. Weeks later they came up with a German ship bound for Portland (Oregon) and were provided with a few essentials. Three days later they sighted Easter Island.

At approximately 6 pm on 2nd November 1895 land to the south of Callao, Peru was sighted and next day **INDIAN EMPIRE** was towed to a berth. 107 days out of Newcastle the ship had been 22 days on her beam ends and 60 days from the scene of the disaster until reaching Callao.

Following a survey **INDIAN EMPIRE** was condemned, but sold by the underwriters to the shipping firm of T. Shute (Liverpool) and despite her age continued to sail until 1899, when once again in Callao she caught fire. her final service was as a hulk in that Peruvian Port.

The third Mate of **INDIAN EMPIRE** at the time of the disaster James Simpson went on to become Captain James Simpson DSC. His first command (at the age of 25) was the **INDIAN EMPIRE (2)** followed by *COLONIAL EMPIRE*, the steamer *SATRAP*, armed trawlers as an RNR Officer, the barque *GARSNAITH* and a series of steamships owned by R. Chapman and Son of Newcastle (UK). He retured in 1936 and died in January 1949 aged 73.

R.J.R. Pennock

TRAINING THE GENERAL LIST OFFICER — TWO YEARS ON

by 'Master Ned'

Two years ago, in this Journal, I wrote an article describing the system of training the G L officer, the faults that I saw in that system, and my proposal for its complete revision. In large part I see no reason to revise that article, or the views that I then put forward, but there have in the past twenty four months been so many changes that I feel a discussion of these changes and the problems that they may have solved or caused would be in order. Training is very much a fluid thing, undergoing constant revision to keep up with the changes in our environment, both naval and external, that it takes only a matter of months, not years, to become out of touch even when one has much experience in the field. Consequently, I intend to examine several areas of activity in G L training that I hope may give rise to some discussion over the validity of the RAN's thinking and methods, both general and particular. One general observation that I would make is that, as far as General List training is concerned, there is too much 'short term' thinking. Short term, and thus not wholly efficient, solutions are applied to what are long term problems. Perhaps much of this is rendered unavoidable by the dismal prospect of A.D.F.A., but one cannot help but get the impression that certain of the cures are worse than the original diseases.

STAFF

A major development has been the assumption of responsibility by the Royal Australian Naval College for the training of all new entry officers — including WRANS. This change has been almost wholly to the good. The Naval College now bears a much more direct relationship to the Fleet and the Navy and this has resulted in an atmosphere of much more purpose and enthusiasm. Old antipathies between the various lists and entries, notable the old supplementary versus General List feud, are beginning to break down and a more healthy and cheerful rivalry substituted.

However, compared with the Britannia Royal Naval College, Dartmouth, which introduced the same system some years earlier, there does appear to be one problem. Simply, there are not enough officers on the training staff — officers, that is, with a background in the executive, supply or engineering branches. In my view, the numbers could be doubled and nothing but good would result. It is my belief that it is officers who are on the verge of gaining their half-stripe that are needed. Their presence alone would do much to clarify the midshipmen's choices of branch and specialization. A more favourable staff/midshipmen ratio is needed, not necessarily for formal instruction, but as general 'guides and mentors'. What in fact the College needs are 'snotties nurses' (in the language of our fathers). When the numbers under training at the RANC were increased to include the new entries of the different lists, the officer training staff did not increase in proportion. The CPOs on staff do their

best to fill the gap that now exists and, to a certain extent, they succeed, but their perspective is inevitably limited and many are inexperienced at dealing with training at the officer level.

Two years ago I noted that a certain state of mind existed in the Navy of dissatisfaction with the results of G L officer training, while at the same time refusing to take steps — and make sacrifices — to improve the system. I wrote that, "the Fleet must realise that to make omelettes it must break a few eggs". This mentality still seems to hold, for when the College itself requested such an increase, the reply was, and is, that there are not enough officers to be spared from other duties. Let me say, quite simply, that officer training should not be a matter of 'sparing' personnel to deal with it; such an attitude is the most short-sighted possible because it denies the RAN any chance of a solution to the chronic shortages of qualified officers in every category. Half-measures now will result in half-results five years, ten years and thirty years from now. If other tasks, if even the operational availability of our front line ships must suffer, then so be it — though I suspect that a judicious weeding of staff in Canberra would yield good results. If we do not take the problem in hand now, it can only worsen.

JUNIOR ENTRY

The system of Junior Entry remains a problem. Observers may have noticed that the number in the 1978 Junior Entry was double that of previous years — up to 60. The thinking of the Selection Board bears explanation as it highlights the basic dilemma the Navy faces over whether or not to continue this entry. The Board, as has been the case for some time, observed that the applications for pre-matriculation entry far outnumbered those for Senior Entry; they found, too, that to keep the numbers up to what had been planned for each entry, they would have had to reject many very promising 16 year olds while selecting 18 year olds who did not seem as satisfactory. The Board realised that those 16 year olds who only just miss out and are asked to 'come back in two years' very often do not in their disappointment and are thus lost to the Navy for good. Very reasonably the Board then made the decision to go on merit for a total entry, rather than dividing the two groups.

But despite this, Junior Entry remains a difficulty, especially in the new College. Those in this entry are no longer given any more than the most basic naval training until they have matriculated. This decision has been taken in large measure to prevent Junior Entries having to repeat a large part of their naval training when they join in with the newly arrived Senior Entry. It was well meant, but the effect seems to have been to convert Junior Entry even more into a system patterned on one of the US military high schools and to separate that entry even more from the rest of the Naval College.

As I see it, there are two solutions to this problem. In the first place, we could dispense with Junior Entry entirely; this would be the simplest solution but it ignores several questions, namely, would a single Senior Entry be able to provide the quality of officers desired, even if enough are entered, and would, in two years time, the number of applications for Senior Entry be sufficient to fill the gap? The second solution is somewhat more complex, but I feel that it is worth trying.

The great fault in the present system is that Junior Entries spend too long at the Naval College and are tied to the Senior Entry. It is my firm belief that the two pre-matriculation years spent at the Naval College are the finest preliminary training at the best age that any officer can have, *but* this is only so long as these two years are followed by (a) immediate commencement of degrees studies *at a university*, or, (b) immediate progression to the extra-College sections of Stage I and then Stage II. In other words, I do not believe that Junior Entries should be kept at the Naval College for more than two years, any longer too easily results in staling and disillusionment. My proposal means that Junior Entry would be kept separate from Senior Entry but, in view of the number of different courses at the Naval College, I cannot see how this could cause any harm. Much more naval training would be done in the first two years, at a time when the officers are at their most receptive and enthusiastic, Junior Entries would not undertake the first year of degree studies at the Naval College, but would proceed immediately to the Unversity of New South Wales (UNSW) while non-degree officers would not undertake the 'Creswell course', but go immediately to sea, returning for a year's tertiary course as Sub-Lieutenants. I would venture to suggest that this system would result in a much higher retention rate of officers, as it is notable that the bulk of resignations — generally quite unnecessary — occur in the first and second years after matriculation.

DEGREE STUDIES

In one particular discipline, that of Arts, there has been a distinct regression. Arts always differed from the other degrees in that no part of it was conducted at the Naval College, but that the officers concerned went straight to UNSW. Last year the decision was taken to align Arts with Science and Engineering by having the first year at Jervis Bay. In theory, it was an admirable decision because it meant that the first year of

naval training would be aligned and that the Senior Entries undertaking the degree would have at least one year under full service discipline before they went to the University. But the price paid was a heavy one. False economies prevailed, aided by the fact that the looming spectre of the australian Defence Force Academy means that any academic expansion at the three Service Colleges is frowned upon, and the hiring of extra lecturers acceptable to the University was not allowed. Only one accredited lecturer in a humanities subject, history, was already at the RANC and this meant that the Arts students had to take Maths, Oceanography and a choice of Physics or chemistry to make up their four subjects. The consequences of this were three-fold; in the first place, many who would otherwise have attempted an Arts degree, being stronger in the humanities and weaker in the sciences, baulked at the first year programme and chose the inferior *Creswell* Course; second, the failure rate, even after only the first half-yearly examinations, has already been far higher than any previous recent year (it might be noted that 1978 D B A contained the lowest proportion of Junior Entries ever); third, the inability to do any Arts subject in first year but history rendered the acquisition of a 'major' — that is, the specialized subject around which the degree is built — more difficult in every field but history. Certainly the necessary 'units' in the other fields can be passed in two years, but many interesting and valuable courses must be foregone because they have as pre-requisites other courses which have the first year 'primer' — course in the subject as their pre-requisite in turn. Thus the would-be Arts graduates will not be able to complete their studies with as good a degree as might otherwise be expected.

As far as the engineering degree is concerned, however, I would advocate a complete reversal of policy. It would be best from every point of view, even, I believe, from that of cost, to resume the training of Australian engineers at the RNEC Manadon. It may seem strange that having thus bewailed the alteration to the Arts degree on educational grounds I should be so recommending a return to in-Service training. But in fact Manadon provides a degree of an acknowledged high standard that is more tuned to Service needs than a civilian one, and is apparently more interesting for the student. RNEC's facilities are excellent and it would be fair to say that its atmosphere and environment, notable the easy access to Europe,

HMAS Jervis Bay — *by courtesy of John Mortimer*

provide the balanced and liberal background so necessary for a naval officer and hard to get for an engineer as an admittedly 'red-brick' university like UNSW. While the cost per student is higher, so is the pass rate — far higher. The present output of GL engineers via the Naval College and UNSW is tiny and completely unsatisfactory. Last, but by no means least, I have yet to find an engineer ex-Manadon who did not enjoy immensely his time there.

THE TRAINING SHIP

As a training platform, the *JERVIS BAY* has been a fair success. Her great asset is that she has space enough for almost any training activity possible and her utility will continue to improve as funds become available to fit further equipment. Her obvious fault is her diesel machinery, which is of little use in engineering training, while that same machinery has given rise to some interesting situations when the ship has been involved in OOW evolutions and some of the less successful pilotage runs, but this is worth putting up with in view of her many advantages. However, she is not enough.

The basic difficulty with the cruise is that there is only one; in my view there should be three, and only the first should be conducted on much the same lines as at present in the *JERVIS BAY*. The other two cruises should be undertaken in small ships. In the last two years the *Creswell* Course officers have had extremely successful training cruises in such small ships, the training vessels *BASS* and *BANKS*. The advantage of these cruises is that far more time can be spent in inter-ship seamanship activities and responsible duties, such as OOW. I propose that four vessels, patterned on the *BANKS* type, but with somewhat more speed, be built and attached permanently to the RANC. The preliminary cruise in the *JERVIS BAY* should be undertaken within months of entry as the first taste of sea-time and this should be followed directly by the first cruise in the small ships. Those officers straight from the *JERVIS BAY*, being frist year, would perform largely seaman duties while second year cadets, on their third cruise, would act as OOW and in other supervisory duties. The advantage of my proposals, I believe, is that they would cover many of the failings of the *JERVIS BAY* and give officers much more practical experience in command than those now joining the Fleet have.

CONCLUSION

I would like to quote, in conclusion, from a letter from Captain S.W. Roskill to the author, written in July of this year. Readers will be well aware of the achievements of Captain Roskill as a historian, but I would like to mention that he served with some distinction on the Admiralty Staff and as Commander and Captain of the cruiser *HMNZS LEANDER* during the War. He is an officer uniquely and completely qualified to comment on officer training and he has done much to influence the Royal Navy in this regard. He has given me permission to quote him; the bold print is mine.

"I did not know about your Government's intentions with regard to a Joint Service Academy. Of course 'Joint Service' doctrine is very much the fashion nowadays, and indeed our own Howard-English Report of about 1960 proposed a Royal Defence College, though it was not intended to be a degree awarding body. Like you, I am doubtful about the merits of such a scheme, and there is the obvious danger that our navies, being the smallest of the three services, will get rather submerged in such an organisation. The recent troubles of the US services, especially at West Point, seem to suggest to me that your navy was wise to retain something of the British tradition in officer training.

You are right to say that I was one of those who fought for degree courses for officers — at first almost alone, the 'blue water school' of Admirals being totally opposed to such a concept. Most of our Service undergraduates and post-graduates here are of course much older than 18 and have gained some experience of their own services e.g. by sea time and time in the Naval College. I am against boys taking degree courses before about 20, though there have been some successful exceptions who have done well after having started their course earlier. It is very difficult to cater for everybody through one comprehensive course or system, since all young people have different rates of development physically, mentally and psychologically. **So I think the best answer is to keep the system flexible and allow lots for the 'special cases' such as the late developer (of whom I was actually one).** *What I am sure of is that every officer should have an opportunity of achieving at least a first degree, and that a small proportion of real 'high flyers' who are likely to go to the top should have further opportunities for education. I certainly hope that young men like you are not forced into a strait jacket at a Joint Service Academy. I think it would be far better to stick to the civilian universities, which surely have a far wider range of really well qualified teachers than such an Academy will ever recruit.*

Yours sincerely,

S.W. Roskill
CBE, DSC, Litt.D, FBA,
Captain Royal Navy

EXERCISE SEA LANES

by Lieutenant-Commander W.N. Swan RAN (Rtd).

In time of war the Navy has to control Allied shipping to protect it. The above Naval Control of Shipping Exercise was conducted from Navy Office Canberra in October 1959. It was the first Service Exercise to be run from the national capital, the largest of its kind ever held in the southern hemisphere and, in some aspects, in the world. It involved all RAN and RNZN, as well as RN, and all British Commonwealth merchant ships, at sea over an area covering 37% of the earth's surface. A climax of the Cold War of the 1950's SEA LANES was conceived, planned, conducted and analysed by the author, who was SO (TRADE) to the Naval Board during the 5 years 1957-61. In this article Swan reveals for the first time what happened at Navy Office 20 years ago.

During the last half of 1958 at Navy Office Melbourne we 26 members of the naval staff were mainly concerned with one matter — **THE MOVE TO CANBERRA** scheduled for early the following year. We were beset by memos and talk on all aspects of this relocation of HQ, from our new "home" in the Admin. building at Parkes to our new personal homes in house, flat or hostel. As this will be the subject of a future article, I shall not describe **THE MOVE** here, dealing only with my (some thought) incredible desire to stage a major international naval exercise in Canberra in 1959.

When I first raised this matter I was greeted by a variety of responses, mostly derogatory. I was assailed by such dampering retorts as, "It's stupid. We don't know what it will be like up there", "Not another one of those", "Sounds like another swan", "It will be ridiculous to attempt such a task in our first year in Canberra," and "We'll still be settling in. What about communications, equipment and separation from shipping offices?" I, of course, gave much thought to all this from other staffies, and to the fact that my family and I would have to adjust to many new aspects of living in the A.C.T.. My own decision was that, despite all objections, if we moved in January 59 and could not stage such a show by October, I would not be worth my salt as a staff officer. I decided to place all the pros and cons before DCNS, and Rear-Admiral Gatacre made a wise decision. "I consider" he minuted, "that such an Exercise during our first year in Canberra would be a good thing, and ensure everything is in working order."

Now the die was cast. As 1958 drew to a close I named our exercise **SEA LANES** (the first word for South East Asia, the second for our sea communications with that vital area), started up the inevitable file and awaited our move to our new abode. Once in Canberra, I started planning in earnest early February, choosing the dates of October 12th to 23rd inclusive and declaring the ANZAM Region to be the Exercise area. By using ANZAM, this brought in Britain and new Zealand; but I secretly hoped for the United States as well, thus extending the area covered from half way across the Indian Ocean to right across the Pacific. From my long association with Americans, I knew we had to tread warily with CINCPACFLT at Pearl, because of the delicate question of command and the fact that the U.S. was not in ANZAM. Our Chief of Naval Staff, Vice-Admiral Sir Henry Burrell, would obviously be overall Commander of **SEA LANES,** and I knew Singapore and Wellington would come to the party; but Washington was another matter. So the dates I chose in October were within the bracket of those of an American NCS Exercise **REX** in the Pacific, and I told them of this and left them to think it over.

Of the many factors which dictated the dates of **SEA LANES,** the most important was the availability of personnel. Throughout Australia we had well over 100 Reserve officers trained by me in NCS duties, of whom we needed about 80 for the two weeks of the Exercise. These men, who would virtually do all the work except communications, came from all walks of life and had to secure release from their employers in order to

Admin building veiled in snow — 1965.
— by courtesy of National Library

undergo their two weeks RANR training. Without them there would be no exercise. However, we got the numbers and I chose 10, led by Commander Bert Dechaineux a Hobart architect, to come to Canberra and man our HQ Ops room, arranging accommodation for them at Brassey House. To be in charge at Sydney HQ, our biggest commitment, I chose Commander Maurice Ross, an experienced officer who had commanded a frigate in the Second World War. Officers then came forward for the other ports, and we seemed to be ready for business as October approached. New Zealand pledged its full support, CINCPACFLT agreed to cooperate on a "simultaneous contiguous Exercise" basis; but CINCFES in Singapore kept me in suspense until early October, when he pledged full co-operation.

It would take too long to describe all the 9 months of planning necessary for **SEA LANES.** The file got thicker and overflowed to a Part 11. In the week before the start I tied up loose ends and Rear-Admiral Becher, who had relieved Rear-Admiral Gatacre as DCNS and would carry the title of OSE (Officer Supervising Exercise) seemed content with what I was doing as OCE (Officer Conducting Exercise). I had to put my foot down at the last minute and say I could not handle the considerable publicity that was building up. "Of course you can't." said Bob Hyslop, then Head of N Branch. "We'll get the Coordinator of Naval Public Relations (Percy Conigrave) up from Melbourne. You've got enough with the actual exercise."

I awoke early in our house in Campbell on Monday, 12th October 1959, and knew my hour had come. Whether **SEA LANES** was a flop or a success, it would be entirely my pigeon. With the balloon due to go up at 0800, and we without a car at this time, I walked to Blamey Crescent to catch the bus to Parkes. Unfortunately, no bus came and I was becoming desperate when the milk van appeared. I hailed him, and asked could he drop me at the Admin building. The milkman eyed me curiously. "Sure mate", he said. "Hop in." So the OCE of Australia's biggest exercise arrived at Navy office with the milk, and found everything was nicely ready, I had fitted out an Ops setup in the "penthouse" on the roof, and found all personnel there ready, including 'Bert Dechaineux and Commander Alex Black, who I had brought in from his sheep farming to help in his retirement.

SEA LANES was a great success after a slow start due to all personnel settling in to unfamiliar duties. Listening to lectures is one thing, doing the job is another. We received tremendous publicity from the media, and the Commonwealth News & Information Bureau gave us splendid coverage. The RAN's communications network was taxed to its utmost. Warships "attacked" merchant ships, and during the 12 days we dealt with 1,000 ships at sea, using their peacetime vocations for our paper reports. It was basically a paperwork exercise, and no merchant ship was inconvenienced in any way at all. Indeed, they like it. The Minister for the Navy, Senator Gorton, visited our Ops centre and described what he saw as an "insurance policy", which indeed it was.

Nobody asked me, but...

THE BATTLE OF THE BEARD

Why is it that hairy, and often not so hairy members of the RAN are only permitted to grow full beards? It is a constant source of irritation to many personnel and one of amusement to civilians as to why the RAN persists in this quaint tradition. After much deliberation the reasons for this tradition seem more v[illegible] than ever. A consideration of the reverse [illegible]ions of the Army and RAAF is an interesting comparison.

There is some logic behind the refusal of the Army allowing their members to grow beards. Particularly heavy was their discipline during World War One, but it is clear that some sound reasons were behind this. Gas attacks were frequent and consequently gas masks were continually worn, naturally enough beards were not permitted as they prevented a good seal. They also fostered the growth of lice and vermin in the trenches as filthy beards became ideal germ carriers. The RAAF, partly through adherence to Army tradition and partly due to oxygen mask seals, also would not permit beards.

These are the reasons behind the traditions of the Army and RAAF, and it seems that some logic exists. But if anything, these reasons decry beards and not moustaches as hazards. For as surely as the likelihood of gas attack, the Fleet Air Arm and divers exist the reasons AGAINST and not for beard growth are there. to even the most died in the wool beard supporter, it must be clear that moustaches are not threats to safety.

Let's then consider the world. Every navy with the exception of the RAN, RN, and RNZN permit their members to grow moustaches. I do not advocate an outbreak of Zapatas or Gouchos as in the USN, but I do propose a half way mark. Moustaches similiar to those worn by the Army and RAAF are quite neat, and don't forget that members of the RANR also wear moustaches.

Logically there are absolutely no reasons as to why moustaches are a taboo. Tradition is a fine thing, but there must always be a capacity for change. If moustaches were permitted and full beards still allowed as well, the existing unique (sappers excepted) RAN tradition would be maintained as the Navy would be the only Australian Service which allowed beards. I write this discourse in a serious vein. If nobody can tell me why we can't have moustaches, then could someone tell me how an attempt to introduce this bristly reform can be done?

LIBRA

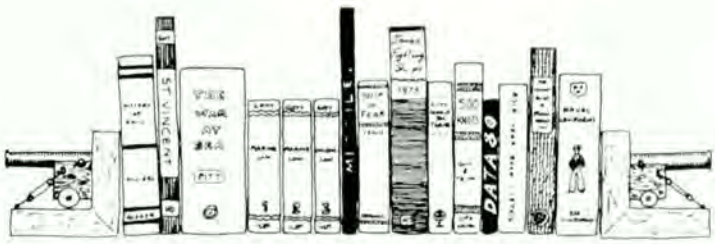
SHORE ESTABLISHMENTS

Nobody asked me but I think the time has come to take a look at the organisation of our social life in shore establishments. More and more often we are being asked to rationalise, integrate, economise ..... yet we still insist in having separate messing and facilities for junior sailors, senior sailors and officers. Why not a country club approach — one galley, serving different food at different prices to different dining rooms, each decorated in different fashion and having different dress regulations? One bar facility serving different bars, each with its our rules, prices and character? Different cabin accommodation for officers and senior/junior sailors radiating outwards from a common amenties area?

The time has come to do away with empty white elephants, and to face up to our prejudices: how many of you will admit to visions of drunken, scruffy sailors striking out at sober, well dressed officers in this country club idea? How many sailors see themselves surrounded by pedantic bores of officers and their overbearing wives? 'Them' and 'us' are still with the Navy, despite the changing economic and educational climate in the world around us. They told me Australia has a classless society where every man was treated for what he was worth — but they forgot to add 'except the Services'.

J. Cutts

BOOK REVIEW



JANE'S FIGHTING SHIPS 1978-79 Edited by Captain J.E. Moore, Royal Navy, MacDonald & Jane's, London, 1978. Price: U.K. £31.00. Aus. $75-80.00.

To a long-hooked addict of Jane's Fighting Ships, the yearly arrival of that massive and inviting tome usually results in the cessation of all useful activity as he ploughs through all 151 pages of advertisements and editorials and 803 of text, looking at everything from the *OHIO* class of SSBNs to the 113 year old Egyptian training ship *EL HORRIYA* (iron beats steel for durability any day).

Now that Captain Moore has been in the editorial chair for a few years, his hold on the book has tightened considerably. Editors appear to undergo a five year apprenticeship before entering their prime, which generally lasts about ten years. Thus far, Captain Moore is no exception and the result is a far more consistent, high quality edition than has appeared for some time. Its arrival two months earlier than expected came as some surprise to your reviewer but Captain Moore has changed the publication date to July so as to give the '1978-79' real meaning. One other change is that the minor vessel sections have been pruned considerably and the volume slimmed down a little. The result is nothing but to the good, because, as Captain Moore has retained all the essential details of each affected ship, some of the bulk has been allowed to go and the price — though still high — has been kept from yet another inflation inspired hike.

Moving to specific countries, the Australian section is excellent and even the most ardent 'nit picker' will be able to find few errors. Despite the fact that the section is already somewhat dated, because it has to be one of the first to go to the printers, one is struck by the length of time that our new construction programme is taking to get under way and how the projected completion dates of such ships as the new oiler will almost certainly be deferred. It gives one some food for thought to turn to the Brazilian section and read of the apparently extremely successful programme of Vosper Thorneycroft frigates that is now completing.

The Russian fleet continues to expand slowly, with the third *KIEV* class carrier apparently to commission next year and the construction of new SSBNs and SSNs proceeding apace, although it is obvious that the USSR is about to be faced with the problem of block obsolescence among its cruisers and escorts, a problem that once so plagued the USN with its vast number of World War II built ships. As might be expected, the Russian equivalent to the American 'FRAM' programmes has already begun, with the modernization of the *KRESTA I* class cruisers and the *KASHIN* class DDGs.

The sub-section on the American carriers makes interesting reading. The decision has apparently been taken to modernize all the super carriers under the 'Carrier Service Life Extension Programme', and then operate each one for a further twenty years! To give two examples, the conventional carrier *SARATOGA*, which completed in 1956, will remain in commission until 2001, while the *NIMITZ* will not go out of service until 2020! This means that she will pay off in the same year as a full Admiral, who entered the RANC at the beginning of this year and became Chief of the Defence Force Staff, will retire! Which beats the *MELBOURNE*, anyway.

With the continuous bickering between Navy, Congress and the President, all the construction programmes are so up in the air that it is impossible to predict what they will be from one week to the next. However, despite the moans emanating daily from the Pentagon/Capitol Hill/White House (delete those not applicable), the USN does seem to be in the process of building up a balanced and capable fleet to face the 1980s and beyond.

The South American countries always make interesting reading and this year is no exception, with Peru winning the prize for sheer originality. Readers will be aware that in 1973 the thrifty Dutch sold the cruiser *DE RUYTER* to Peru and that she has since been commissioned as the *ALMIRANTE GRAU*. However, in 1976 the Dutch also managed to unload onto them the *DE ZEVEN PROVINCIEN*, which had been converted to a guided missile cruiser. The Peruvians wanted to commission her as a CG but the Americans would not permit them the *'Terrier'* system that the cruiser carried and, consequently, the ship has undergone a two year conversion to equip her to carry at least three helicopters. Thus, as a helicopter cruiser, she now joins a fleet consisting of three 'straight' cruisers (the *GRAU* and the two ex-*CEYLONs*), two *DARINGS* (whose third conversion makes the armament of our two look like something out of a fun fair), two *FLETCHERS* and up to 6 brand new Italian-built frigates, as well as 12 submarines in service or on order. And, to top it all off, Jane's notes that there is rumour that Peru will purchase four aircraft-carriers from an Italian Yard! It is obviously never a dull moment over there, one wonders how much we could get for *VENDETTA* and *VAMPIRE* — enough to pay for *MELBOURNE's* replacement?

Such amusements aside, this year's edition does provide fascinating revelations into what is being done by each affected country to deal with the 200-mile EEZ and how little some countries (dare I say Australia?) are doing compared with others (Mexico has 22 large patrol craft in commission, 9 more ordered and a final total of 80 is planned). Which has the bigger littoral area?

In sum, despite what many pundits may say of Jane's continued great bulk and expense, it is still incomparable in the amount of useful and fascinating information it provides. Compression of the volume would be very well, but this reviewer believes that, were Jane's to go the way of Weyer's Warships of the World, or Couhet's volume, it would lose much of its particular quality. The 1978-79 edition is a vintage one, so this reviewer's advice is to get a copy. The wisest course for those who do decide to indulge would be to order from England and save at least $35.00. (Gieves, for those who might have an atrophied and almost forgotten account, runs a bookshop.) Oh, by the way, Jane's keep their value.

MASTER NED

P.S. If anyone has any old copies they would like to sell, this reviewer would be delighted to hear. The older the better. The Hon. Editor will be kind enough to pass any offers on.

"THE BATTLE OF THE ATLANTIC", by Terry Hughes and John Costello. The Dial Press/James Wade New York 1977, ISBN 0-8037-6452-2, (originally published in UK, by W. collins & Son & Co). 342 pages, 190 x 250 millimetres; over 400 photographs, numerous diagrams, maps and tables; extensive bibliography; full alphabetical index — price (approx.) $20.00.

With reasonable justification, the book claims to be "the first complete account of the organisation and outcome of the longest and most crucial campaign of World War II". In the one relatively slim volume and in crisp, fluent prose, the book provides a verbally and pictorially interesting and comprehensive review of the pre-war and wartime policies, strategies and events which concerned this unremitting and remorseless campaign in a cruel stormy ocean. It covers from the secret German Navy activities which commenced in 1922, right through to the German surrender in May 1945. It is written on the basis of information obtained from Allied and German sources, and on information recently released from secret archives. It includes the effect of the British 'Ultra' team's code-breaking which has a marked effect on the understanding of some Allied tactics and successes in the U-boat war. The new knowledge provides an entirely different understanding of some of the tactics and historical events in this capaign. Brief and interesting extracts from statements by famous men and by eye-witnesses are interspersed in the text. The book manages to be an account of people — from Prime Minister and Grand Admiral through to U-boat seaman and Merchant Navy cabin boy — as well as a portrayal of historical events. Both sides are covered fairly. The presentation is objective and interesting. It provides a comprehensible overview of all the various types of inter-related events over a long time-span and in different places. The text and the comprehensive bibliography open the way to more detailed readings on specific events.

The Atlantic Campaign was the pivotal campaign of World War II — the attempt by the German Navy to cut off the vital supply of food, oil and raw materials to the British Isles and starve Britain to surrender. With virtually no indigenous supplies of oil or raw materials, and having to import 40 per cent of food supplies, the safe passage of large numbers of merchant ships was essential. Many of the troops and supplies to the North African and European campaigns and also had to traverse the Atlantic at some stage. The campaign lasted 5¾ years, and was waged over the whole of the North and South Atlantic — from Murmansk to Montevideo, Cape Town to Greenland, New York to Liverpool — by submarines, ships and aircraft.

Twice, the heavy and sustained losses of merchant ships and their cargoes brought Britain to the edge of starvation and Germany to the threshold of victory. Despite the terrible risks from torpedoes, bombs and mines, civilians continued to man the merchant ships, and doggedly sailed their precious ships and cargoes across the perilous ocean.

Losses were heavy on both sides. Allies — 40,000 lives (26,000 being Allied and neutral civilians); 2,603 Allied and neutral merchant ships totalling almost fourteen and a half million gross registered tons; 175 warships; a large number of aircraft. Germany — 28,000 U-boat crew, plus surface ship and air crew lives; 784 U-boats; 4 battleships, cruisers, destroyers, armed merchant cruisers; and merchant ships captured or sunk; a large number of aircraft.

The book is recommended to many types of readers. Those interested in modern history; the sailors and the military and naval historians; the naval tactician and strategist; and the student of Grand Strategy — for the effect of this campaign was crucial to the whole conduct and result of the war against Germany and Italy.

CJG

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