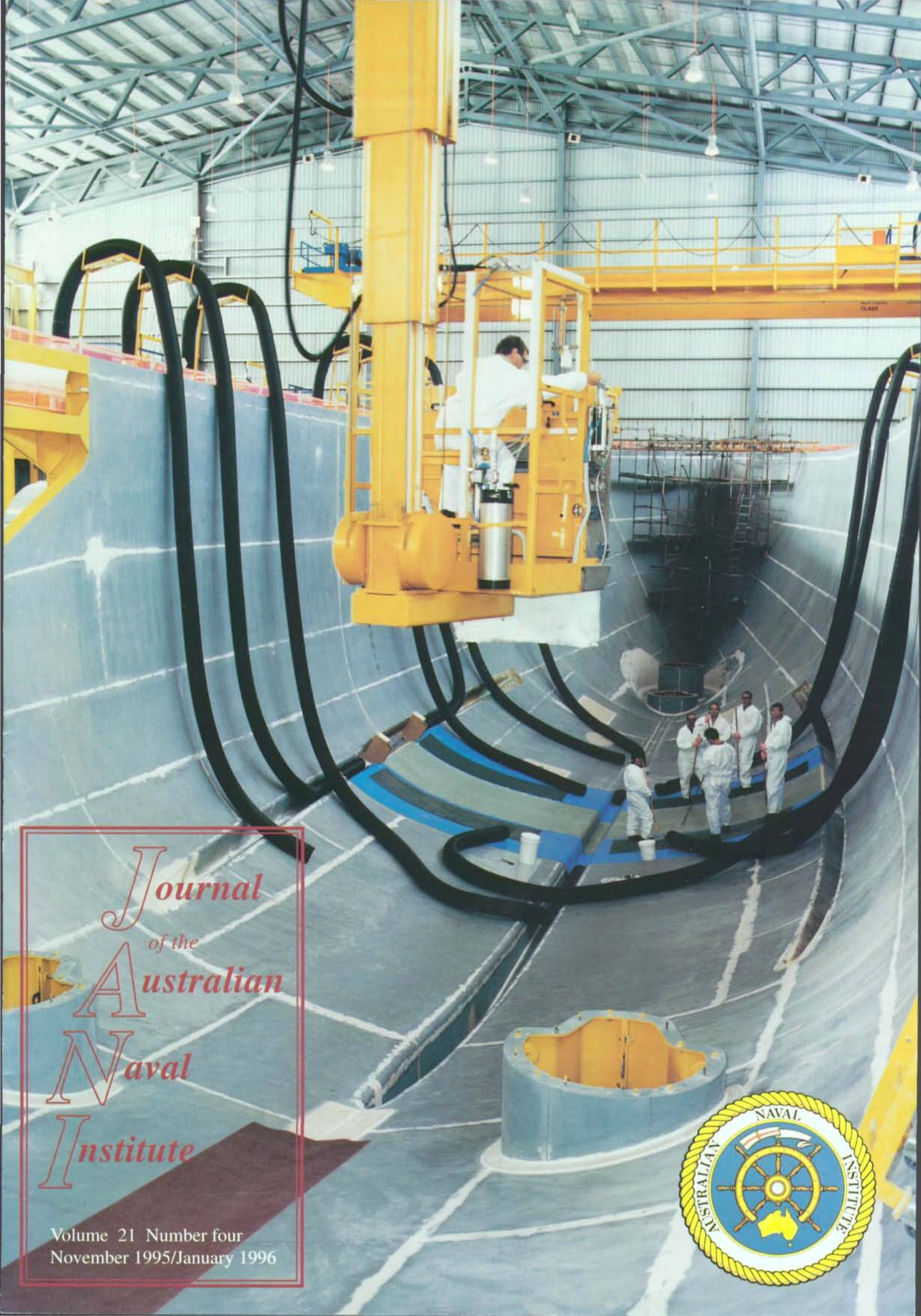

Journal of the Australian Naval Institute

Volume 21 Number four
November 1995/January 1996

AUSTRALIAN NAVAL INSTITUTE INC

The Australian Naval Institute was formed and incorporated in the Australian Capital Territory in 1975. The main objects of the Institute are:

- To encourage and promote the advancement of knowledge related to the Navy and the maritime profession,
- to provide a forum for the exchange of ideas concerning subjects related to the Navy and the maritime profession, and
- to publish a journal.

The Institute is self-supporting and non-profit-making. All publications of the Institute will stress that the authors express their own views and opinions are not necessarily those of the Department of Defence, the Chief of Naval Staff or the Institute. The aim is to encourage discussion, dissemination of information, comment and opinion and the advancement of professional knowledge concerning naval and maritime matters.

The membership of the Institute is open to:

- *Regular Members*. Regular membership is open to members of the RAN, RANR, RNZN or RNZNVR and persons who having qualified for regular membership, subsequently leave the service.
- *Associate Members*. Associate membership is open to all other persons not qualified to be Regular Members, who profess an interest in the aims of the Institute.
- *Honorary Members*. Honorary membership is open to persons who have made a distinguished contribution to the Navy or the maritime profession, or by past service to the institute.

ACKNOWLEDGEMENTS

The Australian Naval Institute is grateful for the assistance provided by the corporations listed below. They are demonstrating their support for the aim of the Institute by being members of the "Friends of the Australian Naval Institute" coterie.

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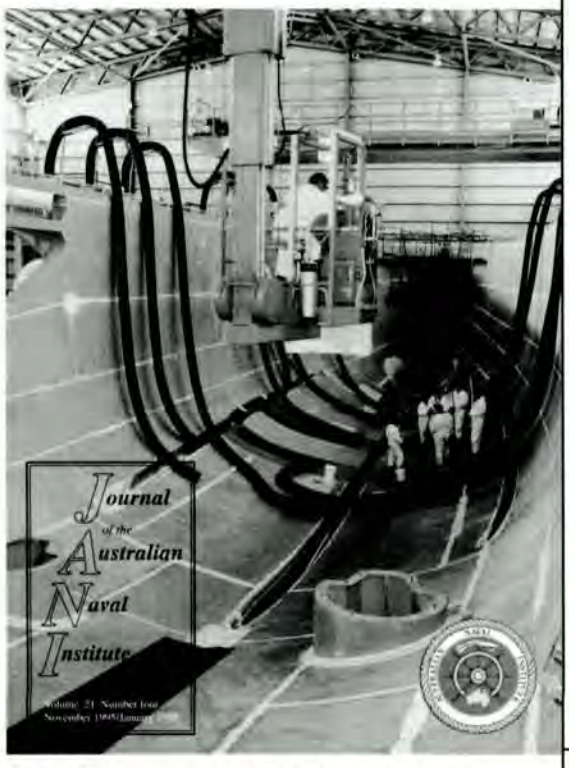
Volume 21 Number 4 November 1995/January 1996

SPECIAL FEATURE

Six defence projects are outlined, together with a handy summary of what to do and, perhaps even more importantly, what *not* to do when running major projects in general and defence projects in particular.



Cover Photograph: ADI Limited tradespeople commence work on laying the keel of the minehunter Hawkesbury. (Photo: Karl Hofman)

Features

Layout & typeset by figaro COMMUNICATIONS Stirling ACT
Phone 06 288 5990

From the President

In November 1995 the SEA POWER conference provided an excellent venue to promote the Australian Naval Institute and its objectives in our 20th Anniversary year. It was a very well organised conference and my feeling was that speakers and delegates had an enjoyable and informative time. All 280 participants were exposed to the Institute and its aims, with each person receiving back issues of our journal together with a 'glossy' ANI membership and information brochure. The conference was attended by about 40 members of the Institute, including six members of the ANI Council who took full advantage of the opportunity to promote the Institute. Sixteen new members were recruited during the conference and, given the many expressions of interest shown at the ANI promotion stand, I expect more membership applications to follow as a result of the conference promotion. I also want to express my appreciation of all those members who participated actively in the conference on behalf of the Institute.

Journal number 4 for 1995 is our annual theme issue. The selected theme is defence project management, a theme which was last considered almost a decade ago in the November 1986 issue of JANI. Interestingly, some of the projects discussed in this current issue - like the New Submarine (Case Study 3) and the FA18 (Case Study 6) - were in their infancy or at an intermediate stage of development in 1986. Therefore, with hindsight it is instructive to look at the lessons learned during these projects.

All defence Projects require planned and managed effort to bring about *change*, especially changes related to force capabilities. In fact, some $3 billion of total annual defence outlay is invested in projects and developing project management techniques. During the last twenty years, building up expertise in project management has become increasingly important for the navy, therefore, few senior naval managers and leaders are likely to complete their careers without involvement in defence projects. If navy projects are consistently brought in on time, on budget and up to specification then less distortion in the overall defence program will occur and the undesirable follow on effects of cost and/or schedule over run can be avoided. I think navy has been reasonably successful in chasing this ideal over recent years.

I am looking forward to 1996; it promises to be a challenging year and will of course be a busy year. There are several new initiatives on Council's table as far as administration and direction of the Institute are concerned and these will be discussed at the Annual General Meeting in Canberra in February. Also, a new Council will be formed and nominations are called for, so please consider nominating and serving your Institute in 1996. You may even be lucky enough to be approached by current Council members and get *invited* to nominate!

All the best for what promises to be an exciting, thoughtful and eventful year.

Chris Barrie

NOTICE OF ANNUAL GENERAL MEETING

Notice is hereby given of the 1996 Annual General Meeting of the Australian Naval Institute Inc.

LEGACY HOUSE, 37 Geils Court DEAKIN, ACT on Thursday 22nd February at 7.30 for 8.00 pm.

Please submit all agenda items and notices of motion in writing by Friday 16th February to: The ANI Secretary. Attention: Lieutenant Wendy Bullen RAN, Department of Defence (Navy) D-3-12A
Russell Hill ACT 2600.

From the Editor

Among other things this annual theme issue of JANI provides readers from *all* walks of life with brief,*readable* defence project outlines. It also gives a tidy sum mary of some of the things to do and not to do in defence project management. Of course, many project management lessons discussed in this issue are equally applicable to managing civilian projects as well as corporate management generally. Bearing this in mind, we look at a variety of Australian defence projects including two from each of the services: From the Senior Service we feature the Collins Class Submarine and the Offshore Patrol Combatant; from Army we have the Austeyr rifle and construction of the Solomon Islands patrol boat base and wharf, and from Air force we have the FA18 project and the B707 tanker conversion project. Readers without a technical or engineering bent should not be intimidated by this material, because each project is conveniently written up for 'the layman' and constructed so as to take 10-15 minutes to read. Most of the material has been generously provided with special permission by the Defence Industry Program of the Australian Defence Studies Centre. The Centre is growing rapidly and specialises in producing *practical* material directly relevant to national security and policy making needs. The six projects were presented at an ADSC project management conference, and special thanks go to the six project presenters. Note that project material has been substantially edited, consequently, only quoted material should be taken as from project presenters.

In this issue we also have an article on naval doctrine produced by Commander Peter Leschen, RAN who is currently the navy's liaison officer at the US Naval Doctrine Command in Norfolk, Virginia. This piece will certainly contribute to a wider understanding of the nature and role of naval doctrine within the RAN.

IIlumination Rounds, our popular and sometimes provocative column, includes a couple of stimulating observations, condemnations and anecdotes. Also sprinkled throughout this issue is a sampling of interesting and amusing odds and ends taken from 'old' ANI journals to celebrate our Institute's (and this Journal's) 20th Anniversary year of 1995. For example, we have included a 'Nobody asked me but...' from 1980, a couple of 'I was there When....' pieces from the 70s and a 'Shiphandling Corner' by 'Cyclops' from 1976. We have even thrown in a few 'Classic Signals' from 1970s issues of the journal to boot! While looking over old issues of JANI for these gems I wondered why such contributions had gradually faded out during the 1980s. I can't believe that modern navy personnel lead such boring, politically correct lives and haven't got some interesting stories to tell, or that they no longer hold independent, strong views on important subjects. Certainly I would like to see Shiphandling Corner return to the journal - stories of groundings, major navigational blunders and near misses make particularly interesting reading for those not involved! So, get your stories and warries in! If you fear courts martial, humiliation or imprisonment use a pseudonym if you like; and have absolute trust in me to protect your true identity!

Finally, you will find not one but two copies of the brand new, all singing and dancing ANI membership brochure in this journal. Use them to recruit a member or two so that your friends, acquaintances and relatives can share the benefits of ANI membership. And look forward to the next issue which is another theme issue concentrating on Australian naval operations.

Alan Hinge

06 2688454

STOP PRESS: Enclosed in this issue is a brochure concerning the RMA (Revolution in Military Affairs) Conference which will take place in Canberra (AWM) during 27-28 February. It is being conducted by the ADSC. Contact the organiser LTCOL KEITH THOMAS BM for details (06 268 6251)

Illumination Rounds

with Oddball

BIG BROTHER IS WATCHING YOU AND YOUR BAG!

I refer to an issue of HMAS *Harman* Weekly Orders which stated that personnel were not permitted to carry multi coloured bags, carry alls and backpacks while in uniform. It further stated that, to ensure personnel are aware of the requirement, the Coxswain staff at Russell Offices will be "reminding" people that they are carrying unacceptable baggage. What is the intention of this order?

It stated that 'assistance is required in returning to a disciplined, uniformed organisation, proud to wear the uniform of the RAN'. Is it the intention that we are all to look the same as much as possible? Should we perhaps be having our hair coloured to look the same? Should we ensure that the many bicycles that are ridden to work are of a uniform colour (navy blue or black of course), and that bicycle safety helmets are of a similar colour? Perhaps the Navy should consider an issue bicycle helmet , with appropriate officers and sailors badges!

Is it that we, as an organisation, fear that the general public will no longer take us seriously if individuals are espied toting rainbow coloured bags on the bus? Are we carrying these nefarious bags out of disrespect for our organisation? Are we conducting ourselves in an undisciplined, *colourful* manner? It is questionable whether such measures encourage discipline or pride anyway. It is even more questionable whether the use of Navy personnel to police this policy is an efficient use of our shrinking manpower budget (not to mention a ludicrous sight).

Let's get realistic. Are we trying to reflect the current attitudes of general society more closely (and hopefully improve public perception of the Navy and improve navy morale), or are we sinking further into the mire of misdirected totalitarian control? Service personnel can still take pride in their service and their uniform without going to ridiculous lengths of unnecessary uniformity. Surely this is going overboard.

Soon it will be an offence to be seen eating from my bright-red snoopy lunch box!

'BagMan'

COMMANDER WITH NINE LIVES

Commander A.S (Donk) Storey DSC and Bar RAN Retd, aged 86, has a record of escaping death which is beaten by only a few who are alive today. In March 1942 he was squadron gunnery officer of the 'Fighting' 15th cruiser squadron, under Admiral Vian, escorting merchant ships and supplies to Malta. When Storey's ship HMS NAIAD was sunk by German U-Boat U 565 on March 11 1942 with the loss of 77 men, he transferred to the light cruiser HMS *Cleopatra* with Admiral Vian.

On March 22, four light cruisers, an old anti aircraft cruiser and a flotilla of British destroyers escorting four merchant ships came under attack from the German Luftwaffe. Heavy Italian warships were also approaching, including the modern 35,000 ton battleship *Littorio* with nine 15 inch guns, with supporting cruisers and destroyers. The British ships turned to attack while the convoy headed away under the cover of a smokescreen. At the height of the action, *Cleopatra's* bridge was hit, with 15 killed. On the bridge, Storey had a narrow escape and for two hours the 6000 ton light cruisers fought against one of the most powerful battleships afloat. In the evening the Italian ships headed for home and of 26,000 tons of supplies, only about 5000 tons reached Malta.

In the Pacific at Leyte Gulf in the Philippines, Storey was staff officer operations to Commodore Collins when a Japanese Kamikaze aircraft dived into HMAS *Australia's* foremast, exploding and showering blazing gasoline and debris over the bridge on October 21(Trafalgar day) 1944. Thirty good men were killed and 60 were wounded; Storey was one of very few on the bridge not to be killed or wounded. Captain Dechaineux and the squadron navigating officer , Commander Rayment, died of wounds.

Commander Storey transferred to HMAS *Shropshire* and on October 25 1944 was on the bridge to take part in the Battle of Surigao Strait, when the Australian cruiser with American warships and the Australian destroyer *Arunta* opened fire on the Japanese battleship *Yamashiro* and its escorts. The *Yamashiro* was sunk in the last battleship against battleship action in history.

During the Lingayen Gulf landings off Luzon , Storey was Commodore 'Fearless Frank' Farncombe's staff officer operations on the open bridge of HMAS *Australia* when the cruiser received five more Kamikaze hits. Thirty-nine of his shipmates were killed.

At Vice Admiral Sir Phillip Vian's request in March 1945, Commander Storey served on his staff in HMS *Indomitable* during the Okinawa campaign. He survived two more Kamikaze hits.

As a 13 year old naval cadet at Jervis Bay in 1923, Arthur Stanley Storey was given the nickname 'Donk' because of his initials A.S.S. If they only knew, they could have called him the 'Kamikaze Kid'.

Alan Zammit

FALSE PROPHETS

It's that time of the year again when the usual gaggle of pseudo-gurus are telling us what life will be like in 10, 20 or 30 years time. Like our politicians, most journalists and academics have a disproportionate idea

of their own intelligence, capability and integrity — otherwise they would be able to hold down real jobs — so watch out for predictions and prognostications from these people, especially as the frenzy of forecasting occurs as we approach the Third Millennium... Let's take the clock back 30 years to 1966 and look at just some of the clangers that journos and academics came up with when anticipating what life would be like about now:

Time magazine of 25 February 1966 suggested that by 2000 A.D. machines would be producing so much of everything that everyone in the US would be independently wealthy, with only 10% of the population working and the rest being paid to be idle. Also, later in 1966, Time claimed that by 2000 all disease would be virtually wiped out, and human foetuses would be grown outside the uterus for the convenience of women wanting to avoid the discomfort of traditional pregnancy. Of course, the compelling mediocrity of media analysis hasn't changed much in the last 30 years, but neither has the quality of prognostications from the pseudo sophisticates of the research and analysis establishment. For example, the Rand corporation was dropping what history has shown to be its own clangers in '66. Besides a raft of wrong assessments on Vietnam they were coming up with conclusions that by 2000 A.D. huge fields of kelp and seaweed would be harvested by frogmen living in undersea bunkers. Rand scientists also concluded that drug control of personality would be widely accepted, citing the example of wives going to stores to get 'happy pills' for disagreeable husbands— half our luck!

'Anti - Nostradamus'

WOMEN IN COMBAT

I am getting a little sick of hearing this macho bulldust about how women are not suited for combat operations. How often do we need to have it explained to us - women make up 50% of our society, they are in the Navy to stay, and on an individual basis, there is nothing they should not be allowed to do.

It seems to me that it's about time we escaped the cultural stereotyping that tells us that only men can be warriors. Amazons aside, those historians amongst us should be aware of facts such as these:

- During the Second World War, the Russians frequently used women in combat units. The British historian Richard Holmes mentions Ludmilla Pavlichenko, a sniper who personally killed 309 Germans.
- In addition, the Russian 586th Fighter, 587th Bomber and 588th Night Bomber Regiments were all comprised entirely of women.
- In Vietnam, the 'Tiger Lady of the Delta', Ho Thi Que, was decorated three times for bravery before being killed in action in 1965.

The medical profession have shown conclusively that there is no physiological reason why women should be excluded from combat. Although, on average, women are not physically as strong as men, they have a significantly higher pain threshold. No one can dispute the fact that modern warfare, particularly naval warfare, is far less likely to involve direct physical confrontation with the enemy. Physical strength will continue to decline in importance. So long as all members of a ship's company can lift a hatch, heft a charged fire hose, and climb a ladder, they will be able to serve in harm's way.

The sooner we can escape the cultural blinkers that place men and women at opposite ends of the warrior-nurturer spectrum, the better off we will be. Women will have an important role to play in the Navy of the next millennia. They will bring to bear additional skills and strengths in terms of conflict resolution, ability to cope with stress and personnel management that we are only just beginning to recognise.

Oddball

CONTROVERSY CORNER

Defying orders or responding to a moral imperative?

Captain Lawrence Rockwood was serving as a US Army counter intelligence officer in Haiti when he slipped out of his barracks one fine morning with his M16 and bluffed his way into the island's main prison to see whether human rights violations were being committed. Later, a court martial found him guilty of disobedience, disrespect and conduct unbecoming an officer, with the Army portraying him as headstrong, arrogant, practising Tibetan Buddhist bent on becoming a one-man human rights movement.

Months earlier, on arrival in Port Au Prince, he received reports of brutality and overcrowding in Haitian prisons and tried to persuade superiors to investigate, but was told that it was not a priority. He later requested permission to inspect the prison personally but was denied the necessary US military escort. A formal complaint from Rockwood followed, claiming that commanders were subverting President Clinton's mission of stopping brutal atrocities. Rockwood wrote a note saying, '...I've done everything that's legal to stop something that's plainly illegal. Now you cowards court martial my dead body'. He then went to the prison and claimed to have seen inmates in skeletal condition. However, this claim was rejected by US military police who inspected the prison shortly after Rockwood was removed from it.

Rockwood has been presented with a Human Rights award by the New York Civil Liberties Union, but has appealed against his discharge saying that, "...You can't leave the military in the hands of cynical people who believe that might makes right'.

condensed from the Guardian.

Classic Signals

WORLD WAR TWO (1939-45)

"BETCHA" was the signal from the aircraft carrier HMS *Indefatigable* on approaching the WRNS establishment HMS *Impregnable* at Devonport.

KOREA (1950-54)

Operations off the west coast of Korea were the responsibility of British Commonwealth navies. It was the custom of ships to anchor nightly close in to the coast according to a predetermined pattern ordered by the senior officer present.

At dusk the senior officer (a very famous RAN officer) came onto his bridge and peered keenly around his group of ships, and his attention was drawn to the navigator busy at the chart table: "What are you doing pilot?", he said.

"Coding up positions for the night stations, Sir" was the reply. (Code was necessary as all our transmissions were monitored by the communists).

"Hell, let's not worry about that pilot, there are several ways to kill a cat. Here, give me the chart and the TBS (Talk between ships)" commanded the senior officer.

Watched by his dismayed officers, with the chart as a guide and using the call signs of his group, the senior officer sent his message in loud and clear English:

"...West Force this is Leader. Night stations for tonight: Imagining the island of Chodo to be the batting end and the island of Sokto to be the bowling end, then Red Rose will go silly mid on, Haywain fine leg, Diggership slips, All Black gully, Canuck cover point while leader will take square leg and umpire. Over".

The delight of the operators in the Australian, New Zealand and British ships could be detected with their voices as they replied with a smart, 'This is so-and - so. Roger. Out'.

There was the sound of an operating circuit, tentative throat clearing, and a long, long pause. Then came a broad and plaintive Canadian voice: "This is Canuck. Say again your last message please!"

CONFRONTATION (1963-66)

Cheeky Indonesians

During Confrontation an RN Officer in command of a minesweeper in the Malacca Strait challenged an Indonesian coastal force ship with the time honoured: "What ship?"

The reply was quick and to the point: "Buy yourself a copy of Janes' for Christmas"

On another occasion a tense situation developed as his minesweeper began warily circling round an Indonesian Patrol boat trying to identify it. Both had come to action stations and they began stalking each other like two dogs working up to a fight. Finally, the sweeper in accordance with his instructions broke off to resume his patrol; as he did so the Indonesians' lamp spelled out the wry comment:"Hornblower would be proud of you."

VIETNAM (1965 - 71)

The Second Coming

Cruising off the Vietnamese coast in deep water during Market Time operations, the lookout reported a man walking on water some distance off the starboard bow. The OOW frantically searched his charts for sandbars while the curious faithful gathered to gaze in awe at this wonder of the millennium. As the ship cautiously approached our ambulatory dharma, a secular explanation became apparent to our incredulous eyes: he was a fisherman tending his nets, and his locomotion was achieved by shuffling through the water on a mat of woven fronds just below the surface and just out of sight from any distance. It was an extraordinary phenomenon and the padre was later able to deliver an inspired sermon, singling out the lookout for his piety and the OOW for his scepticism (Oh well, not quite a signal, but amusing nonetheless!)

No Time for Subbies

The Fleet Commander, with the Fleet Communications Officer (FCO) in attendance was conducting Officer of the Watch Manoeuvres. One ship reacted very slowly to a particular flag hoist and took a painfully long time to achieve new station. The following conversation took place on the flag bridge:

FCO: 'Suggest negative Bravo Zulu to ship...Sir'

Fleet Commander: 'Who is the OOW?'

FCO: 'Sub Lieutenant .....Sir'. (Names signalled at beginning of serial)

Fleet Commander:'No. That is an unnecessary signal to a sub lieutenant. Everything done by a Sub Lieutenant is Negative Bravo Zulu unless he is told otherwise'.

(Note: *negative* Bravo Zulu means not well done)

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 vague than ever. A consideration of the reverse traditions 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

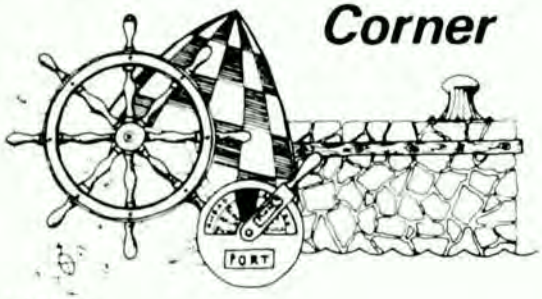
SHORE ESTABLISHMENTS

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

Shiphandling Corner



May 76

INCIDENT ONE

This incident occurred at a little-used port in the Far East. The Ship was a Daring Class Destroyer. She and her consort were due to go alongside a fuelling wharf at 0800 (local), in sequence, fuel, move to other berths and then both Captains were to be flown out to the national capital for official calls on all the rich, great and famous in the country. It was a tight schedule. The response to the logreq said that tugs would stand by on arrival. The alongside berth was like this:

The berthing plan was to pass through Position A, between the foul ground and the point west of the wharf. Although there was a stiff sou'westerly blowing it was well within the ship's capabilities to get alongside and, with a tug to assist, it looked dead easy.

The plan also assumed the existence of a charted Hauling Off Buoy which, with its ground tackle, would preclude the use of the ship's anchors, and in any case, this buoy could be used if required to get away. On entering harbour at about 0750 the first blow fell when Harbour Control said that the promised tugs were not available. The ship forged on and things began to happen quickly, as they do on these occasions. On rounding the point and shaping up for the berth no Hauling Off Buoy could be seen. The second blow had fallen to upset the planning. As the ship slowed down for its final approach it became obvious that the sou'westerly would have more effect than was comfortable, and, in the absence of the Hauling Off Buoy, an anchor could, and would have to be used. As it was, the ship ended up gently and comfortably alongside with 3 shackles out on the starboard cable. Despite views previously held by the Captain about the dangers of using short lengths of cable, the anchor had held the ship well up on berthing, and it seemed reasonable that it might do the same on departure. Queries about the tugs and the hoped-for Hauling Off Buoy met with bland amiablility from the shore authorities, and it was clear that departure could not rely on assistance from them. Some confidence was placed on the 3 shackles out–but sadly misplaced confidence as it turned out.

On departure the cable was hauled taut and the spring and engines were used to get some turning moment on; not too much, because there was not that much manoeuvring room between wharf and shoal. Finally though, it was necessary to go astern to shorten in, weigh, and get out. As the cable was heaved in the anchor dragged, the ship caught the wind and its bows bumped all the way down the wharf. As the ship cleared the western end of the wharf, it became increasingly clear that there was some considerable risk of grounding between the wharf and the point. By then the cable was in to about a shackle, the ship still had stern way on but was drifting down wind. The foc'sle was ordered to stop heaving and put on the brake and the slip "Half ahead Port, revolutions 135, slow ahead Starboard, Starboard 30", and the ship responded and gathered headway quickly, the cable went taut and this helped wrench the bow to starboard and safety; better to lose an anchor than a ship. The stern swung worryingly close to the western end of the wharf but once clear the revs could be taken off, and the anchor could be dredged out into clear water and weighed. It had been a near thing.

What Self Criticism is Offered?

In hindsight it is hard to offer any excuses. The Captain made a mess of it from beginning to end, and only that he avoided damage to his ship got him out of the severe censure he deserved. He started to go wrong when he assumed that promised tugs would be available and the chart was maintained up to date by the host country, but proper attention to the aim of safe handling and less con-

cern about his diplomatic role could have prevented all the consequences. Instead of the dash to the wharf through Position A he should have heard the warning bells as he entered harbour and was told no tugs were available. If he had then proceeded to Point B, and weighed up the situation he could have taken it all much more calmly. Even when apparently committed to the berth at Position A he could just as easily have turned to Starboard, proceeded to Position B, and again, taken stock of the situation. Instead he rushed on impetuously into what ended as a hazardous situation, full of anxieties about what were only secondary considerations at the time. The only things in the Captain's favour were the good understanding which had been developed, with his team on the foc'sle, and his splendid engineroom, and their quick responses to his final and almost desperate orders which eventually saved the situation.

Having made a foolish mistake in getting alongside with 3 shackles out in those circumstances, the Captain could have invited his consort to anchor somewhere towards Position B, pass him a line and then use the consort as a very powerful tug. Armour propre, is probably the right expression why this was not done, but how silly it looks in retrospect. Better a little dented pride and no worries, rather than what happened. Finally when he was getting into extreme danger with the anchor still down and the ship blowing down wind, rather than go ahead and dredge the anchor out that way, he could have just as easily gone astern and dredged it out between the point and the shoal. Changing from ahead to astern at that critical time only gave the wind more opportunity to force him further to leeward.

Lessons Learnt

The aim was submerged and confused with subsidiary considerations. Another ten minutes weighing up the situation would have been unimportant in the long run and it would have saved a lot of unnecessary worry. More importantly the ship would never have been in any danger.

Professional Wrecker's Comments

The overall plan for berthing/unberthing seemed reasonable. However the plan required the use of tugs and a buoy. As tugs and buoy were not available an alternative plan was required.

The lesson to be learnt is that a plan is devised so that an evolution may be carried out safely and efficiently. If the plan becomes unworkable a dangerous situation is probably developing and a re-think is necessary.

CYCLOPS

INCIDENT TWO:

Incident One in the Shiphandling Corner of the February 1976 issue brings to mind another instance of shiphandling concerning the minesweepers built in Australia during the war years.

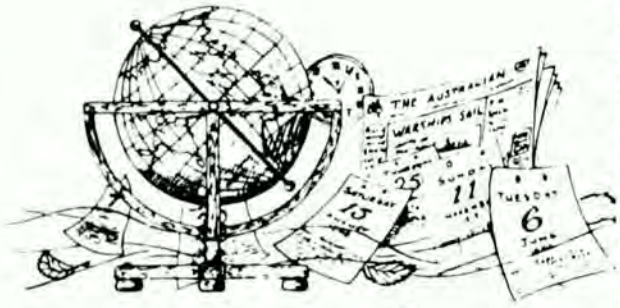
The first ships of the class were built with 1750 HP engines and Deloraine was the first to be built at Morts Dock with 2000HP engines. This involved several structural changes in the ship and re-arrangements which included pockets in the wing fuel tanks to accommodate larger boilers, change of rotation of propellers and some steering gear modifications because of an extensive re-arrangement of the bridge structure.

Time came for trials and there was much discussion on shiphandling characteristics with the new propellers and the civilian pilot was warned of the change of propeller rotation and the possibilities of misinterpretation of engine orders.

It was a fine calm day with the water of Morts Bay as smooth as an oil slick when a small tug pulled the bow out before main engines were ordered slow ahead both with 10 degrees of port rudder. As speed built up it soon became apparent that the ship was swinging to starboard. Was this the effect of propeller rotation? There was little time for discussion as successively increasing degrees of helm were ordered to correct the swing. The point of no return had come and before a change of direction could be achieved, the ship continued to swing in spite of a crash astern order. A collision was inevitable with a Sydney ferry moored at its overhaul yard. Only slight damage on either side and mostly to the rickety wharf to which the ferry was secured.

Investigation showed that the steering gear rods in the re-arrangement had been moved from one side of the ship to another, another train of bevel wheels introduced and rotation altered which gave port indication on the bridge with a starboard rudder. The gear had been checked but not well enough because when orders were given at the basin trials to go hard over each way, no one had bothered to ascertain whether the bridge and steering flat were synchronised port to port and starboard to starboard.

R.F.A.



I was there when...

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A MYTH IS LAID TO REST

I WAS THERE WHEN the great broccoli myth of the Naval College was finally laid to rest.

At midday, seven days a week for three and a half years, we used to watch with grave solemnity the progress of the dish of broccoli. It would be carried out of the galley with due pomp and circumstance by a stony-faced steward and deposited in front of the head of the table. Then it would be passed down the length of the table and ceremoniously returned, completely untouched, to the galley. Sometimes though, a Cadet more daring than his fellows, would poke at it with his fork or whisper a ribald comment about it, and the others would laugh, nervously, and avoid each other's eyes.

Only once did we see anybody foolhardy, hungry or naively trusting enough to eat any, and this Cadet forced down a whole dish of it for a wager. Shortly afterwards he left the College, having been considered to lack officer-like qualities, and nobody was surprised for he really had exhibited remarkably poor judgement in this sensational feat.

We all knew, you see, that the broccoli was made of a greenish-yellow plastic–the sort of thing they sell in novelty shops like Frankenstein's feet or dog's you-know-what–and that the Chief Cook and Chief Victualler were working a racket. The Chief Steward had a piece of the action as well. It was clear to us that all the cooks did was to pour hot water over the stuff to make it steam and look real. I forget how the distinctive aroma was achieved, but it was probably contrived from some concoction based on hydrogen sulphide from the chemistry lab; Ras Berry was thought not to be above association with such a lucrative scheme. Anyway, when the broccoli was returned to the galley, the water was simply decanted and the dish would be ready for a repeat performance the following day. The whole deception was really quite ingenious, and quite safe too, for no Cadet would dare risk reporting the situation to Authority. (You see how early we are indoctrinated against the White Mafia). Meanwhile, the Chiefs waxed fat on their illicit profits and it did not go unnoticed when they bought new cars or threw lavish parties in the Chief's Mess on the hill.

Some years later, it was my happy lot to have a sojourn as Supply Officer at the College, and on my very first day I rushed to the dining hall in certain expectation that the venture would have been perpetuated. I would catch them red-handed and vindicate generations of Cadets' suspicions. Sweet nostalgia: there was the steward with his steaming dish of broccoli (plastic, all right, I could see at a glance); there was the Chief Cook with an odd expression on his face; and there were a hundred pairs of unblinking eyes hungrily watching their victualling allowance go back to the gallery.

I sprang forward to seize the incriminating evidence, but . . . mortification! The broccoli was genuine. I could hardly believe it but it really was the standard purser's issue, doubtlessly nutritious, but stewed to that unappetising and otherwise indescribable state which only institutions like lunatic asylums and naval training establishments can achieve.

Well, broccoli disappeared from the menu and the Chief Steward offered to put on crow instead in my special honour, but I failed to appreciate the humour in the gesture. (Chief Stewards are like that. The same droll comic observed that in its preparation, food was not touched by human hand. What he meant was that it was handled by cooks–the Chief Cook didn't think that remark too funny either.)

Now this account is true, but my contemporaries regard it somewhat sceptically. They explain that everybody knows that real broccoli is always used for a few days whenever a new Supply Officer joins, and they pointedly enquire how I was able to buy a new Mercedes a few months afterwards. Of course that is a slanderous irrelevancy, yet have they never wondered about the ubiquitous macedoine of veg?

DJC

Doctrine - Issues for the RAN

by Commander P D. Leschen, RAN[1]

Since World War II navies, the RAN included, have not placed much emphasis on doctrine, particularly in written form. Some naval officers have been uncomfortable with the idea of doctrine, being concerned that it could make them doctrinaire, stifling the tactical innovation and boldness necessary to win in war. More recently, however, navy doctrine has received increased attention. In the RAN's case this is partly a response to continuing pressure on the defence budget at a time when units are being committed to a wide range of operations around the world, and the RAN's technological edge in the region is being eroded in some areas. The hope is that better doctrine will contribute to more effective and efficient operations, and thus allow the RAN to retain its capabilities and advantages in a time of shrinking resources.

Additionally the Army, RAAF and ADF Warfare Centre (ADFWC) are all putting considerable effort into the development of doctrine, as are the USN and an increasing number of other navies. The amount of military doctrine available is therefore increasing rapidly, and it is important that the RAN keep up with the development of military thinking around the world.

This article will analyse the concept of doctrine to identify the different forms it can take and its role in the employment of military forces. It will then look at the state of RAN doctrine, and ADF doctrine as it affects the RAN. This will be compared with doctrinal development in the USN. Finally it will identify areas where RAN doctrinal development work should be focussed.

The RAN is already involved to some extent in all these areas, and the author is not presently in a position to know the details of work already underway in Australia. The essay will therefore draw general conclusions but not attempt to make specific recommendations.

DEFINITIONS OF DOCTRINE

General Definition

The *Concise Oxford Dictionary* defines doctrine as:

a. What is taught; a body of instruction.

b. A principle of religious or political (etc) belief, or a set of such principles; dogma.

The first part of this definition suggests that doctrine tells people what to do and how to do it. The second part of the definition introduces the concept of principles which will guide peoples' behaviour; such principles tell them how to think about something rather than prescribing a course of action. The use of 'dogma' suggests that such principles can be at least authoritative, and possibly beyond questioning.

The ideas of instruction and guiding principles represent a positive contribution of doctrine. No professional organisation could achieve its objectives without both instructions and principles, in some form, to shape its thinking and behaviour. On the other hand, the negative suggestion that doctrine may be authoritative and beyond questioning leads to fears that it will stifle creative thinking, innovation and initiative.

ADF Definition

The ADF definition of doctrine is: 'fundamental principles by which military forces guide their actions in support of national objectives. It is authoritative but requires judgement in application'[2].

This definition expands on the concept of principles contained in the dictionary definition. The idea of a body of instruction is also implicit; principles which are not known and understood by the ADF cannot guide its actions.

Fundamental principles guiding military action suggests that doctrine derives from experience and has a degree of permanence, an approach that has its roots in the historical school of strategic thought. However, while doctrine may provide relevant guidance for military actions despite changing circumstances and technology, it cannot determine what those actions should be. That will remain the province of problem solving processes, such as the appreciation. Doctrine is therefore one input to a problem solving process, which helps determine the validity of resulting courses of action. To use a much quoted phrase, doctrine tells you how to think, not what to think.

Doctrine must also be responsive to changing circumstances. Fundamental principles may not survive significant changes in technology, as strategists of the material school understood. Additionally, doctrine must never be in conflict with national policy and, at the higher levels of war, must be very closely aligned with it; otherwise military action cannot support national objectives. Thus doctrine must strike a balance between retaining the relevant lessons of history while keeping up with the pace of change.

This is why the use of 'judgement' in the definition of doctrine is so important. It recognises that doctrine can never provide more than guidance; doctrine based on past experience may be outdated, while doctrine based on future projections may be quite wrong. Therefore it is vital that it be applied with the judgement of the commander on the spot.

This helps to explain RAN ambivalence to the idea of 'authoritative' doctrine. 'Authoritative' means that the doctrine is officially sanctioned by leadership, but can also suggest that it must be inflexibly applied, regardless of its practicality in the circumstances; such application will almost certainly hinder rather than help the achievement of objectives. However, the doctrinaire application of doctrine is a reflection of the way people or organisations use doctrine, rather than anything inherent in the concept of doctrine itself, and can therefore be avoided.

Authoritative doctrine also has its positive side, standardising behaviour so that orders may be carried out as expected. Officers at any level of command will require this of their subordinates while, in the same breath, demanding the maximum latitude to carry out their assigned tasks. Both desires are reasonable, and are not incompatible; doctrine can be authoritative without unnecessarily curtailing flexibility in carrying out tasks.

Fears of doctrine on the grounds that it requires doctrinaire behaviour are therefore overstated. Indeed, the ADF definition of doctrine places responsibility for the application of doctrine squarely with each individual. To illustrate, a commander who wins in action may be hailed a hero regardless of how closely doctrine was followed. On the other hand a commander who loses may have failed to follow doctrine correctly, or have exercised poor judgement in failing to depart from doctrine when the situation demanded. In either case the commander cannot escape responsibility for the results of his actions by citing doctrine as a defence; this responsibility is unaffected whether the relevant doctrine was good, bad or indifferent, or even if it was unwritten.

Form of Doctrine

Within these definitions doctrine may take several forms. This can be seen by looking at a variety of large organisations, and the single Services within the military in particular. They all develop a strong culture of shared beliefs and practices which are well understood by the members; indeed they could not be considered professional if they did not have such a body of doctrine. However the way this doctrine is developed and disseminated can vary widely. It may be written or unwritten, formally promulgated or informally 'understood'. It may be produced 'top down' by one central organisation, or percolate 'bottom up' from the people at the action end of a decentralised organisation. It may also be changing or unchanging, depending on the circumstances and people's attitude to it.

In fact it does not matter what form an organisation's doctrine takes, so long as it unites the organisation in the pursuit of its objectives in the most effective and efficient manner. Nevertheless, deciding what form doctrine should take is important. If an organisation's doctrine is informal and unwritten, it may be a difficult task to define it, and to identify areas where it has become outdated or counter productive. However it may be that the informal doctrine is working well, and that cost benefit analysis indicates that the significant effort required to codify it is largely wasted.

Doctrine and the Levels of War

The strategic level of war is concerned with the art and science of employing national power,[3] political, economic and military. Strategic level headquarters interact with the Government to establish how the military element of national power is to be employed and what it is to achieve. The operational level of war is concerned with the planning and conduct of campaigns. It is at this level that military strategy is implemented by assigning missions, tasks and resources to tactical operations[4].

Both these levels of war are focused on national objectives and are guided or directed by national policy. For both domestic and international political purposes the civilian leaders want maximum flexibility and maneuverability and are hesitant to fix on firm objectives. The military on the other hand requires just such a firm objective as early as possible in order to plan and conduct military operations[5]. Thus doctrine is needed to provide guidance for military contingency planning efforts in advance of clear political direction to conduct specific operations. It must have the flexibility to help identify the range of workable military options as well as those that are fundamentally unsound. However it is unlikely that doctrine at these levels can ever offer the flag or general officer the flash of insight that determines a winning option; it is not the factor separating the great from the merely competent leader.

The tactical level of war is concerned with the planning and conduct of battle and is characterised by the application of concentrated force and offensive action to gain objectives[6]. Once battle is joined the focus will shift towards winning rather than achieving national objectives. Doctrine can therefore offer more specific guidance on how to fight a battle. However, once down to the procedural/technical level, things tend to be directive. This is beyond the realms of 'fundamental principles' and 'guidance' and is therefore not doctrine. To illustrate, guidance on the em-

ployment of the Standard missile system is doctrinal, a tactical level 'action in support of national objectives', but the firing procedures are not.

The discussion so far leads to an important conclusion; military doctrine needs to be defined broadly to include its roles at the different levels of war and its many different forms. National policy, doctrine and procedures are part of the same continuum and their boundaries are blurred. The interactions between them are vitally important so they should not be artificially isolated from each other.

ADF AND RAN DOCTRINE

Australian Defence Policy

Current Australian Defence policy is provided in two documents. The Government White Paper, Defending Australia 1994[7] is the key document describing Australia's military strategy and detailing the force structure required to implement it. It reflects the enormous changes that have occurred around the world since the 1987 White Paper; however, while there have been some changes in emphasis, the underlying *Defence of Australia* strategy remains substantially unchanged.

The Strategic Review 1993 is a document which looks at Australia's strategic environment over a three year time scale, and is the latest of a series of documents running back to the Second World War. Produced in conjunction with the Department of Foreign Affairs and Trade, it has a broader focus than the White Paper, and its impact is more on the employment of current military forces than on future force structure decisions.

Joint and Combined Doctrine

The development of joint and combined doctrine to implement Australia's defence policy is the responsibility of the ADFWC, which is responsible to HQADF and responsive to the single Services. Doctrine is being set out in the ADF Publications (ADFP) Operations Series, which necessarily extend down from the strategic to the operational and tactical levels of war. ADFP 1 - 4 are specifically listed as doctrinal publications, covering doctrine, the division of responsibilities within the ADF, rules of engagement and mobilisation planning. ADFP 1 (Doctrine) is the key publication, covering defence policy and ADF functions, roles, organisation, command and control, planning, and concept of operations. It then provides ADF doctrine for operations of all kinds, such as amphibious, air defence, joint maritime operations, strategic strike and aid to the civil power. These chapters are then expanded in separate ADFPs, some of which are still being developed. These publications contain an increasing amount of doctrine that in the past might have been considered the province of the single Services. For example, ADFP 18 will cover joint maritime operations, and will contain material recognisable by any officer who has read maritime strategy or attended a naval staff college.

Joint doctrine is also taking other forms, such as Australian Maritime Tactical Instructions (AMTI). This publication incorporates material from the old Australian Fleet Tactical Instructions and other single service and joint publications into a single book on maritime tactics. Promulgated by the Maritime and Air Commanders, it recognises what has long been the case; maritime operations are a joint effort between the RAN and RAAF.

RAN Single Service Doctrine

At the strategic level of war RAN doctrine derives from the work of thinkers such as Mahan, Corbett, Turner and Gorshkov, and from the historical and material schools of strategic thinking. Two RAN organisations are specifically involved in studying and educating personnel in maritime strategy and the doctrine that underlies it. The Maritime Studies Program (MSP)looks at a wide range of maritime issues that affect Australia, publishing papers and running regular conferences to canvas and disseminate a wide range of opinions. Their particular focus is to raise the importance of Australian maritime issues in the minds of the ADF and the public. The RAN Staff College (RANSC), among other things, educates officers in continental, maritime, air and revolutionary strategic concepts before proceeding to a more detailed study of maritime strategy and its application in the Australian context.

This material is not promulgated as RAN single Service doctrine. However it provides guidance on how to think about Australian maritime problems, in the form of a range of ideas to consider when deciding how to employ Australian maritime forces in peace and war. It therefore qualifies as a form of informal, unwritten RAN doctrine. Evidence that this doctrine exists and is understood lies in the common approach that our senior naval officers take to planning naval operations; while the details may vary the underlying principles and assumptions remain the same. Furthermore, this material is being steadily formalised as written doctrine in the ADFP series, albeit in a joint rather than single Service forum.

The largest body of RAN single Service doctrine is focused at the tactical level of war. The RAN has always had access to such doctrine, largely as a result of its relationship with the Royal Navy and, more recently, the USN and NATO. It takes the form of a large number of tactical publications from Australian, NATO, USN and RN sources which have a high degree of commonality across national boundaries.

In the quite recent past this led to the odd situation where an RAN unit could sometimes conduct combined operations with other navies, particularly the USN, more easily than joint operations with forces of the RAAF or Army. The RAN is quite comfortable with this kind of doctrine. This is to be expected, as personnel spend the first part of their career gaining expertise at operating in the naval environment. The material is thoroughly learned by personnel during courses at specialist schools and during through practical experience during work ups, exercises and operations.

ADF Organisation and Doctrine

The heirarchy of current and developing ADF and RAN doctrine closely parallels ADF organisation. The strategic and operational levels of war are essentially joint or combined in nature; indeed the White Paper makes it clear that a task so large as the defence of Australia can only be effectively carried out by the joint efforts of the ADF, supported by combined operations with our allies if necessary. It is self evident that maritime operations will require the joint efforts of the RAN and RAAF, and land operations, while being the prime concern of the Army, will require the direct and indirect support of RAN and RAAF assets providing, among other things, fire support and transport. It is therefore sensible that doctrine at these levels of war be contained in joint publications, which are accepted and applied by the whole ADF.

At the tactical level of war it is essential that each service understands the capabilities of the others, and that the command, control and communications arrangements are in place so that each service can effectively support the others. Joint tactical level doctrine is therefore important, and exists in the ADFP and other publications such as AMTI. However, at this level of war there is also a place for a significant body of single Service doctrine.

US/USN EXPERIENCE

At this point it is interesting to draw comparisons with the US/USN experience. US forces are increasingly focussed on joint operations but, unlike HQADF, the Joint Chiefs of Staff organisation does not have a command role and, at least for the moment, has limited ability to effectively coordinate procurement decisions. The single Services therefore have more power than their Australian counterparts do today. Each Service is developing a body of single Service doctrine, which runs in parallel with the hierarchy of joint doctrine. Thus, as in Australia, the structure of US doctrine closely parallels US force structure and procurement processes.

US naval[9] doctrinal developments are largely aimed to ensure that its thinking remains current in the post cold war world. The cold war maritime strategy aimed at achieving world wide maritime superiority to allow the US continued free use of the sea. With the reduced threat to free use of the seas the USN and US Marine Corps (USMC) have enunciated a strategy for operations 'Forward...From the Sea'[10], which describes the naval option for US intervention in crises around the world where US interests are under threat. The implications of this move were not immediately apparent, and there was a perception that USN doctrine, based on cold war assumptions, needed significant rethinking.

Additionally, the roles and missions of the US armed forces are under review, and the development of naval doctrine may assist in arguing current and new force structure proposals in the face of intense competition for shrinking Defence dollars.

Against this background, Naval Doctrine Command (NDC) was created to develop the doctrine to support the new naval strategy. Its mission[11] is to:

a. develop naval concepts and integrated naval doctrine,

b coordinate the development and evaluation of navy-service unique doctrine,

c. provide a coordinated USN/USMC naval voice in joint and combined doctrine development, and

d. ensure naval and joint doctrine are addressed in training and education curricula, and in operations, exercises and wargames.

In order to achieve this mission NDC is working on several key activities.

Naval Doctrine Publications (NDP)

NDC is producing six NDPs which set out to fill the gap between the strategic level document 'Forward...From the Sea' and the tactical level doctrine contained in USN Naval Warfare Publications (NWP). These publications cover Naval Warfare, Intelligence, Operations, Logistics, Planning and Command and Control. They represent a synthesis of the body of maritime strategic thinking since Mahan, combined with the experience of planning and conducting operations. In many ways they mirror the sections of the RANSC syllabus on maritime strategy and ADF operations, in both content and level. Their principle audience is the middle ranks of the officer corps, and they are also useful to inform government, public service and civilian audiences what it is that the USN/USMC team does and how it does it. They are interesting reading for senior naval commanders, but at this level are likely to be seen primarily as a codification of what is already well understood.

Continued page 61

PROJECT CASE STUDY 1: The Offshore Patrol Combatant

Containing risk in a 'fast tracked', sole sourced project with huge export potential demands identifying core issues and exposing them to senior management early. 'Boundaries' must be placed around design and construction risk, contracts must be carefully designed and intellectual property rights established before going to contract.

The 1991 Force Structure Review recognised the need for a far more capable vessel to replace the Fremantle Class patrol boats at the turn of the century. The new vessel is to have substantially better range, sea keeping, endurance and surveillance/combat capabilities. The multi billion dollar Offshore Patrol Combatant (OPC) project originally aimed for production of 9 to 12 ships (with helicopters) for Australia, and involved possible collaboration with Malaysia in ship acquisition. Helicopters were to be purchased separately with the chance that they could be bought in combination with ANZAC ship helicopters. Malaysia planned for between twenty and thirty vessels over a 15-20 year period, and a joint RAN-RMN operational requirement was agreed in late 1993.

Transfield Shipbuilding was the only Australian company that placed a bid in the Malaysian open competition, and the company presented a proposal to the Department of Defence for a design study in September 1993, with the design based on the evolving joint requirement. Following evaluation of the Transfield proposal, and its approval through the defence committees by the end of 1993, it went to cabinet in late March 1994 and a contract was signed in early April. Consequently, the project was set up as a 'sole source' arrangement before the actual requirement was fully defined. According to the Presenter, "... (the project was) clearly 'fast-track'. The text books suggest four and a half years are typical for defining a requirement and getting into contract. Some of you will know of some projects that have been around 10 years and still haven't got that far! We didn't have much time; in fact when the project office was set up we were given about 18 months to get through the design phase, have the design fully evaluated, set up contracts with Malaysia, go into contract and set up reviews and MOUs (Memoranda of Understanding)".

Risk Containment

Collaboration with another country brings particular uncertainties, risks and challenges. For example, the project had to meet Malaysia's acquisition timing, but little knowledge of the Malaysian agenda and strategy existed at the time because the Treasury in Malaysia manages the acquisition process. Consequently, an assessment of inherent project risks and probable difficulties was required, and the first task was to clearly identify core issues and expose them to senior management early. This needed to be done to obtain advice, but even more importantly to let management know how the project intended to tackle problems. The Presenter remarked that, "... (we had) risks that we were finding very hard to identify. Many areas in the Defence Department will say 'You can't take the next step until you have got all your ducks in a row', and clearly, when you can't get them all in a row that creates dilemmas in some areas. What you have to do is at least put a boundary around the problem; know what you can or can't do at each stage; don't ignore difficulties, and move onto the things that you can tackle up front. Look for developments, work out particular issues and get some extra information where you can". In this project informal links and contacts in Malaysia proved very valuable in clarifying requirements and processes.

The OPC Project was not even in the FYDP but aimed to deliver vessels by the turn of the century. Therefore, a 'cost cap' was recommended in the approval process to impose some discipline and limit risk, but as development progressed it became evident that budget would be exceeded. The Presenter commented that, "We looked at it (cost) very closely with a sponsor and asked 'What are the things that we really need to concentrate on; what is the top level requirement?' Cost/Capability trade-offs could then be proposed for some of the less important elements of the project, consequently, the number that could be produced under the cost cap was estimated between 9-12 vessels (including helicopters). Another tool to reduce the risk of paying too much in a sole sourced situation was to make high cost visibility a fundamental element of moving forward to contract. Consequently, accepting a sole source should involve gaining full visibility of contractor's costs and selection processes for suppliers and sub-contractors".

Sole Sourcing

Even though only one Australian company was involved in the Malaysian competition, strong justification for sole sourcing still had to be made to the Australian government. A good case would have to be put up for government approval not only for the design phase, but also for the construction phase. A case existed that 70-80 per cent of prime contract value was likely to be contracted out, and this is believed to have helped 'sell' sole sourcing to senior defence committees and ultimately to government.

In terms of anticipating construction, the Presenter noted that, "There was little time between carrying out the design and going into construction, and there was a high risk that if we went out to open tender we would never achieve construction in time, also we had a problem with responsibility for an unproven design and taking it out to other manufacturers and ship yards. We felt leaving the design and construction to the same company would be accepted and clearly define responsibility".

Contracting Strategy

Deciding on what sort of contract to use is always important in managing risk. Clearly, the project had some higher risks than many other acquisition projects and achieving high visibility of costs was important. During the construction phase this pointed towards a Ceiling Price/Incentive-type contract where the project defines target costs, target price, an overall ceiling price and then works out a share ratio for over-runs and under-runs with the contractor.

The design phase involved a standard variable price contract. The Presenter commented that, "The design risk, how big was it? In fact, again, as we detailed the core issues we weren't quite sure. Many felt the design risk was particularly high because Transfield, who put forward the proposal, hadn't actually carried out a warship design from a clean sheet of paper. But we looked at the record. They had produced the Australian FFG frigates from a build to print type process; they moved onto the ANZACS involving ... a lot more detailed design with new systems and their integrations, so indeed the OPC was the next logical step. In fact, what has been set up now with Transfield is that (with) all the major elements that they don't have experience in, they will have those elements of the design verified by an international agency. For instance: an agency based in the Netherlands will carry out tank testing, and international classification societies will look at their calculations. That is another way both the company and the Commonwealth have looked forward to see how risks could be managed".

Intellectual Property

Intellectual property is frequently a problem and issues usually centre around getting a balance between ownership and access, however, policy now seems less preoccupied with ownership and oriented more towards access. A key requirement for the OPC was to work out what would happen in the case of the design being developed, the competition opening up and Transfield losing the Malaysian competition. How would the intellectual property be used 'downstream'? The other issue posed was that the OPC was all very much part of Malaysia's industrialisation, and would Malaysia automatically get ownership of the intellectual property? These kinds of issues should be identified very early in projects and resolved before going to contract.

Pointers

- Set some sort of 'boundary' around the project when dealing with high levels of uncertainty and demanding time constraints. Start with the basic common requirement; work out what you can or can't do at each stage and move onto the things that can be tackled initially. A better picture of project criteria and constraints will be built up as things unfold.
- Expose senior management to core issues and project risks at an early date.
- Consider use of a cost cap in the approval process to enforce discipline and assist in making cost/capability tradeoffs. Make cost/capability trade-offs for some of the less important elements of the project after having established the basic common requirement.
- Design and construction by the same company in 'Fast Tracked' projects often saves time and helps to clearly define lines of responsibility.
- Prove that a high level of prime contract value is likely to be contracted out locally to assist in getting sole sourcing approval.
- Insist on a high level of cost visibility for contractor activities if sole sourcing. High visibility should be a basic element of moving forward to contract, in fact, accepting a sole source for major projects should involve gaining full visibility of the contractor's costs and selection processes for suppliers and sub-contractors.
- Develop a comprehensive commercial profile for your contractor to assist in assessing risks. If the contractor has not undertaken a project of your kind before, carefully look at the track record. Establish the contactor's current capability baseline and what it developed from. Then decide if a quantum or marginal extension of capability is called for.
- Verify all major elements of design that the contractor does not have experience in. Verification should be done by at least one international agency, moreover, calculations should be confirmed by a classification society.
- Resolve intellectual property issues early. Emphasise access rather than ownership.

PROJECT CASE STUDY 2:
The Steyr Rifle

Buying a weapon 'off the shelf' may seem simple enough, but modifying and producing an overseas weapon design for Australian conditions involves risk: Avoid 're-engineering' the unit you selected; test and evaluate your product as you would a prototype and train your users properly.

The Australian Army's Small Arms Replacement Project (SARP) aimed to introduce a new family of small arms and ammunition into the Australian Defence Force (ADF). The 'Steyr Family' of weapons is manufactured in Australia by Australian Defence Industries (ADI) under license to European designs.

Sixty seven thousand 'Austeyr' F88 rifles were scheduled to be produced under license from the Austrian manufacturer, Steyr Mannlicher, as well as several thousand F89 MINIMI Light Support Weapons (machine guns) made under licence from the Belgian manufacturer, FNNH. However, in 1995 the Australian National Audit Office (ANAO) found that the premium paid for locally made Steyr rifles was an example of defence contracts which were not cost effective for the Commonwealth. The ANAO found that unit production cost of the Australian rifle was 79 per cent higher than that of the imported rifle. This was more than twice the originally estimated 36 per cent premium the Commonwealth was prepared to pay for local manufacture to maintain an Australian small arms manufacturing capability. The Defence Department argued that the high premium included ancillaries, Australian industry involvement and contingency. Nevertheless, the ANAO considered these elements part of the weapon's unit cost which would not have been incurred had the weapons been imported, arguing that these costs should have been transparent so they could be compared with potential benefits at the outset.

Production Trials

From 1982 to 1985 extensive Australian weapon and ammunition trials saw the selection of the Steyr as the ADF's preferred individual weapon. However, extensive problems were involved in transferring the technical data package from Austria to Australia. For example, while ammunition is based on NATO Standard SS109 type 5.56 x 45mm ammunition, it ended up being made in Australia to a totally different pattern. According to the Presenter, "It is a very simple bullet. There are only six parts in a bullet: the gilding case, the lead (core), a bit of steel, some propellent, a case and a primer. None of these parts move until you pull the trigger. Very simple. (However) we made over 400 changes to that bullet!" These changes included Technical Variation Authorities, Engineering Change Proposals, Production Permits and Production Concessions.

Overall, more than a thousand pattern (design) change requests were made during the project. One thousand temporary variation authorities, concessions and permits were issued on the rifle. Nevertheless, the Presenter remarked that, "Despite all that we failed to do adequate production trials. We failed to prove that this rifle (Austeyr) was as good as, in fact better than, the (Austrian) rifle we trialed. This was a significant mistake and reliability problems were encountered very early in the project. In fact, the problem was so significant that after production of the first 5,000 weapons, Army refused to take any more until the quality of the weapon could be proven. (This) led to a six month break while the manufacturer improved quality ... but despite this we still didn't do adequate proof (quality) trials. We didn't really test it to say *'Yes, this weapon satisfies our requirements'*. The result was that the rifle remained under a cloud for a number of years and the maintenance staff, the guys who handle it all the time, were never really quite satisfied. And, in fact, the Maintenance Engineering Agency said that when they did a reliability and maintainability study, the weapon had an unsatisfactory mean rounds between stoppages figure compared with the specification". Between 15,000 and 20,000 thousand weapons had entered service at this time and the weapon enjoyed a poor reputation. Consequently, a thorough evaluation of the weapon was needed.

Verifying Quality

In June 1993 a three phase, comprehensive evaluation program commenced. This involved random selection of 400 weapons from the 12,000 then in store at Moorebank in Sydney. These weapons were subjected to the following tests:

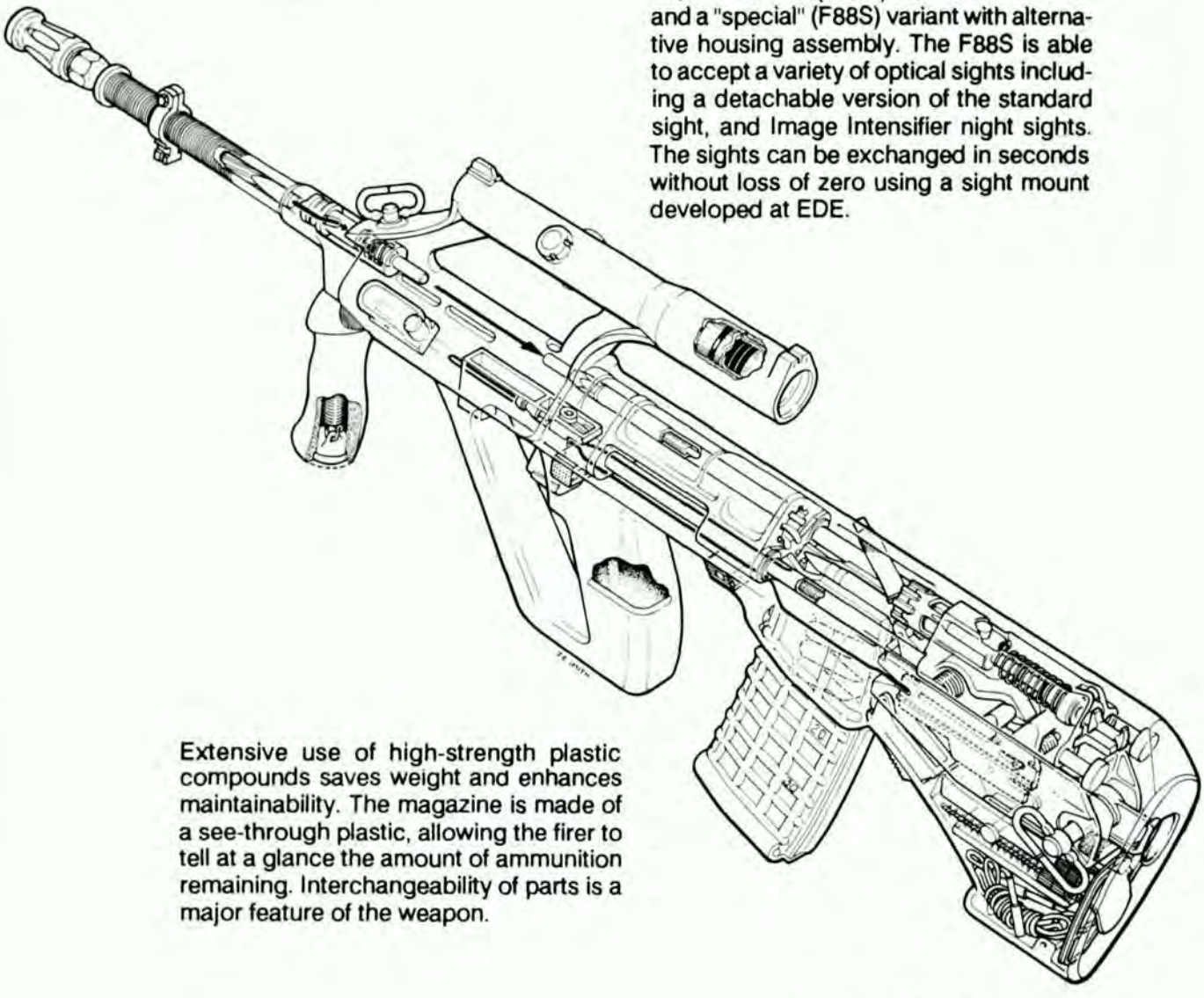
- Visual inspection of the whole sample of 400 for obvious defects.
- 40 consecutive rounds were fired through 40 rifles (10 per cent of sample) as defined in the specification. All passed.
- 6,000 rounds were then fired through each of ten weapons selected from 1992-93 manufacture to objectively quantify the mean rounds between stoppage. The mean rounds between stoppage was estimated as approximately 3000, which far exceeded the specification of 500.
- Weapons were sent to the Engineering Development Establishment (EDE) for dismantling to precisely ascertain performance against specification dimensions for thickness of the chrome in the barrel (about 10 microns), hardness of the steel, clarity

THE F88 STEYR SYSTEM

The Steyr immediately draws attention to itself because of it's appearance. It is a select-fire assault rifle in "bull-pup" configuration. This arrangement uses the buttstock to house the bulk of the moving parts and thus facilitates an extremely compact design. It does mean that the weapon must be converted for left handed firers: this is facilitated by exchange of the bolt-head and use of the left-hand ejection port.

The 1.5 x magnification optical sight is extremely rugged, and allows rapid target acquisition and engagement. Unlike iron sights, the optical sight means the firer's vision has only to focus at one point - the target. Emergency open sights are incorporated as part of the sight tube.

The F88 is to be issued in three variants: the standard rifle with 508mm length barrel, the carbine (F88C) with 407mm barrel and a "special" (F88S) variant with alternative housing assembly. The F88S is able to accept a variety of optical sights including a detachable version of the standard sight, and Image Intensifier night sights. The sights can be exchanged in seconds without loss of zero using a sight mount developed at EDE.



Extensive use of high-strength plastic compounds saves weight and enhances maintainability. The magazine is made of a see-through plastic, allowing the firer to tell at a glance the amount of ammunition remaining. Interchangeability of parts is a major feature of the weapon.

STEYR F88 RIFLE

of the optics, absorption rates of the plastic etc. All weapons ended up conforming to specification.

Therefore, hard quantitative data became available, but schedule and budget were affected. The Presenter remarked that, "My point is this: that testing cost me a lot of time; it has cost me a lot of money; it has cost the contractor a fair amount of money too. The (comprehensive) testing should have been done in 1988 or 1990; not in 1993 when we received and accepted into service over half our weapons". As a result of this lesson the approach to accepting the light machine gun version of the Austeyr (F89 MINIMI LSW) was changed. The Army was due to accept another 5,000 units but they were not to be accepted until a rigorous first article inspection had been done. This was to involve firing 50,000 to 100,000 rounds through a significant number of the batch.

User Training

The Austeyr is fundamentally different to the Self Loading Rifle (SLR) that it replaced. It is shorter and its magazine is located behind the trigger and cannot be easily seen in the firing position. The safety catch is different both in style and in method of operation. It is capable of fully automatic fire and takes a smaller bullet. However, initial user training was inadequate.

The initial SARP Training Team comprised a Captain and five instructors attached to the Infantry Centre at Singleton, NSW. The team was charged with visiting units to train NCOs in advance of the rifle arriving. The NCOs would then become unit trainers who would in turn train the soldiers. A four and a half day conversion course was programmed, but this was shortened in some cases to half a day. The Presenter commented that, "A lot of soldiers did no training on this rifle at all. And, in addition ... there were a lot of slips in the project. In a number of instances the rifle arrived in units months after the trainers had been trained and posted. So, this led to a situation where soldiers were not being given this four and a half day course".

Subsequently, a high rate of UDs (unauthorised or negligent discharges) occurred, and a soldier was killed in South Australia through an accidental discharge. According to the Presenter, "It really came to a head when we sent the First Battalion, Royal Australian Regiment to Somalia in 1993. This was a crack unit; this was our Operational Deployment Force. These were all professional soldiers; they were all well trained; they'd all had this rifle for over 12 months and in the first 6 weeks they had 26 unauthorised discharges, another soldier (was killed), I asked far and wide how do we solve the problem? The way we solved the problem was to have the Deputy Chief of the General Staff issue an 'edict' saying that (without) a four and a half day training course on this weapon you will not fire it. And this was taken very seriously".

The Presenter added that, "We revised our unload drills and reinstituted the SARP Training Team which, unfortunately, because the project was so far on, had stopped visiting units and training the trainers. A public relations campaign in the Army newspapers started with a two and half page spread. We arranged for the Director of Occupational Health and Safety to issue training wall charts and brochures, and we spent a fair bit of money making a 10 minute safety awareness training video. I am pleased to report in the last twelve months the instances of unauthorised discharges have dropped quite significantly". He continued, "My point is: there is a lesson here for all of us regarding training. Each and every one of us is introducing something into service, be it a submarine, be it an air-to-air refuelling tanker, be it a pair of boots or a rifle; if we don't ensure that our user or operator is well trained we will never get the best results from our equipment. Secondly, the user will quickly lose confidence in his equipment as happened with my rifle, and in the worst case we are going to kill him".

Project Staffing

The SARP project was not fully manned until 1990. However, by 1992, as a result of response to the 1991 Force Structure Review, two of the six project staff were lost. One of the positions lost was that of Logistics Support Officer at a stage when there were only 14,000 weapons in service out of 75,000. Consequently, much of the Integrated Logistics Support work was continually deferred. According to the Presenter, "The issue sequence went right off the rails; that's why I had 12,000 weapons at Moorebank last year (1993). They weren't being issued. I was making them; ADI was making them, but no-one was issuing them. Why? No ILS officer! You don't take a 25 percent cut in your man-power and necessarily survive".

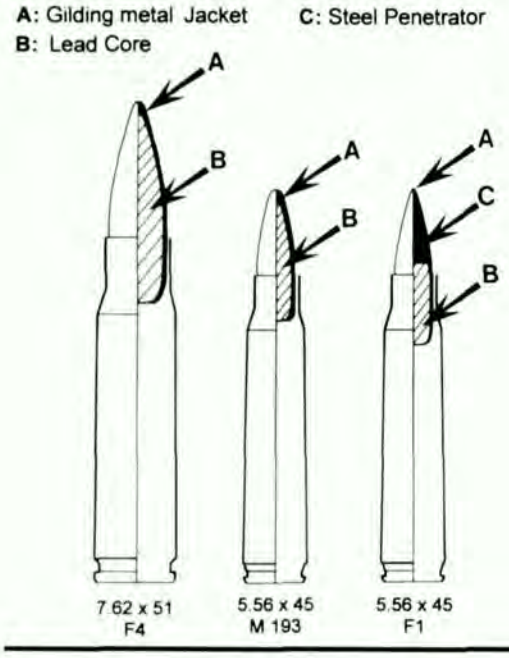
After one year the logistics support officer billet was returned following strong representation of the damage done to project cost and schedule. The Presenter added that, "Most ILS got back on track, but the point I draw your attention to is getting the man-power 'up front'. What I'm saying is we didn't have it up front. That was bad enough; we then lost it towards the tail (end of the project) and that doesn't work. Don't surrender any of your staff until you're sure you can manage your project with less staff. I didn't fight it hard enough when it happened to me".

Relations with Contractors

The Presenter also advised managers to, "Work with your contractor, not against him. I see any number of project directors or project managers who, I'm sure, have one aim in life: to bankrupt their contractor! It doesn't work. You've got to work with him, that's why I'm pleased to see this partnering idea come in. (But always bear in mind) he's in it for a profit and will try and pull the wool over your eyes, so yes, you've got to work with him, but at the same time keep him at arms length and bear in mind his ultimate aim is to make a profit".

Pointers

- Avoid changing specifications. For each change proposal focus on marginal performance increase for cost and take pains to work out the compounding effects of changes on a net effect on total performance basis.
- Inform the Commonwealth of the premium it will have to pay for local manufacture to maintain Australian capabilities. Include ancillaries, Australian Industry Involvement and contingency in a unit price which can be compared to an import unit price, so relative costs can be compared with potential benefits.
- Get adequate staffing 'up front' and keep it. Avoid being rushed into decisions and actions, and fight hard against surrendering any staff until you are sure you can manage the project with less. Compile and date a 'hurt' statement which comprehensively details cost/schedule/performance variations likely to result from losing staff.
- Save time and money in the long term by conducting systematic, statistically valid production trials. Properly conducted evaluation tests and trials will cost time and money in the short term, but are essential in proving that the end user is getting what he or she needs. By all means, trial products in other countries, but do not underestimate the importance of conducting comprehensive validations and production trials in Australia under Australian field conditions. This is especially the case when substantial pattern /configurational changes have taken place in components and systems produced in Australia.
- Build the end user's confidence. Ensure that the operator is well trained, otherwise he or she will never get the best results from the new equipment. If not adequately familiarised with the equipment the user will quickly lose confidence in it, consequently, make extensive use of mobile training teams (where appropriate), training videos, wall charts and inserts in service/departmental news papers and professional journals.
- Ensure that equipment training courses are developed, documented, quality controlled and validated, especially if mobile training teams are being used. Build these (substantial) costs into the ILS budget.
- Work with contractors, not against them. Bear in mind the contractor's ultimate aim is to make a profit and he or she will be tempted to take short cuts if profit margins are unreasonable.



From L to R: SLR, M16 and Austeyr cartridges. Over 400 changes were made to produce the standard F1 Ball cartridge for the Austeyr.

PROJECT CASE STUDY 3: The Collins Class Submarine

A Major Capital Procurement project deep into its implementation phase. This project highlights the critical importance of producing a comprehensive Statement of Requirements and Project Definition Study (PDS). It also illustrates the advantages of having a single prime contract for design and production arising from the PDS and the benefits of developing competitive pressures between tenderers right up to contract signature.

The New Submarine Project Office was created in 1982 to plan the acquisition of six submarines to replace the Oberon Class by the turn of the century. Project cost was of the order of $A3.9 billion at 1986 base date prices, and Australian industry involvement was to be maximised in terms of local construction and provision of through life support, without paying large cost penalties.

Project Staffing and Organisational Challenges

Staffing of defence projects has always had its problems, some of which are restrictions associated with public service regulations and staffing ceilings. On this issue the Presenter suggested that, "... (in this environment) not only is it hard to get good managers and keep them, but it's extremely difficult to restructure project organisations to meet changing demands of the different phases of a project. The only solution I can see to this problem is to perhaps establish the Materiel divisions as pools of personnel who can be posted in and out of projects as required, rather than having fixed establishments for each project". However, in the case of the submarine project a strong, centralised project team independent of resources from elsewhere was established within the Department. Without such a team and the authority to make decisions on all technical matters, the project director would probably have found it extremely difficult to provide the positive control that is essential to the success of a project of this magnitude.

Competitive Tendering

The first step in the procurement process was development of a Statement of Requirements (SOR), that is, the required ship characteristics expressed purely in capability and performance terms, and in May 1983 a request for tender to conduct a Project Definition Study (PDS) was issued to seven potential submarine suppliers and five combat system suppliers around the world. The aim was to select two platform and two combat system suppliers to undertake a detailed PDS. The successful tenderers were announced in 1985, together with the decision that all the submarines were to be built and supported in Australia. Contracts were then placed with two platform designers who were both required to develop offers with two nominated combat system suppliers.

The Project Definition Study was considered critical to the success of the project because, when coupled with the evaluation and negotiation period that followed, it was essentially the first phase of a very complex design process.

The PDS set objectives and ultimately defined the contract baseline by specifying the submarine, establishing the management arrangements for the production contract, defining the Australian Industry Involvement(AII) program, and specifying Integrated Logistics Support (ILS) requirements.

Contractor involvement in the PDS

The submarine project's strategy was to negotiate with both contractors to refine the specification and final terms and conditions, right up until the successful bidder was announced. To take this strategy to the limit, one could retain two contractors throughout the detailed design phase and possibly into production of a prototype. However, this was not practical for something as complex and expensive as submarine construction. Nevertheless, it may be the most appropriate strategy for projects involving less developmental effort. Another element of the project strategy was to minimise change to specifications – partly to control cost – but primarily to enable the contractors to get on with the design without the major distraction of processing contract amendments. Even a limited number of changes tends to divert substantial management effort with a complex platform like a submarine.

The Presenter commented that, "I cannot overstress the importance of the PDS being conducted by the contractor who is to undertake the detailed design and construction. The PDS is more than just a specification development phase. It is the critical period during which both the contractor and the customer reach as good a common understanding as possible of the requirement. I certainly disagree with those who argue that the PDS should be conducted and the final specification developed by other than the eventual contractor in the belief that the eventual contractor may gain some advantage by having developed documentation. A further important factor in the development of a good understanding of the requirement and a good preliminary design was the decision to locate a small RAN team at each of the four PDS contractors' premises. These teams provided advice and guidance only; not direction, leaving the contrac-

tors free to make their own commercial judgements relative to the final product ... Whilst it is important to have a comprehensive PDS conducted by the final prime contractor, it is also important to retain competition until the final production contract is let".

Contract

The outcome of the Project Definition Study and subsequent source selection/contract negotiation process was that a 'turn key' contract for construction of six submarines was awarded to the Australian Submarine Corporation (ASC) in June 1987. Rockwell Systems Australia was nominated as the combat system contractor. The fixed price contract to the ASC was worth approximately $3.7 billion and is now largely variable price. There were some provisionally priced packages covering those activities whose scope was not able to be fully defined during the PDS, and the gradual conversion of these packages to variable prices has been a time consuming and costly process. It may have been better to extend the PDS phase to enable more of those packages to be agreed in a more competitive environment.

According to the Presenter, "The basis of the contract is the performance specification developed during the PDS. It has proved to be an excellent document, enabling the detailed design to proceed with minimal change, and has resulted in a product which, it appears to us, will exceed our expectations. I believe the two major factors in the success of the project to date are the competitive PDS phase and the award of a single prime contract for design and production arising from that PDS. However, to realise the benefits of a prime contractor working to a performance specification, it is necessary to let him get on with the job and to provide a clear, single point of contact within the Department".

Contract Administration

The Presenter emphasised a number of points concerning contract administration, "First, profit: Project success is dependent on the contract making a fair and reasonable profit. If a profit is not being made, the contractor's project manager will be under pressure to find quick and easy solutions, and will therefore pay very little attention to your real requirements. Secondly, it's important to retain a sense of perspective. It's all too easy to argue ad-infinitum over the cost of small but critical packages of work, especially when they haven't been agreed before contract signature and you are trying to firm them up. Doing so (arguing) can distract the management on both sides and place the entire program at risk. A project director must have the foresight and the authority to make sound commercial judgements in the context of the entire project ... Project management (also) involves compromise. It's important to seek solutions that are in the interests of both parties – rather than insisting on solutions that are entirely to the customer's benefit and to the contractor's disadvantage".

In order to measure contract progress and to manage payments, a Contract Monitoring and Control System (CMAC) was developed specifically for the submarine project. It proved useful and has enabled measurement of progress and budget as well as identification of potential problem areas, with the possible exception of software. While an effective schedule, cost and progress monitoring tool is essential, it is also important that the tool not be unduly restrictive on the contractor. It must allow him the flexibility to manage the project as he sees fit, given that the objective is to monitor project progress, and not to 'tell him how to do the job'.

The Presenter also emphasised that, "... particularly in the early stages of the contract we relied heavily on project teams resident at the various subcontractor's premises. These teams, which were carefully briefed, made a significant contribution to clarifying RAN requirements, providing advice, validating CMAC claims and improving communications. The last point was particularly important. Given our many overseas contractors and the inevitable language and cultural differences, we found that we could easily get into problems and misunderstandings arising from poor communications – It's amazing how differently sub-contractors operating from seven different countries can perceive problems. We now have teams at the construction facility in Adelaide and (at) the major combat system software sub-contractor's premises".

Australian Industry Involvement

The Presenter believed that the project, "... realised many unforeseen benefits from the very extensive and successful Australian Industry Involvement (AII) program. Bringing Australian contractors up to the required quality standards and achieving the necessary technology transfer was initially viewed as a significant project risk. (However) in practice we have found that Australian industry has responded extremely well and that the availability in Australia of system and equipment expertise is a significant factor in containing overall program risk. There is no doubt in my mind that any premium we paid in the contract to realise the specified very high levels of AII was well worth while, and will be recovered many times over throughout the life of the Class".

Monitoring and Assuring Quality

From the outset, the submarine project placed great importance on Quality Assurance (QA) and, as mentioned, a dedicated project QA team was established to regulate the QA requirements of the contract. The

Presenter added that, "Quality and progress monitoring efforts could perhaps have been integrated, rather than being treated as separate functions. It's (also) important to remember that if in monitoring the product it is found to be compliant, but you do not like the product as it's being developed, there is no choice but to amend the contract to change or clarify the requirement. Any attempt by project staff to persuade the contractor staff to make changes 'under the counter' will invariably lead to claims in the event of the program getting into trouble. If it's worth changing, it's worth changing properly and up front".

Integrated Logistic Support

The submarine project was unable to get agreement on a firm scope of work and price for ILS before contract signature, and this led to protracted negotiations and a sometimes difficult working relationship with the contractor.

In-Service Support

For large projects, early development of a comprehensive, activity based cost model for in service support is essential.

Government Furnished Equipment (GFE)

Another important factor was taking an early decision to minimise the amount of Government Furnished Equipment. GFE has historically been a problem area in defence contracts, and even the limited quantity included in the submarine construction contract demanded considerable management effort. It was considered a wise decision that only equipment that could not be procured by the contractor should be provided as GFE, even if it were already in the inventory.

Software Issues

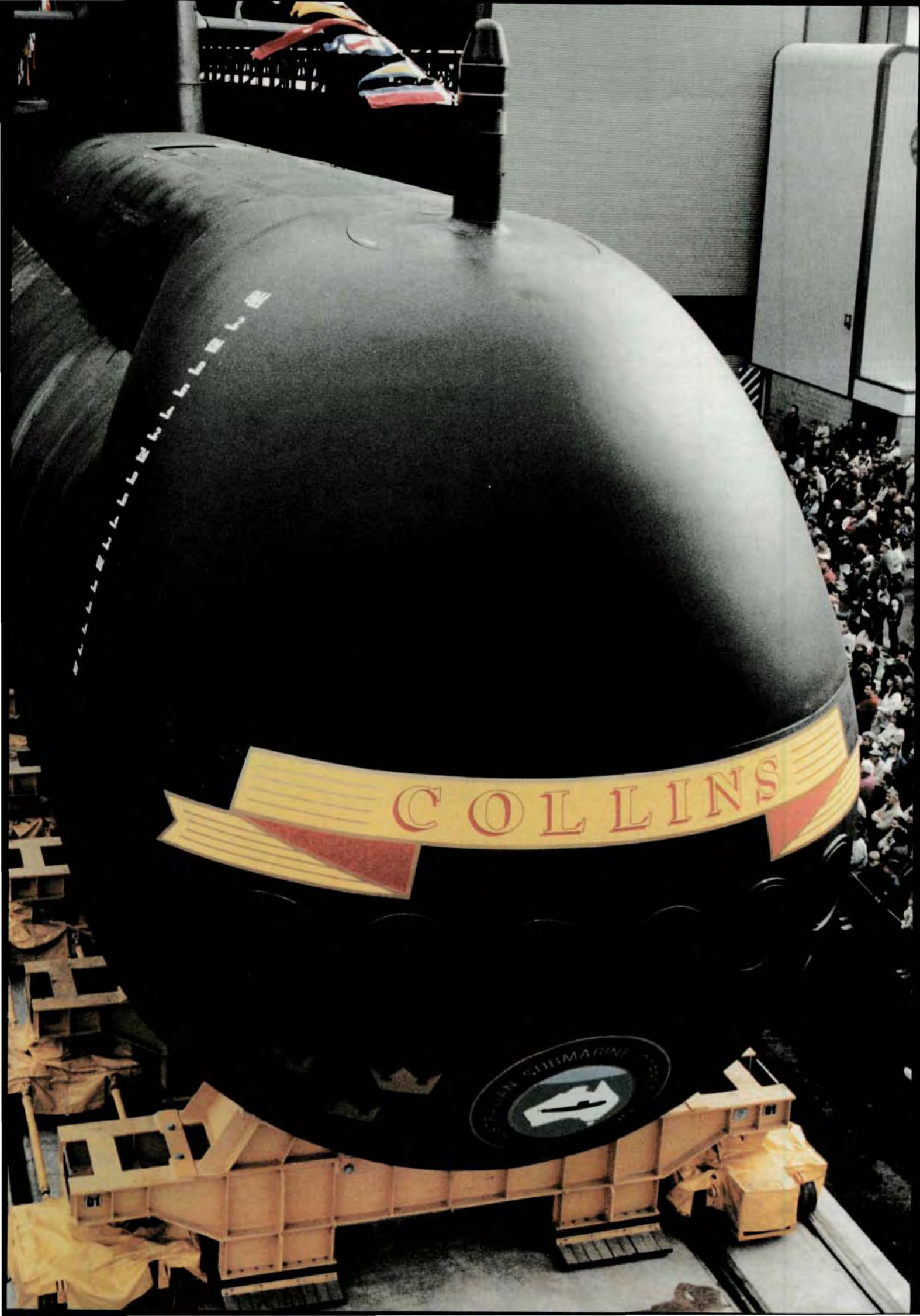
It was well known that the submarine project had encountered substantial software problems, and a member of the audience asked the Presenter the following question, ".... with the Collins Class submarine and the obviously large software component of the combat system, what have we learned about managing a project with large software components? Now, if you are sitting down with a tabulariser at the start of the project, how would you rewrite your contract requirements to make the contractor manage the software component more effectively?"

The Presenter responded that, "I don't believe anyone in the world has cracked this problem. At the risk of being accused of doing too much overseas travel, we've spoken to submarine projects and major navy projects around the world. They have all suffered this problem – from the USN program, to the French Navy's latest submarine. Mind you, that's no excuse, and looking back I'd say that the biggest lesson we've learnt is to firstly get the specification right – the requirements right. I believe we did that. Secondly to agree with the contractor and mandate a development process, and having both agreed it – to make sure he sticks to it. Early on in our development the cry from the sub-contractors was: 'That's standing in our way; don't quality audit us on that. The process isn't really right; we'll just come up with another process'. That, to my mind, is not acceptable and comes back to the quality point I was making. It's important to quality audit so that the design process is being followed. Quality isn't just about construction and production, it's also about design. Mandate the design process and ensure that it is quality assured and being followed. If the contractor doesn't like it, it's up to the contractor to say, 'I want to change the contract'. We were perhaps too easy in that regard ... I believe a few years ago (and it was one of the problems we had) the quality processes, or the design development processes for software, weren't good. I think they're getting better, and I think you can do that now with more confidence".

Pointers

The two major success generators in the submarine project were the competitive, comprehensive Project Definition Study (PDS) Phase, and the award of a single prime contract for design and production arising from that PDS. Key PDS outputs were an agreed preliminary design, and an agreed process by which the detailed design was to be completed. Important pointers are to:

- Get the specifications right. This is most important, because even a limited number of changes after contract agreement causes a disproportionate management effort . Therefore, spend all the time and money necessary on a comprehensive PDS that enables the detailed design to proceed with minimal change. Good project strategy incorporates minimising change to specifications, partly to control cost, but primarily to enable contractors to get on with the design without the major distraction of processing contract amendments.
- Optimise competitiveness and achieve 'redundancy' by retaining two or more contractors throughout the detailed design phase and possibly even into production of a prototype (for projects involving less developmental effort). The submarine project's strategy was to negotiate with both contractors to refine the specifications and final terms and conditions right up until the successful bidder was announced.
- Ensure that the Project Definition Study


COLLINS

(PDS) is conducted by the contractor who is to undertake detailed design and construction. The PDS is far more than just a specification development phase. It embraces the critical period during which both the contractor and the customer reach as good a common understanding as possible of the requirement. Nevertheless, while it is important to have a PDS conducted by the final prime contractor, it is also important to retain competition until the final production contract is let.

- Realise the full benefit of a prime contractor working to a performance specification and let him or her get on with the job.
- Provide a clear, single point of contact for contractors. A strong, centralised project team independent of resources from elsewhere was established within the Department. Without such a team and the authority to make decisions on technical matters, successive project directors would have found it difficult to exercise the positive control needed for high risk projects.
- Locate small project representative teams at PDS contractor's premises to develop understanding of requirements and promote a good preliminary design. These teams/representatives should provide advice and guidance only; not direction.
- Consider transition into service early in the project, and develop a comprehensive, activity based cost model for in service support.
- Consider minimising the amount of Government Furnished Equipment (GFE) – which has historically been a problem area in defence contracts – and only use that which cannot be procured by the contractor, even if it is already in the inventory!
- Tailor a monitoring and control system for your project to measure contract progress and manage payments. However, while an effective schedule, cost and progress monitoring tool is essential, it is also important that the tool not be unduly restrictive on the contractor. It must allow him the flexibility to manage the project as he sees fit, given that the objective is to monitor project progress; not to 'tell him how to do the job'.
- Integrate quality and progress monitoring efforts as much as possible, rather than treating them as separate functions. If in monitoring the product it is found to be compliant, but you do not like the way it is developing, then there is no choice but to amend the contract to change or clarify the requirements. Also, remember that 'Quality' is not just about construction and production; it is also about design. Agree with the contractor and mandate a development process and, having both agreed to it, make sure he or she sticks to it by having it quality assured.
- Discourage attempts to persuade the contractor's staff to make 'under the counter' changes which will lead to claims if the program gets into trouble.
- Restructure the project organisation to meet changing demands at different project phases.
- Use Australian industry. Generally, industry proved it could respond very well in terms of system and equipment expertise during the submarine project.

PROJECT CASE STUDY 4: The B707 Tanker Project: An Air-to-Air Refueller Conversion

Converting and modifying major platforms demands a build up of 'in house' technical and operational experience even if substantial 'up front' cost in time and money is needed. This promotes unambiguous specifications and solid RFTs, which lead to better contracts and fewer nightmares in contract administration.

An Air-to-Air Refuelling (AAR) capability was endorsed by the 1987 White Paper to enhance the effectiveness of the four squadrons of FA-18 aircraft which form the backbone of Australia's air defence capability. The FA-18 has an unrefuelled combat radius of approximately 450-600 nautical miles (depending on Attack or Fighter mission) and an in-flight refuelling capability would assist in the long range, 'sea air gap' operations which form the cornerstone of Australia's military strategy of Defence in Depth.

The version of the FA-18 supplied to Australia has an air-to-air refuelling probe fitted, and this project provided an opportunity to make use of the inbuilt capability. However, purchase of an 'off the shelf' tanker was not seriously contemplated for reasons of cost, and the B707 aircraft was selected mainly because Australia had two aircraft already in the RAAF inventory. Moreover, while the B707 is an 'old technology aircraft' it remains an extremely capable and reliable platform.

Technical and Operational Challenges

The fundamental problem for the RAAF at the beginning of the project was that operational experience of AAR was very limited. Depot level maintenance on the B707 transport aircraft was undertaken by Qantas, and this left little 'in house' B707 engineering expertise in the RAAF. There was also a requirement for maximum Australian Industry Involvement, but Australian industry experience in air-to-air refuelling systems was extremely limited. To gain the necessary background information in AAR, the RAAF had relied heavily upon advice from the RAF, the USAF and the Air Refuelling Standards Advisory Group (ARSAG) meetings. The ARSAG is a major international air refuelling symposium organisation which sets international world standards for safety in air-to-air refuelling.

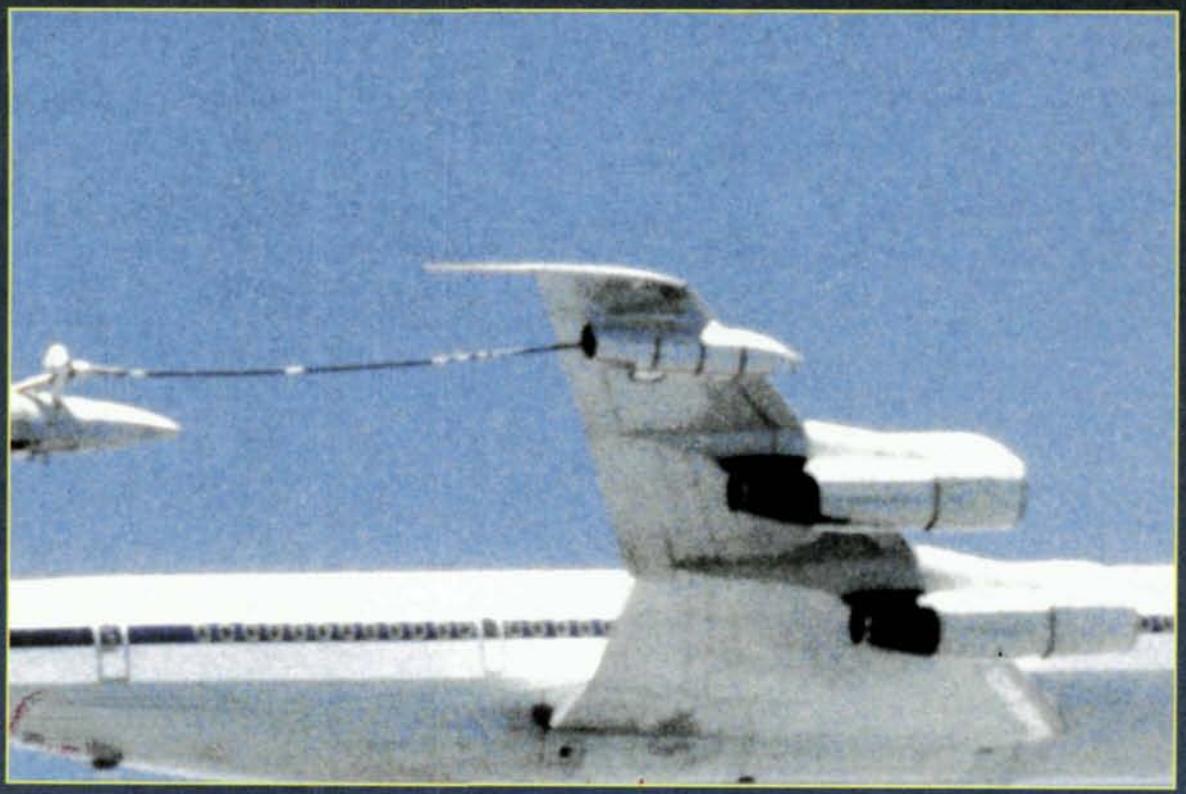
The main technical challenges of the project were:

- major modification to the aircraft fuel system, including placement of two additional hydraulic systems, mainly to provide redundancy in the case of failure of the primary aircraft fuel system;
- fitting the Air-to-Air refuelling pylon and pod;
- structural reinforcement arising from the AAR pods having to be placed on the end of each wing;
- installing a TV monitoring system with day/night capability to see what was happening behind the aircraft during refuels;
- fitting an internal intercom system and additional lighting so that pilots could locate and reference the tanker at night; and
- fitting a substantial avionics package to support the AAR role.

Operationally, a lack of in country pilot experience in AAR operations was a major problem, and the following comments made by the Presenter summarised the main problem: "This was a totally new concept for the RAAF and in terms of manpower on the ground we had, for example, very limited experience from the point of view of receiver pilots (also) we had no qualified test pilot for the B707 at the start of the project. We had a qualified, AAR experienced FA-18 test pilot at the beginning of the project and he remained with us until within about four months of the start of the flight test program. Unfortunately, at that particular point he decided he preferred to be flying 747s for Cathay Pacific and a replacement had to be found and trained in very quick time". From a technical and specification point of view, the Presenter remarked the project was, "... a bit like Noah's Ark. I mean, everybody knows what Noah's Ark is. It was 300 cubits long. It was 50 cubits wide; it was 30 cubits high. Noah was obviously the only person who would accept a spec like that! The thing had to be covered in pitch inside and out but there was no MILSPEC for the pitch, no process spec for it's application, no determination of how they were going to get the animals on – side by side or one behind each other? In such a situation the apparently easy alternative is the 'turn key' or industry solution, but with a turn key solution one of the problems is that the Department has to accept, to a very large extent, the total risk involved. For low risk projects, turn key options are acceptable, but when there is a developmental element, turn key solutions can be a bit of a trick. Relying too heavily on industry solutions can lead to difficulties".

Project Staffing

Starting a project understaffed should be avoided. The Tanker Project Office was undermanned from the start,



The B707 Tanker. This force multiplier can increase the "Legs" of aircraft to more effectively operate in the Sea-Air Gap. (RAAF Photo)

had little financial support and very little backup administration on the contract was available. The Presenter suggested that manning and resourcing requirements should be worked out early enough, and advised other project managers to "... get it (staffing) managed right to start with, and your life will be a lot easier".

Tendering and Contracting

A key lesson in this project was to make sure that specifications are realistic and accurate – that they are achievable and actually mean something. Essentially, the Request for Tender for the tanker project was ambiguous because it generally lacked detail and failed to specify particular requirements accurately enough. For example, the RFT required that the tanker deliver 400 gallons per minute at 50 psi +/- 5 psi. However, the FA-18 is unable to accept more than about 350 gallons per minute, either on the ground or in the air, and a rate of 400 gallons per minute is rarely achieved, even on the ground. Similar lack of detail existed in the areas of avionics and testing.

An inadequate RFT almost invariably leads to a difficult contract. The Tanker contract and specification suffered the same problem as the RFT – a failure to carefully specify the essential requirements. For example, a specific type of air-to-air refuelling pod was called for and the contractor responded with two existing, proven, in-service pods. However, there was a third pod (Mark 32-B) being developed as a British pod for the American KC10 Tanker program. The project assumed that, by the time of going to contract, this pod would have been flight proven, FAA certified and in-service. Unfortunately, the whole of the KC10 program came to a halt and by contract time the system was not proven. The problem for the contractor was that if he agreed to accept the Mark 32-B Pod in its unproven state and it encountered problems, he would be in major difficulty with possibly no way out. The moral is to avoid setting up a contract that leaves the contractor in a 'no get out' situation. In the event, what was negotiated for the tanker (far too late, according to the Presenter) during contract negotiations, was nine months of 'breathing space'. If at the end of that time the 32-B pod was not satisfactory, then the contractor could use one of the proven alternatives.

Poor contracts lead to many problems, and maintaining good working relations with the contractor is vital. The Presenter stressed that, "... comments like 'let's make the contractor perform; hold his feet to the fire', are counter productive. If we are going to hold the contractor and 'roast his feet', we've got to be prepared to take a fair bit of heat ourselves".

Design Review Process and Testing

Lack of detailed knowledge of the requirements also impacted on the design review process. Three stages are involved in this process: System Design Review (SDR), Preliminary Design Review (PDR) and Critical Design Review (CDR), and the process turned out to be a major learning experience for the RAAF. The Critical Design Review is the last stage in the process where finally the seal of approval is given to the contractor's design. Consequently, it is really too late a stage to change key design elements. Nevertheless, because the project team had not specified the design well enough, major changes were made at a late stage, for example, in the design of the avionics integration of the inertial navigation system. According to the Presenter, "We should have realised (these problems) at System Design Review time; even at PDR but not at CDR. It was too late (but) we got out of it with cooperation between ourselves and our contractors ... we managed to get the thing put right, but it was a lesson to be learned. We didn't get it right early enough and up front enough".

Another major difficulty was inadequate and restricted provision for testing and trials. Testing of any equipment in any contract is dependent on contractor cooperation, and deciding to increase testing after contract signature immediately increases the contractor's liability and risk; this will cost the project in terms of budget and schedule. Once again, a poor contract leads to many problems later.

Implications for other projects

Lessons in this case study could be helpful in other 'first off' projects, such as AEWC (Airborne Early Warning and Control Aircraft), Remotely Piloted Vehicles, and Night Vision Intensification Equipment. As the Presenter observed, "Everybody knows what (these things) are; we've all seen pictures of them; we've all read the glossy brochures; we've all read the Gulf (War) reports and so forth – unquestionably very sophisticated pieces of equipment, but maybe we haven't yet got enough experience of them. In the case of AEWC aircraft does anybody really, seriously, know enough about them to actually go out to tender? It could well be worth while going out and leasing an aircraft for a couple of years to find out what it's all about. Whichever way we do it, once we've got this corporate experience – which we didn't have with the Tanker project – then we will need to keep it. If this means selective postings of personnel within the Defence Department generally that is the way it is, and our career managers are going to have to live with this".

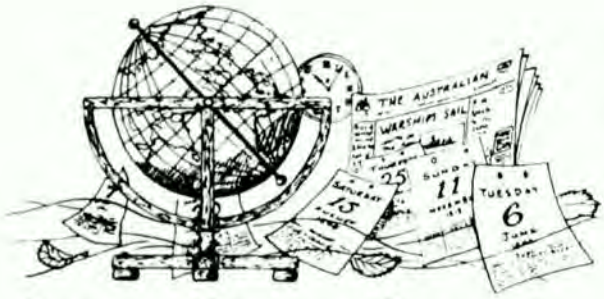
Pointers

The Tanker project was the first of its kind for the Air Force. The project worked out well in the end but key lessons were to:

- Develop a sound corporate experience base for the actual operation of the platform type. In the tanker case, leasing an overseas setup for a familiarisation period was probably a good way to go. Alternatively, sending a team overseas to work in the AAR field would have improved corporate knowledge. Making sure enough personnel were sent to ensure redundancy would be important; an investment of three to six months in this way would probably have had a disproportionately good effect on the project.
- Identify potentially valuable sources of 'local' knowledge and experience. These may exist in other Services or outside the Department. Apparently no effort was made to take advantage of former RAN A4 Skyhawk pilot experience of air-to-air refuelling in both the receiver and refueller roles. This was a potentially valuable source of 'local knowledge'.
- Beware of relying too heavily on industry solutions. 'Turn key' approaches can lead to difficulties, particularly when substantial developmental work is involved.
- Make sure that specifications actually mean something, that is, that they are accurate and achievable.
- Spend whatever time and resources it takes to develop a first rate RFT. An inadequate RFT usually leads to a poorly designed contract and avoidable difficulties in administration. The Tanker contract and specifications suffered the same problem as the RFT – a failure to carefully specify the essential requirements.
- Maintain good working relations with the contractor. Poor contracts lead to many problems and good communications are vital in overcoming these difficulties. Also, be alert to the need to facilitate communications between prime and sub contractors if difficulties arise in these relationships.
- Make adequate provision for testing and trials in the contract.
- Decide on and ensure sufficient manning and resource levels from the outset. Starting a project understaffed must be avoided.

A4 Skyhawk — Note the refuelling probe

ADI Limited's chairman, Mr Russell Eynmore, addresses guests at the official opening of ADI's minehunter construction facility in Newcastle. The facility was officially opened by Minister for Defence, Senator Robert Ray.



I was there when...

Cyprus Patrol Incident

October 1959. Instances of violence between Greeks and Turks in the island of Cyprus were beginning to decrease. There was talk in the air of a negotiated peace settlement, and of independence for the troubled colony. Nevertheless, British troops kept tight control ashore, while the Royal Navy maintained an unrelenting patrol to stop gunrunners and illegal entry.

This story starts with a British destroyer steaming purposefully towards the end of her four day patrol . . . 30 minutes, 6 miles, to go. Then, off the run for a precious 2 days' stand-down: a sports carnival with the Royal Welsh Fusiliers in the local garrison; jolly picnics with the staff of the British Army hospital; sailing, swimming, skindiving and general gaiety. Throughout the ship the atmosphere was buoyant, cheerful, full of anticipation. Then – crunch! An immediate signal from Commodore, Cyprus: 'Army reports darkened ship grid reference 123456 course East, speed medium.' Proceed with all despatch and investigate.' When the position was plotted, it turned out to be 3 hours' steaming away. So 'hard a port, ring on 25 knots, boarding party will be required at 0030' –and so much for our cherished hopes. Never mind, at least we could finish off the patrol with a swift arrest, made possible by smooth Army/Navy co-operation.

My first inkling that all was not well came when I awoke from a doze in a wardroom chair at 0045. Seeing the assortment of gaiters, pouches, pistols and webbing hanging on me reminded me that I was in charge of the boarding party and that we should have been ready fifteen minutes ago. I got the rest of the party mustered and also checked on the seaboats crew and lowerers of the watch on deck, then went up to the bridge, trying to show a proper mixture of nonchalance and efficiency. Going to the bridge was a mistake; the Captain was berserk because the suspected vessel couldn't be found, the boarding party wasn't ready and he was missing his run ashore. I cowered in a dark corner.

Just then a small radar contact was detected five miles away–nothing visual on the bearing therefore it *must* be a darkened smuggler. With some feeling of relief we started the usual routine i.e., creep up on him, darkened and silent, drop the seaboat, illuminate with the 20 inch signal projector, cover him with the 40mm, then board and search. With the confidence born of experience, tradition, training and familiarity we slipped into the drill.

'Away boarding party.' We, and the Turkish Cypriot policeman, clambered into the seaboat; quiet, efficient orders from the bridge; quiet oaths as people stubbed their toes, ran into each other and tripped over their weapons in the pitch black night. 'Lower the seaboat to the waterline.' I noticed that we were suspended some five feet above the waterline but, before I could comment, the First Lieutenant staggered onto the upper deck yawning and rubbing his eyes, took in the darkened scene on instinct and ordered 'Slip'. Down, down, down we fell before hitting the sea with a wallop then shearing away on our errand, our helmets knocked off and bones jarred by the impact. When we were 50 yards away, the Petty Officer noticed that the policeman, who had definitely been in the boat at the davit head, was missing so we turned back towards the ship. There we found him, clutching his lifeline, swinging five feet above water, scared out of his wits, alternately swearing and praying, determined never to let go. We had to knock him off the lifeline into the bottom of the boat, where he was gagged and sat upon.

Having overcome all setbacks, we cut under the stern and followed the instructions passed via the portable radio. Check equipment, check webbing, assume a fierce expression. On came the searchlight. Standing starkly in the beam stood our target for tonight–one large fishing buoy, with a radar reflector and three bored sea gulls. It was suggested that at least we shoot the seagulls, but we decided that would not be British. But no smuggler, no infiltrator, not even a cache of weapons under the buoy, let alone a full fish trap. Back to the ship, hoist away, and all that sort of thing–Boarding Officer report to the bridge. The Captain, smarting from the anti climax, was busy suggesting to the First Lieutenant, Navigator, OOW and me, ways in which our performance could be improved when he was interrupted by the second anti climax, in the form of a fresh signal thrust into his hand.

'Immediate from Commodore Cyprus. Disregard my last. Army now assess that vessel reported was RN destroyer and regret that grid reference was garbled.' We didn't need an operations research expert to point out to us that the first contact reported had been of ourselves.

D.J.M.

PROJECT CASE STUDY 5: The Solomon Islands Patrol Boat Wharf

A 'Fast Tracked' Australian project executed overseas. Developing knowledge of, and adapting to, local circumstances is critical.

The Solomon Islands Patrol Boat Base, which is located on Makona Bay at Honiara, was built over an eight month period under Australia's Defence Cooperation Program (DCP). The DCP is co-ordinated by the International Policy Division of the Department of Defence and provides regional assistance, mainly to our neighbours in the South-West Pacific and South East Asia. This assistance includes training support, both 'in country' and in Australia, provision of equipment such as patrol boats and construction of facilities.

By 1991 Australia had provided the Royal Solomon Islands Police with two Pacific Class Patrol boats (PPBs), and also agreed to fund berthing and shore facilities to support patrol boat operations. This task required feasibility studies as well as civil engineering design and construction, and International Policy Division had a number of options to complete the work, including the engagement of Australian or local contractors. The project was subsequently undertaken by Army Land Command Engineers.

The 95 metre causeway and jetty is capable of berthing two vessels, including visiting Fremantle Class Patrol Boats (FCPB). The building comprises a double storey Headquarter building and the whole facility is provided with emergency power supplies.

The patrol boat wharf was a 'fast tracked' project where the design would not be completed before construction started. It was also likely – and it subsequently happened – that the design agency would have to arrange the major structural steel contracts to ensure delivery in Honiara in accord with the construction program. A 'turn-key' requirement to ensure that the facility was fitted out for immediate use was a late addition which had to be contained within the original budget.

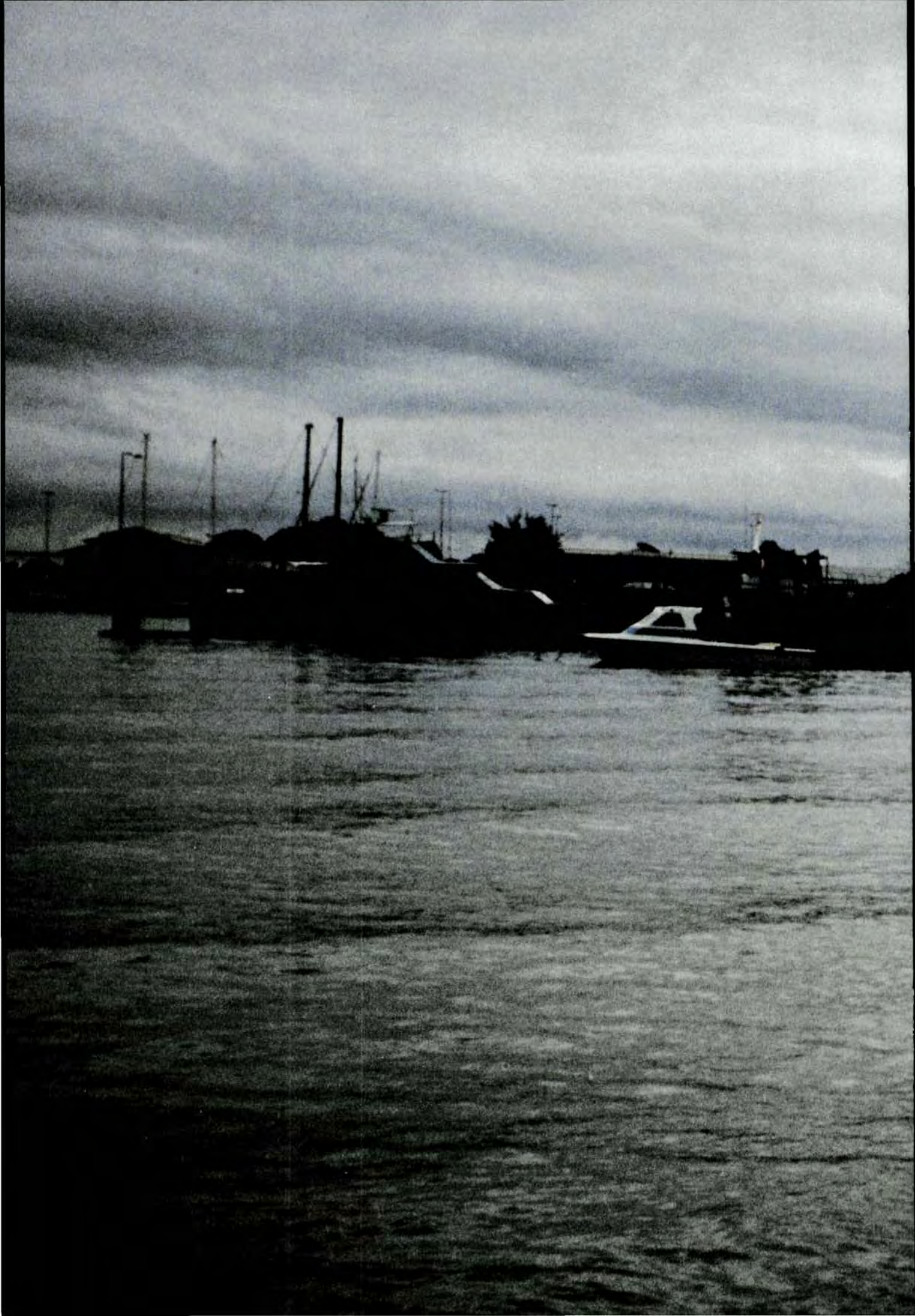
This project had a six month defects liability period or warranty. However, it was not easy to meet as no Army tradesmen were 'in country', and no suitable local contractor could be found. The requirement ended up being satisfied by having a small Australian team visit three and six months after completion.

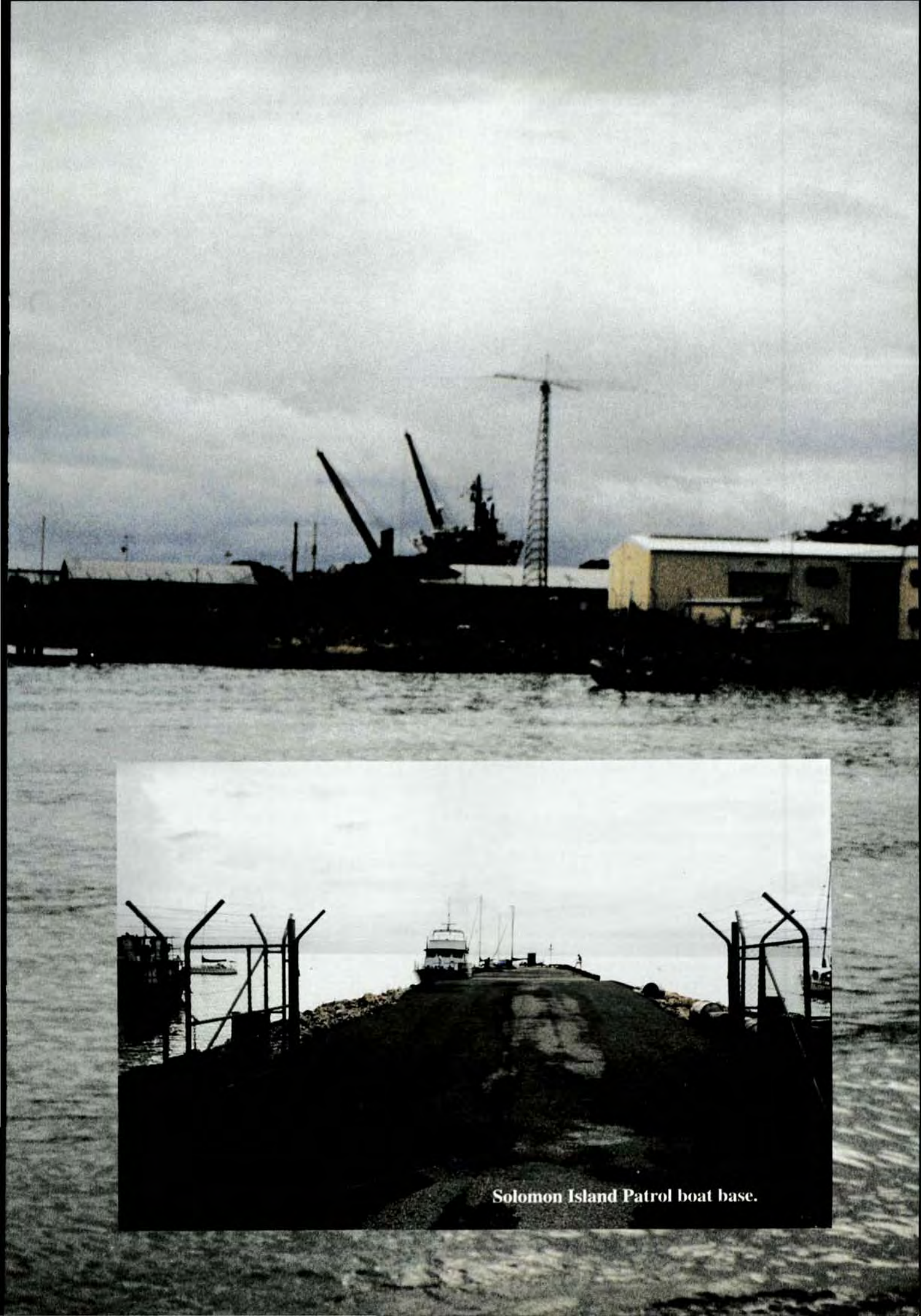
Executing Projects Overseas: Challenges and Difficulties

Executing a project, largely from Australia, and using Australian funds to build a facility that would be owned by that country, rates fairly high as a challenge. It became evident early, when sites were being identified for the facility, that local political directions, rather than engineering assessments, would decide the final location of the base. The Presenter made the point that,"... you may have to accept a less than ideal solution. (Nevertheless) if there are on going implications you must document them, and let the client know. In this case it was recommended that the patrol boats should be moored elsewhere in the event of bad weather". He also advised to, "... be prepared for the unexpected. Following an incident near Bougainville – which was totally unrelated to the project – there was an exchange of letters between the Prime Ministers of both (project) countries, and after this the Solomon Islands wanted the project stopped – one month prior to completion. We kept out of the diplomatic discussions, and kept on working".

The Presenter further emphasised the difficulties encountered if one assumes that Australian experience and procedures can always be readily transferred to overseas projects, saying "... (don't) assume anything. The procedures that you are familiar with in Australia will most likely be different overseas – whether it be design codes, provision and standard of materials, delivery schedules, building approvals, contract methods and documentation, payment procedures, work practices and terminology. I am not saying that overseas methods are any better or any worse than Australian practices, but they will clearly be different. It (behoves) you to identify and understand local procedures during the project planning stage. This includes local customs. For example, in Kiribati, a small island half-way across the Pacific, it is customary to have the project completion celebration party for the workers before the project starts. This allows the workers to see you in a social environment so that they can decide whether they want to work for you or not – (this is) yet to catch on in Australia, but I'm sure it will!'

Most of the Australian firms contracted to supply and deliver materials to the Solomons did not regularly deal off-shore. Consequently, to assist contractors, the project manager provided details of known shipping schedules, shipping lines, in country agents and wharf handling facilities and also ensured that contract delivery times were realistic. This system worked, and there were no contract disputes with Australian firms. However, there was one in-country contract dispute for the supply of jetty timber, which was eventually cancelled for non-conformance despite time extensions and the loan of an Australian work supervisor. This matter was resolved by direct negotiation, without the intervention of lawyers or the threat of court action. Nevertheless, the project manager sought and received valuable legal advice from the Australian Government Solicitor.





Solomon Island Patrol boat base.

Clarifying Responsibility and Accountability

This project came at a time of substantial reorganisation in Defence. Previously, up to seven different defence organisations had been involved with Defence Co-operation construction projects and this could lead to inefficiencies. Therefore, after discussions with Commander of Land Engineers (Army) and International Policy Division, it was agreed that Army engineering units would be given total responsibility for the project and a project manager was appointed who would have total responsibility, accountability and authority.

Overseas projects demand high levels of tolerance, and it is important to remember that changes occur in most projects. In cases of variations arising through a project manager's mistake, or as an addition to the project, the contractor should not be expected to absorb the cost. Open discussions should be entered into and a price requested. Moreover, the Presenter suggested that, "If embarrassing mistakes are made, get to your boss before he or she gets to you. There is always likely to be a hidden agenda with somebody on some part of the project. Think about the various points of view, and have your options thought out before difficulties arise. Moreover, tolerance is often an unfamiliar word to project managers – who are on tight deadlines and have the problems of the world firmly resting upon their shoulders. Engineers who are project managers tend to become involved at every level. I suggest it is better to tell someone what is required, give them the resources to do it, and let them do it, rather than proceed to tell them how to do it".

The Presenter also stressed that, "A project manager must have a clear vision, or concept of the completed project. I could form a picture in my head, and still can, of the finished project, and knew where all the components fitted. If you do not know where your project is going, what the end point is or how you are going to control it, you will have difficulties. You must be a leader, and get out of your office and be seen. If there is a tough decision, don't delegate it. Practice face to face contact; it produces better results than phones, faxes and long letters, but still document everything. Seek involvement with all parties you work with and ensure everybody, including your boss, is briefed regularly. If there are problems don't procrastinate. Deal with them and recognise the wider implications of your decision before you make it".

Pointers

- Ensure that you have adequate responsibility, accountability and authority and that these elements are recognised by all parties to the overseas project.
- Develop and communicate your Vision of the completed project.
- Identify and understand local procedures and customs during the project planning phase. Assume that procedures you are familiar with in Australia will most likely be different overseas – whether it be design codes, provision and standard of materials, delivery schedules, building approvals, contract methods and documentation, payment procedures, work practices or terminology.
- Be prepared to occasionally accept a less than ideal solution. Local political, economic or cultural considerations will sometimes take priority over objective engineering assessments. However, if you have to accept a less than ideal solution, and there are likely be on going implications, you should document them and let the client know.
- Make sure contract delivery times are realistic and assist contractors by providing details of shipping lines, known shipping schedules, in country agents and wharf handling facilities.
- Brief and receive legal advice in cases of non compliance with contract.
- Get out of the office and be seen. Lead.
- Brief all parties regularly, including superiors and liaise with the end user.
- Avoid involvement in diplomatic disputes. Continue working unless officially directed to stop.
- Use periodic, small team visits to deal with overseas warranty claims.

PROJECT CASE STUDY 6:
The FA-18 Fighter Aircraft

This major acquisition under the Foreign Military Sales (FMS) Program was facilitated by using competitive contracting pressures, building rapport with other 'users' and involving Australian industry at an early stage in the departmental process.

The FA-18 was selected in 1981 in competition with three other aircraft to replace the RAAF's Mirage fighter, which had been in service since the 1960s. Seventy five FA-18 aircraft were acquired from the US under FMS (Foreign Military Sales) arrangements, with the United States Navy (USN) being the prime agency. The project came in on time and somewhat below budget, with some contingency allowance being returned. The first aircraft was delivered in October 1984 and the last in May 1991 at a total project cost of $A4.5 billion dollars. The aircraft has clocked up over 70,000 flying hours at an average of about 10,000 hours a year. An attrition rate of 5.6 aircraft per 100,000 flying hours was originally estimated and four aircraft have been lost to date.

Key success generators in the project were the use of competitive pressures from the outset and involvement of Australian industry at an early stage of the Departmental process.

Competitive and Structured Selection Process

The selection process for the aircraft was highly structured. It started in 1975 with going to tender and fourteen responses were received. Responses were short listed to four in 1978 and further refined to two in 1979, with the Letter of Offer and Acceptance (LOA) eventually being signed in October 1981. Importantly, maximum use was made of competitive pressures during 1975-80, and the Presenter remarked that, "We competed, if you like, the United States against France, and we competed the F16 against the FA-18. We competed US Air Force against US Navy and I guess we competed Australian industry against US industry ... so there were a lot of competitive activities all going on at the same time, of which we made as much use as we could to keep the price as low as possible (while) recognising they had to make a profit".

The Presenter observed that, "These were the days, of course, before Equipment Acquisition Strategies (EAS's) were even thought of, and the amount of documentation that went behind all of this was surprisingly small for such a big project, compared to what we have to do today. We had an early definition of the capabilities and the objectives of the program; all being developed by a special high level group called the Defence Aircraft Industry Steering Group and that really laid the ground rules. It was a pretty solid grounding as it turned out to be, and in hindsight, although we all got a bit impatient with it at the time, it was time very well spent. I think it is very important to put as much work as you can in the early definition stages, so you know exactly what it is that you want to buy. You can (then) write down in your contracts or whatever exactly what it is that you are going to buy, with very few holes remaining in the contract or documentation".

Acquisition arrangements under the Foreign Military Sales Program were fairly complicated. The Australian Department of Defence's agency was the Tactical Fighter Project Office (TFPO). The Minister for Defence signed an LOA with the United States Department of Defence (represented by the USN) for 75 FA-18 aircraft. The USN had prime contracts with McDonnell Douglas and General Electric and many other US companies were involved in the FA-18 program. Work also had to be sub-contracted to Australian industry. During the contractual process the TFPO worked closely with the US suppliers – McDonnell Douglas, General Electric and the USN – and this paid dividends. A Tactical Fighter Project Sub-Office was set up in Washington to work with the USN; liaison was also set up with McDonnell Douglas in St Louis and a small office existed for a time with General Electric. Overall, the project was well resourced in terms of staff, but the question of having perhaps too many staff in the US arose. The concept was that TFPO people in the US would work closely with McDonnell Douglas, General Electric and the US Navy to use and get the data from them for assessment of ILS and other requirements. However, possible overstaffing can involve the temptation to reinvent wheels or 're-engineer' requirements, and not make full use of US resources and expertise 'next door'.

Regular program management reviews were conducted about twice each year alternately in the United States and Australia, and the requirement to review the project was written down in the contract at the start. Moreover the FA-18, in its several versions, had been exported to many countries and a conscious effort was made to benefit from international experience of operating and maintaining the aircraft. The Presenter emphasised that, "We had a lot of rapport with other countries who were looking at fighters at the same time, particularly with the Canadians as they actually bought the FA-18 twelve months before we did. We developed a very close working relationship with the Canadians and that rapport has remained".

Industry Program

Another key success generator was that the United States, as part of the overall price of buying the aircraft, was made largely responsible for making the

Navy will be counting on these aircraft and their pilots to be on time and on target in joint maritime operations. (RAAF Photo)

industry program in Australia work, and the Program had full support from the USN. The Industry Program involved a direct Australian Industry Involvement (AII or AIP – Australian Industry Participation at the time) contract with McDonnell Douglas, and an AIP Deed that defined the industry program flowed from this arrangement. However, the use of capabilities created in industry by the FA-18 project has not been as substantial as anticipated, and some disappointment has been expressed in that opportunities were not properly used by the RAAF. The Presenter shed some light on this criticism when suggesting that, "The FA-18, generally speaking, has turned out to be more reliable than we had thought it would be. So the arisings (fleet maintenance incomes) just are not there, and you cannot generate arisings out of nothing".

Liaison with the End User

The Presenter emphasised the importance of consulting with the user when noting that, "An FA-18 costs about 30,000 dollars an hour to fly, so it's not cheap, and it's a huge investment. Four and a half billion dollars up front, plus 30 thousand dollars an hour is all aimed at getting fifty pilots to fly the FA-18 in the most effective way possible, and that's what it's all about. We in the 'project world' must not forget this and get too wrapped up with running projects for their own sake because there are customers out there that want the equipment".

During the project, operational units were regularly advised on how the project was progressing. The 'Project Office' went to Williamtown (base for three of the four FA-18 Squadrons) at least every year to brief the squadrons on where the project stood. Briefings invariably attracted substantial interest and very valuable feedback was received, particularly on ILS matters.

Integrated Logistics Support

Inadequate time spent on defining Integrated Logistics Support (ILS) requirements in the early stages of a project is a common source of compromised project performance. The Presenter remarked that, "We had a heavy emphasis on ILS although we did not call it that in those days, but that is what it was, and we put a lot of effort into defining the ILS requirements up front for the project. The other thing I think we learnt was that in defining ILS requirements, and that is spares and training, it is at least as difficult to define as the prime equipment, and this should not be forgotten. There is a big temptation to put all your effort into defining the prime equipment; letting the ILS look after itself. Well that is a mistake. You have got to spend at least as much effort defining the ILS, and I think in the FA-18 project we probably spent more".

Furthermore, the Presenter advised managers to, "... resist deferring ILS acquisitions as you go through the project because, if things get deferred you never get them back. That seems to be a fact of life. In the mid 1980's the Department was short of money in the Capital Equipment Program, and there was a lot of pressure on the FA-18 because it was the 'Big Project' – the one spending all the money, the 500 million dollars a year type project. Pressure therefore developed to defer a little bit of this; a little bit of that. 'Surely you do not need all that 500 million (and can you) make 480-460 do'? We did defer things, and we never got them back. So, resist deferring ILS acquisitions if you can".

The Presenter also warned that, "... on the support side of things, I think we ended up having over-dependence on USN automatic test equipment and test program sets. Some of that equipment is horrendously expensive, and I think we could well have done with designing our own types of automatic test equipment. We did it once: one item we designed and made in Australia at British Aerospace and, in hindsight, we should have done that more often. It would have been very useful".

The Presenter reminded managers to, "Watch the 'fine print' in the warranty. We had a warranty with the USN through the FMS arrangements – well with McDonnell Douglas actually – which was pretty good. In fact, it was better than the US Navy warranty on structural issues, but when we came to actually apply it we found it wasn't quite as good as we thought. We found we had to take aircraft back to St Louis for the warranty to really apply and a few issues like that. So, read the fine print on the warranty which we really did not do well enough".

Intellectual Property

Attending to the implications of intellectual property rights and establishing just what is and is not permitted for transfer, ownership and use has become a salient consideration in project management in recent years. Bearing in mind that FA-18 contract development took place in the early 80s, the Presenter suggested that, "I think we underestimated at the start the importance of getting intellectual property rights (which should have been) organised while the competition was on. We tended to concentrate on getting the best buy, if you like, in terms of the hardware and everything else, and when it came to looking for intellectual property to support the aircraft downstream, it turned out to be not quite as easy to get as we thought it was going to be – or as cheap either. So intellectual property is something that is worth putting an emphasis on early".

Responsiveness to the Press

Considerable activity went into developing useful relations with the press and giving the new aircraft high visibility. The Presenter observed that, "Quite clearly at the time, the FA-18 was a glamour project – I guess it still is – but the Press wanted to know all about it: how fast it went, how much it would cost etc. The other side we emphasised was the fact that the program would generate in industry a considerable workload, (which was) seen as being very important. Indeed, it is interesting to go back to when the Labor Government got in (1983), they wanted to know whether we still wanted 75 Aircraft, and the thing that really dissuaded them from reducing numbers was the workload implication for industry if we changed".

Pointers

- Put as much work as possible into the early definition stages, so you know exactly what it is that you want to buy. This is a decisive project success generator because fewer 'holes' are likely to result in the project documentation or in the contract.
- Make determined efforts to systematically absorb as much international experience of operating and maintaining the equipment or platform type as possible.
- Make maximum use of competitive pressures between tenderers/countries/agencies right up to contract signature if possible.
- Regular, 'face to face' program management reviews should be conducted, with the requirement being written into the contract from the start.
- Resist the temptation to let ILS 'look after itself', and avoid putting all your effort into defining the prime equipment. Emphasise to the team that defining ILS requirements (including spares and training) is usually at least as difficult as defining the prime mission equipment.
- Strongly resist deferring ILS acquisitions as the project progresses, because if things get deferred you may not be in a position to get them back.
- Avoid automatically sourcing all support equipment from the prime equipment supplier. Sometimes, items such as test equipment can be far too expensive, and one should undertake a cost effectiveness analysis to determine if they could be better sourced elsewhere, or even undertake 'in house' design of *some* support equipment.
- Avoid 'reinventing the wheel'. Beware of overstaffing which can involve the danger of unnecessarily 're-engineering' requirements by under-employed, talented people.
- Watch and cost the 'fine print' in warranties. For example, will you have to take equipment back to the country of manufacture to get major work done?
- Don't underestimate the importance of getting intellectual property (IP) rights agreed while competition for contract is still 'hot'. Getting the best deal on IP is part of getting the best buy and is necessary to support the platform downstream.
- Develop useful relations with the Press and give your project appropriate visibility.

Minimising Risk in Defence Projects:

100 Practical Pointers

Alan Hinge

Poor risk management is proceeding with an action without due regard for project-related risk and, in particular, *avoidable* risk. For project managers 'risk' can take on a multitude of specific forms, but in the end project risk manifests itself as the chance of incurring loss in terms of cost/schedule overrun or failure to meet performance specifications, that is, a situation arises where the project's product cannot do what it is supposed to do. This article aims to offer some practical pointers on reducing the risk of avoidable cost/schedule/performance problems arising in projects.It draws on many project case studies, including the six used in this Journal.

What project risk management *is not*

There is no substitute for quality of thought in risk management, and technology alone rarely offers a panacea for poor planning. For example, managing or exercising control over project risk is seldom achieved by buying bigger and better scheduling or networking software packages. Research indicates that only 10-20 per cent of *total* activities in major projects can be identified and logically linked early in a project's life, and project teams are only ever likely to make use of a fraction of the capabilities most software packages offer anyway.[1] Furthermore, as Linard and White suggest:

> "...Critical Path Method(CPM) has a long history in project management. In fact, while CPM is an essential tool, it provides at most 15 per cent of required project information. CPM is a tool applied to the programming and scheduling of work. *CPM should not be used as a synonym for project management* (emphasis in the original)".[2]

Similarly, another way of *not* exercising genuine control over project risk is by padding out project costs and schedules with excessive contingency allowances which are all too often used to compensate for inadequate planning and estimation . Any contingency allowance over 20 per cent almost certainly indicates inadequate planning 'up front', but *effective* contingency loadings on budget as high as 30-40 per cent have been used in some major Australian projects.[3]

What project risk management *is*

Project risk management involves identifying, analysing and responding to risk factors that affect cost/schedule and performance *throughout* the project. If taking an unnecessary risk is proceeding with an action without due regard to, or provision for avoidable risk and consequences, then good risk management in projects involves clear recognition of potentially avoidable schedule/cost/performance hazards, and then making preparations to eliminate them or cushion the project from their adverse consequences before 'setting out' with a Request For Tender (RFT). The key to successful risk reduction is *anticipation* during the key planning stage which covers project proposal, definition, selection and development up to RFT. Anticipation is simply the ability to work out what is likely to occur and, therefore, what can be done about it, so one may act *in advance*.

Anticipation is stimulated by developing a thorough understanding of a project's objectives, coupled with extensive experience of what went right and what went wrong in similar project environments in the past. Anticipation in the planning stages is a key to moulding your future project environment.... 'an ounce of prevention is worth a pound of cure!' Consequently, the approach to reducing project risk used in this article concentrates on developing pointers, which are often posed as self check questions, that may assist project managers in:

(a) anticipating and preparing for what can go wrong – to reduce the chance of adverse cost, schedule or performance variations; and

(b) initiating actions to increase the chances of things going right.

The following four project phases will be focussed on:

1. INITIAL RISK ASSESSMENT – involves initial anticipation of project risks to determine the level and detail of planning needed. Failure to adequately resource the planning stage to reflect inherent project risk level is likely to give rise to a disproportionate number of problems later in the project.

2. PLANNING – good planning depends on gaining an early, thorough understanding of your project so your team can mould circumstances and not be buried under them! Thorough understanding is based on developing clear linkages between cost and performance (effectiveness) early in the project proposal, selection and definition phases. This calls for the widespread use of disciplined, systematic cost effectiveness (CE) analysis to clearly link cost and effectiveness *within and between* project options. The two crucial benefits of systematic cost effectiveness analyses of options in the project proposal, definition and planning stages are:

- A close quantitative examination of alternative approaches/solutions to meet project aims *forces* the team to generate, scrutinise and quantify solid benchmarks and performance indicators. These comprehensive measures of effectiveness form clear baselines for contract development, negotiation and administration (especially cost/schedule estimating, project monitoring and evaluation and calculation of earned value[4]).
- Early, disciplined CE analysis usually yields a detailed appreciation of technical risk and extent of practical difficulty. This prevents one from becoming overly ambitious and assists in maintaining realistic objectives.

3. CONTRACTING AND CONTRACT ADMINISTRATION – Contractors can make or break your project despite the best planning and organisation from 'your side'. You must know clearly what your contractors can and cannot do. This involves developing comprehensive commercial profiles of the firms you will have to count on to minimise slippage and cost overrun. Solid commercial profiles enable you to understand your contractor's strengths and limitations. This can help establish an informed and professional basis for genuine partnership in overcoming problems. (Practical pointers on developing these profiles are covered below).

4. IMPLEMENTATION – anticipating requirements and potential problems during the production and trials/evaluation phases, and hedging against them, reduces risk. The Implementation Phase starts on construction/production contract signature.

Initial Risk Assessment

.....Just how hard is your job going to be?

An important, early step in developing an understanding of a project 'environment' is undertaking an assessment of technical, contractual, schedule and management factors that will vary depending on the nature of the project and its stage of development. Risk factors should be reassessed throughout the life of the project, but the initial risk assessment identifies and exposes core issues early. These issues are important guides for designing project organisation, that is, selecting numbers and types of project planning staff, together with the resources needed to get the project properly off the ground. Initial risk assessment is also instrumental in decisions on which inter-agency links should be built up early in a project's life. These links are important for getting advice, and early liaison can prevent bureaucratic blockages.

An initial scheme of three risk levels – Low, Medium and High – can be used to indicate the detail and difficulty of project planning, and hence determine the resources required to plan properly. Of course, risk level will often be re-adjusted after the detailed planning phase is completed; only then can firm cost and schedule estimates be made and genuine contingency allowances be allocated.

Some *Low Risk* project characteristics are:

- low level of technical complexity;
- the unit is an 'off the shelf purchase', perhaps involving minor 'in country' modification;
- manufacture and assembly of a proven design using technology within current national industrial capability;
- the unit, or one similar to it, has been previously manufactured locally;
- a reliable and experienced prime supplier exists (local assembly);
- the contract is relatively low risk. For example, Firm Fixed Price (FFP), Unit Rate (UR) or even Firm Fixed Price Plus Incentive Fee (FFPIF) types of contract;[5]
- Short duration (5 years or less from production/construction contract signature to end of the production 'run'). While short duration can involve high risk if schedule is underestimated, it generally indicates a relative lack of complexity and occupies one or two military posting cycles. Consequently, the extremely damaging effects of posting turbulence and management discontinuity should be minimised.

The number of these factors applying to the project, and the extent to which each factor applies will guide judgement on numbers and kinds of planning staff required. As a rule of thumb, low risk projects should have a contingency allowance of 5-10 per cent associated with most of their elements. This leads to an

addition of around 5-10 per cent to solid cost (*and* schedule) estimates which should be produced in the detailed planning phase.

An example of a project that fell into the low risk category was the Small Arms Replacement Project (see Case Study 2). The SARP basically met the first five low risk criteria described above – its level of technical complexity was relatively low, and it was effectively an 'off the shelf purchase' involving (it was thought) minor 'in country' modification. Moreover, the project involved manufacture and assembly of a proven design using technology currently within Australia's industrial capability. Furthermore, the Austeyr rifle's predecessor (the Self Loading Rifle or SLR) had been manufactured locally by an experienced supplier. Nevertheless, substantial 're-engineering' of a proven rifle design and standard ammunition took the project into the medium risk category, and an excessive price premium of 80 per cent above the imported model's unit price was paid by the Commonwealth.

Some *Medium Risk* project characteristics are:

- manufacture and assembly of a proven design using technology involving some development of Australian infrastructure;
- significant level of technical complexity and interfacing problems (integrating existing and developmental technologies increases technical risk);
- unit has not been manufactured 'in country' before;
- local modification of existing equipment at the major system level;
- project duration of 5 to 10 years, where slippage and staff turnover can have substantial compounding effects;
- overseas purchase of prime equipment with significant local manufacture and development;
- moderate risk contracting. For example, a Cost Plus Fixed Fee (CPFF) type of contract; and
- existence of constraining 'international' factors and uncertainties.

Medium risk projects should be accorded a cost/schedule contingency allowance of 10–20 per cent above hard project estimates. The B707 Tanker Project (Case Study 4) clearly fell into the medium risk category. It satisfied most of the above criteria, however, initially opting for the unproven Mark 32B Refuelling Pod may have increased risk level. Similarly, the FA-18 project fell into the medium risk category in that it was essentially a 'franchising' arrangement.

Some *High Risk* project characteristics are:

- local manufacture of unproven design with large overseas component;
- local development of a new concept;
- local construction and design using new technology;
- high level of new technology and design effort needed leads to a high level of technological complexity (including software);
- high level of interfacing difficulty due to equipments from several countries being built into the one platform or unit;
- high risk contract. For example, Cost Plus Percentage of Cost (CPPC) type of contract; and
- project duration in excess of 10 years (Contract signing to last delivery).

Case Study 3 (Collins Class submarine) clearly falls into the category of a high risk project. High risk projects should be accorded a cost/schedule contingency allowance of 20 per cent. Where exceptional in country design, research and development is involved, a case could probably be made for contingency of up to 25%, but the Collins Class does not fall into this category. As suggested earlier, any contingency allowance higher than 20 per cent usually reflects inadequate analysis and planning, and the need to progress with the particular option should be questioned unless a lot more 'homework' is done, that is, the risk seems unacceptable unless further analysis can reduce uncertainty. Of course, political imperatives can also weigh heavily on the decision to proceed or not, as was the case with the Collins Class.[6]

Making Judgements on Risk

Special aspects of a project should not be overlooked during initial risk assessment. This is especially the case in international, 'fast tracked' projects where pains must be taken to identify and understand local procedures, culture and customs during the planning stage. It can be argued that both the Offshore Patrol Combatant and the Solomon Islands Patrol Boat Wharf (despite its relative lack of technical complexity) – were medium risk projects because of ambiguous international considerations, constraints and conditions applying. For example, the Solomon Islands Patrol Boat Wharf project highlighted the limited portability of some Australian construction management procedures – whether they be concerned with design codes, provision and standard of materials, delivery schedules, building approvals, contract methods and documentation, payment procedures, work practices and terminology. Similarly, the Offshore Patrol Combatant project demonstrated that informal

overseas links and contacts were necesary to clarify unfamiliar government processes, identify risks and develop criteria and constraints.

In determining overall project risk levels, sometimes the project manager must 'extrapolate' and judge whether a contractor has the *potential* to satisfy a criterion. For example, if the prime contractor has not undertaken a project like yours before, carefully look at his or her record (see below on developing a contractor's commercial profile), and assess the contractor's current capability baseline and establish what it developed from. Then, decide if a quantum or marginal extension of capability is called for. We saw with the Offshore Patrol Combatant project that the contractor had produced the Australian FFG frigates from a build-to-print type process, and then moved onto the ANZAC ship which involved much more detailed design and construction. From this established capability baseline, the design and construction of an Offshore Patrol Combatant appeared a logical and achievable extension. Therefore, perceptions of construction risk were reduced, probably from a high to a medium level. Furthermore, 'risk boundaries' were developed for the project by having all major elements of design that the contractor did not have experience in verified by at least one international agency and, subsequently, these calculations were to be confirmed by an independent Classification Society. A 'cost cap' was also emplaced during the OPC approval process to add discipline and reduce the risk of cost over-run by forcing cost/capability tradeoffs to be made from the beginning.

Once you have judged the inherent risk in the project and placed boundaries around conspicuous problem areas, appropriate allocation of personnel and resources should be made to reflect the risk level. After this, you now move into probably the most decisive phase of the project in terms of reducing the potential of risk factors to 'bite' – The Planning Phase.

Project Planning

If you think insurance is expensive, try having the accident!

The critical aim of the planning phase is to work out how things are put together 'up front' so that change is minimised during the implementation phase, which starts on signature of the construction/production contract. Baumgartner suggests, "....the activity which has the most far reaching effect on the project is the extent, detail and realism of the project plans. Most of the problems which develop in a project can be traced back to faulty planning".[7] Without detailed planning – an approach to which is described later in this chapter – performance cannot be effectively and efficiently monitored because specifications will probably not be as comprehensive as they could and should be. Consequently, changes to plan as the project progresses are likely to increase, compound and cause slippage.

'Patchy' planning capabilities have been endemic in Defence project management, and the key findings of the 1986 Joint Parliamentary Committee on Public Accounts Report 243 on Defence Project Management continue to give a relevant summary of the main problems still faced in defence project management.[8] According to the then Chair of the Sectional Committee on Defence Project Management, the eight most common problems were[9] :

a. inadequate evaluation of project proposals;
b. incomplete project planning;
c. underestimation of risk, cost and time;
d. poor evaluation of tenderers;
e. contracts which did not specify requirements or provide incentives for contractors to minimise cost and perform to schedule;
f. poor monitoring of contractor performance;
g. links between contract changes and cost/schedule were not sufficiently scrutinised (specification changes lead to big cost/schedule overruns); and
h. slow departmental decision making and approval processes.

Importantly, the majority of these problems stem either directly or indirectly from lack of attention to planning and failure to set comprehensive effectiveness (performance) and cost baselines in the project definition to RFT stages (the planning phase). This is because, without developing a thorough understanding of these baselines and their inter relationships during the planning phase, one cannot comprehensively specify requirements or efficiently evaluate tenderers, monitor and evaluate performance or work out the 'flow through' cost/schedule/performance consequences of configurational changes. Proceeding to the RFT stage with a relatively general or 'parametric' idea of what is needed can have disproportionately bad consequences 'down the track'. After all, without knowing exactly what is needed, how can one know exactly what work is to be done and then cost it?

Very importantly, a determined effort must be made to build a sound, corporate experience base for the actual operation and maintenance of the Australian platform type or variant being produced by a project. Potentially valuable sources of 'local' knowledge and experience should not be overlooked, as appeared to be the case in the B707 Tanker Project (Case Study 4), for example, when the air to air refuelling experience of Ex-RAN A4 Skyhawk pilots was not drawn on. Project managers in the planning stage should look at absorbing as much international experience of op-

erating and maintaining identical/similar equipment or platforms as possible. For example, in the case of the FA-18, the rapport built up with Canadian users was an important factor in project success. In the B707 Tanker case, leasing an overseas air to air refuelling setup for a familiarisation period could have been a way of achieving depth of familiarity and corporate experience. Alternatively, sending a team overseas to work in the Air-to-Air refuelling field would almost certainly have improved corporate knowledge. Making sure enough personnel were sent overseas to ensure redundancy would also be important; an investment of three to six months in training and 'hands on' operational experience would almost certainly have had a disproportionately advantageous effect on project planning, especially when it came to establishing realistic, unambiguous specifications and objectives.

Setting objectives

Careful selection of an aim and objectives, as always, is the beginning of the planning process. A project plan is a *detailed* method for achieving an aim, which in turn is reached by achieving a series of major objectives or milestones. While much lip service is paid to the crucial importance of planning, many project management teams do not appear to be able to plan in detail, or spend enough time planning and *comparing alternatives*. But just how do you develop the baselines of knowledge and judgement to properly plan a complex project?

First, the project manager should get his or her team and resources together at the earliest possible stage and keep them together (the importance of this step is discussed in more detail later). Furthermore, the project manager should ensure that he or she has been given adequate responsibility, authority and accountability and that these elements are recognised by all parties to the project.

Second, care must be taken that the customer or 'end user' has clearly identified what is needed, especially concerning *detailed* performance and support requirements. Then the user and project management team should get together to determine and agree on specifications, and carefully proceed to document requirements so that continuity in the project's decision trail is achieved. Unambiguous and detailed documentation also means that tenderers and contractors will be in a position to know what is required. A common 'vision' of what is needed – and how it is going to be put together – is built up, and this helps cost and schedule estimates at all levels to be realistic and comprehensive. In fact, the Presenter for the Collins Class Submarine (Case Study 3) highlighted this when emphasising that the most important thing to do is to spend all the time and money necessary on a comprehensive PDS (Project Definition Study) to get the specification right. This enables detailed design to proceed with *minimal change*, and good project strategy must incorporate minimising change to specifications. Moreover, undertaking a comprehensive PDS is far more than just a specification development phase: It embraces the critical period during which both the contractor and the customer reach as good a common understanding of what is required as possible. Similarly, the FA-18 project experience highlighted that a decisive project success generator was to put as much work as possible into the early definition stages, so that one knew exactly what was needed. Consequently, fewer 'holes' appeared in the project documentation or in the contract.

Possible project solutions or alternative systems and sub systems should be carefully identified and then systematically compared in the planning stage. These steps are particularly onerous and demand patience, but can have a disproportionate bearing on the long term reduction of risk. This is because two fundamental questions must be faced and treated comprehensively at an early stage, rather than when slippage occurs later. These questions are: How do I measure effectiveness?, and How do I measure cost? If a firm 'handle' on these issues is not developed before RFT your ability to evaluate tenderers, monitor and evaluate project progress, determine earned value and generally contain risk is compromised. Therefore, professional project planning involves building up a thorough understanding of the dynamic, usually non linear relationship between cost and effectiveness *across* a particular choice and *between* alternatives. This calls for extensive use of systematic Cost Effectiveness Analysis (CEA).

Using Cost Effectiveness Analysis

Medium and high risk defence projects are often about building complex systems – combinations of interacting, interdependent sub systems – to achieve strategic, tactical or support aims. Cost Effectiveness Analysis is a process directed at developing a comprehensive *understanding* of the relationship between cost and effectiveness for a given product and over a range of real alternatives. It is a tool to help make choices throughout a project, but especially when selecting project options and defining requirements. Depending on the choice and nature of systems and alternatives, CEA uses methods derived mainly from cost benefit analysis and systems analysis (or any other discipline that is useful) to select the better alternative to improve a 'system'.[10]

A cost effectiveness based approach can help project managers decide what to choose, how much of it is enough and what the best cost/capability tradeoffs are throughout a project. At the broadest level, *a* cost effective option is one giving the user an acceptable return for a reasonable outlay (in his or her eyes).

Taking this one step further, *the most* cost effective option would give the better return for a fixed cost, or, achieve a specified level of benefit or effectiveness for least cost. However, the 'maximise effectiveness for fixed cost' and 'minimise cost for set effectiveness' approaches, while useful in practice, remain sub optimised or simplified approaches to cost effectiveness. Fixing one factor to minimise or maximise the other does not adequately represent the dynamic, usually non linear relationship between the two variables.

Generally, neither cost nor effectiveness alone is sufficient to make the better choice between complex and expensive options. *Both* cost and effectiveness should be understood at the same time and in relation to each other. Importantly, really understanding the relationship and interaction between effectiveness and cost *at the margins* is central to making good choices between alternative systems and even courses of action throughout a project.

In business, a key cost benefit accounting idea for choosing between alternatives involves the marginal or incremental approach. This method analyses changes in total costs and benefits (revenue) and compares the *relative* profitability of alternatives. Good managers seek understanding to judge when marginal cost exceeds marginal return, that is, when further spending on a component, system, platform or course of action gives incremental gains valued at less than incremental cost. At this point further expenditure is no longer justified or *cost effective*.

Understanding the relationship between cost and effectiveness at the margins involves being able to ask and answer the following *kinds* of questions: How much more effectiveness/performance do I get in a particular situation for, say, 5 per cent more cost? If I reduce effectiveness specifications by 10 per cent how much will be saved on total cost? Does 30 per cent extra cost justify an 8 per cent increase in performance? In effect, the project manager must always have some idea of when the ratio of marginal cost to marginal benefit or return becomes less than one, that is, when it is not useful to contemplate change. He or she must operate around the 'knee' of the Cost/Effectiveness curve and know when a diminishing return situation exists (see Fig 1).

The curve at Fig 1 represents an idealised 'How Much is Enough?' decision making case using a quantitative representation of the relationship between cost and (aggregated) effectiveness to decide which alternative to choose, or how much of 'something' is enough. While most project choices do not follow the idealised curve neatly, the diminishing return phase is often quite apparent. Similar analyses can be done when choosing at the system and subsystem levels, and an example of a CE approach to major capability and systems selection is given on page 50.

Use of the CE Curve (Situations A - F)

A: Low cost/Low effectiveness.

B: Low cost/Increasing rate of effectiveness per dollar is evident.

C: Between 'B' and 'C' substantial increases in effectiveness exist for less and less dollar cost. Stage 'C' represents a rarely achieved situation where large increases in effectiveness are achieved for negligible cost input.

D: This represents the 'knee' region of the curve, where the rate of increase in effectiveness per dollar input starts to fall rapidly, and the 'law' of diminishing returns begins to bite. At point 'D' almost 80 per cent of maximum performance is being achieved for about $40 million.

E: This stage involves much more money needing to be injected for each percent increase in effectiveness/performance. The question of whether small marginal increases in effectiveness justify expenditure of large sums must be asked. The decision maker must carefully distinguish between essential and desirable levels of performance at this point. At point 'E' 90 per cent of maximum performance is being achieved for about $70 million.

F: 100 per cent performance for $100 million cost. Very large costs are needed to improve performance by even incremental amounts. A 10 per cent increase in performance has cost about $30 million, or 30 per cent of total cost. This is usually unacceptable, and rare exceptions would include items like spacesuits, where only the very highest standard of performance is acceptable.

The CE points A - F along the curve represent relative positions of project choices when *cost and effectiveness are taken into account at the same time*. Early in projects they could represent platform or prime equipment options to give a capability – six kinds of destroyers, six fighter aircraft or six Armoured Fighting Vehicle alternatives. Later, for example, major systems could be compared and the points may represent alternatives of the same kinds of system – different bullets, AAR fuel pods, search radars or even contracting companies. Later still, points on the curve could represent levels of performance of a particular item depending on proposed configurational/pattern changes to be made, for example, when considering a number of pattern change alternatives to a bullet.

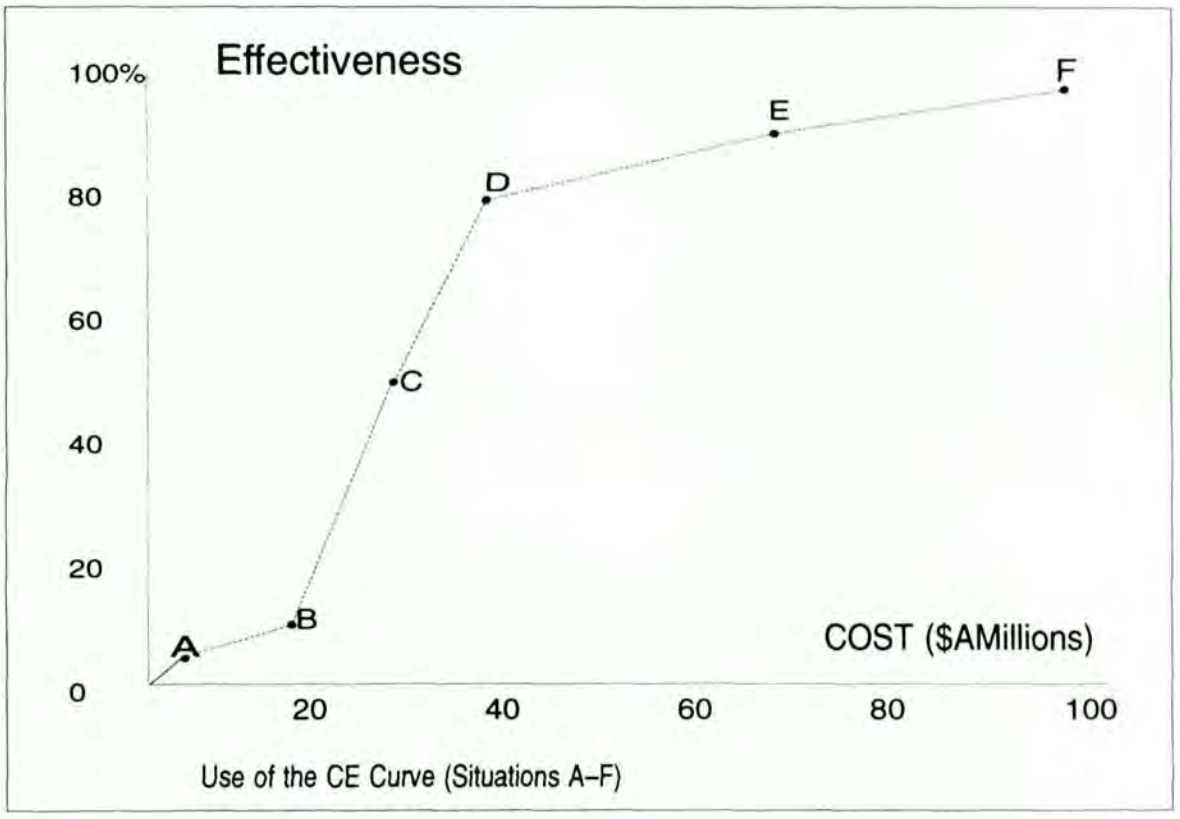


Figure 1: The Cost Effectiveness (CE Curve): a Key Planning Tool

Our Case Studies are again instructive. For example, in practical terms, the cost effectiveness of the volume of changes (over 400) to the NATO Standard SS109 Round during the SARP (Case Study 2) must be open to question, especially given the adverse cost/ schedule/ performance consequences of this number of changes. What *could be done* for significant change proposals is: For each change, work out the improvement in effectiveness above that of the baseline NATO round (or the round as it is configured and processed to date) and compare the change in effectivess/performance to the *cost* of the proposed change. Be prepared to use the 80/20 rule and, remember, 'cost' is not merely price: Cost is a measure of benefits foregone or opportunities lost, and may include added manufacturing difficulty, lack of full compatibility, schedule slippage, increased end user operating difficulty as well as unforeseen changes needed as a result of the change. These calculations and considerations are complex and things have to be carefully thought through, but that is the whole point of making choices systematic and forcing changes to be integrated within the entire project environment and viewed from the perspective of *net effect on total performance*.

Similarly, proving the cost effectiveness advantage of the planned adoption of the experimental Mark 32B refuelling pod for the B707 Tanker (Case Study 4) , when compared to the two in-service alternatives, would be of interest. Even if the new pod were available would it offer sufficiently improved performance at the margins?

Ultimately, cost and effectiveness must be understood *together* for each alternative if good choices are to be made *throughout* the project – and a project manager's job is to make good choices. *A complete understanding of alternative choices and their relation to each other is assisted by making out a CE curve to represent the relative positions of each alternative or development in particular situations*. This usually requires solid 'number crunching' and should be attempted so that the project manager can have a good idea of where he or she actually is, or wants to be, 'on the curve'. *Having this knowledge enables one to successfully operate at the margins and choose to be around the 'knee' of the CE curve*. The CE Curve representation of options enables project managers to know 'how much is enough' or, sometimes even more to the point, 'how *little* is enough'.

Most importantly, the process of going through cost effectiveness analyses – which will have their fair shares of limitations – gives the project team the best possible 'handle' on the linkages between costs and effectiveness throughout the sub systems and systems of the project product. Consequently, the scope of the project task is better recognised; practical limitations and risks are more clearly identified; tradeoffs can be made. This forms the best possible basis for assessing tenders, and developing and administering con-

BRIEF EXAMPLE of Cost Effectiveness Analysis Approach to System and Sub System Selection

An important risk reduction discipline throughout a project, and especially in the planning phase, is developing a detailed understanding of effectiveness and cost using quantitative data as much as possible. The example below broadly demonstrates the use of cost effectiveness analysis to choose from a range of options; working down from choices at the capability level (convoy protection) through to the individual platform (destroyer) level and on to the system and subsystem levels.

CAPABILITY SELECTION – Convoy protection

Convoy protection was the cornerstone of navy's argument for a carrier in the early 1980's, but cost effectiveness analysis caused questions of whether an aircraft carrier would really make a cost effective contribution to national security on the basis of the traditional reasons given for acquisition. The table below summarises the results of a long series of studies.

PROTECTION TYPE*	COST**	EFFECTIVENESS (SHIPS LOST)	BREAK EVEN ***
Focal Area only (Baseline)	$ 50 M	8	NA
2P3/ 1 Destroyer	$ 70 M	4	$ 5M
2P3/ 4 Destroyers	$200 M	2	$25M
2P3/ 4 Destroyers/ Carrier	$400 M	1.2	$51M

* Assumes 12 convoys of 20 ships per annum. Focal area protection is bare minimum protection provided by government (2 P3 aircraft to cover out to about five hundred miles).

** $Aust 1980.

*** Average ship and cargo value needed to match protection cost above the baseline (minimum protection). Depending on the cargo carried and age of vessel, a sunk ship would be worth from $10-$20 million (Hull costs $8-15 million) Author's estimate in $Aust 1980.

In the first convoy protection situation a focal area defence capability around approaches to major ports yielded an estimated eight ship annual loss at a basic protection cost of $50 million. To halve likely annual losses to four ships, a minimum escort (1 destroyer per convoy) cost increase of $20 million (40 per cent) was required. However the 'law' of diminishing returns soon came into play. Increasing escort size by three destroyers cost four times ($200 million) that of 'basic cover' if losses were to be further halved to two ships per annum. Marginal reduction in loss for marginal cost was getting much less attractive, especially if the six ships saved and their cargoes (relative to the baseline) were unlikely to have an average value exceeding $25 million each. The average value of ship and cargo at the time was approximately $15 million. Besides, high opportunity costs for three added destroyers per convoy during a conflict must be taken into account.

If a carrier escort were added to the four destroyers, this would seem to offer even worse value at the margins by not even halving losses at double the cost ($400 million). To justify carrier protection – on purely financial grounds – an average ship and cargo saved value of over $ 51 million would have to exist. This was clearly not cost effective on the basis of convoy effectiveness acquisition criteria given. Therefore, analysis *at the margins* of a convoy protection baseline capability indicated one or two destroyers as surface escorts per convoy would appear to yield the best choice.

Of course, the value of the figures in the table depends on the quality of the analysis. This in turn depends on the information available, representativeness and manageability of information, validity of assumptions made, methodology used and whether the time was available to sit down and do things properly. The quality of analysis is critical and the limitations of CEA must be kept in mind. Nevertheless, the 'number crunching' and research involved in getting and analysing information develops detailed understanding of the situation and reveals the full range of options.

PLATFORM SELECTION

A similar comparative analysis can be used to assist with choosing the kind of escort destroyer for convoying. After establishing criteria and measures of effectiveness and weighting them, a CE curve could indicate the best destroyer option, say Option 'X'. However, option 'X' itself comprises systems, some of which have alternative 'makes and models' which should be compared to the standard 'fit' to identify relative returns of effectiveness/cost at the margins. Let us take one such major system, for example the main gun armament, and assume that 75mm, 125mm, 150mm and 175mm gun options exist. If the 125 mm achieves the best balance of cost and effectiveness relative to the others on a CE curve then it becomes the chosen system. Taking the selection problem one step further, perhaps four companies W,X,Y and Z make 125 mm guns and cost effectiveness analysis will show which manufacturer provides the best increase in marginal effectiveness relative to marginal cost (over the base model). Once again, a CE curve can be generated to reveal the relative positions of manufacturers on a cost *and* effectiveness basis. These kinds of analyses can be taken to sub system levels right down to the component level if necessary (studies within studies within studies!) but this is rarely necessary. However, after detailed analysis of configurational alternatives, evaluators often have to 'work back up the line' and review the originally chosen platform type because of their improved appreciation of the dimensions of capability and aggregated effectiveness combinations of major systems and sub systems.

The CE analysis *process* can yield a better understanding of the project in terms of cost and effectiveness linkages at any level, and the benefits of this process carry on throughout the project. Most importantly, the *process* of going through these kinds of analyses – which will have their fair shares of assumptions and limitations – gives the project team the best possible 'handle' on the linkages between costs and effectiveness throughout the 'ship'. The scope of the project task is better recognised; practical limitations and risks are more clearly identified; better understandings of how things are 'put together' arise and tradeoffs can be made. This forms the best possible basis for assessing tenders and negotiating and administering contracts through better monitoring, evaluating and determination of earned value. Therefore, risk reduction and management at subsequent stages of the project are likely to be improved by (a) minimising uncertainty 'up front' through planning, and (b) building up the team's corporate ability to make good choices between alternatives and hence better manage cost, schedule and performance.

tracts through better monitoring, evaluating and determination of earned value. Therefore, risk reduction and management at subsequent stages of the project are likely to be improved by (a) minimising uncertainty 'up front' through planning, and (b) building up the team's corporate ability to *link* and manage cost, schedule and performance throughout the project.

Other advantages of using CE analysis throughout the planning process

Assuming a high quality of analysis, a cost effectiveness approach can help resolve difficult issues on a more objective basis throughout the project when groping through defence's technical and bureaucratic 'minefields'. Good quality analysis of alternative choices improves corporate understanding of a project environment and encourages adequate consideration of requirements and alternatives for success. This is done by first determining factors driving outcomes; then identifying, clarifying and testing, as far as possible, the validity of explicit assumptions, underlying assumptions and simplifying assumptions. Above all, good CEA provides a way of setting out choices between real alternatives for project managers, and *linking these choices to budget* as much as possible *at* the planning stage.

Most importantly, cost effectiveness analysis assists in reducing project risk by causing questions to be asked early, and focussing planning through 'stimulated anticipation'. The basic aim being to have sufficiently worked things out 'up front' to minimise post contract agreement change. CEA also improves the chances of rational planning choices by focussing discussion and avoiding talk in generalities. Disciplined CE analysis can also defend against military and bureaucratic pork barrelling and empire building, by forcing those responsible for proposals to quantify costs and benefits for each important choice as far as possible. Otherwise, reliance on value judgements, guesses, 'winging it' and hunches leads to clouded issues, muddled thought and unmet or *expensively* met objectives. CEA also provides a screening process for obvious non-starters – a kind of entrance exam: it may not be able to pick 'winners' in many cases, but it can often identify 'losers' that do not justify investment at the performance or capability margins. Choices are narrowed down. Also, if things do not go according to plan, the original analysis may be used to pin-point where, why, and how things went astray.

We will now look at some specific cost and effectiveness considerations as they concern projects.

Project Cost Considerations

Over reliance on costings from tenderers should be avoided and one should get a 'handle' on direct and through life project costs from within the project planning team or from *good*, independent consulting teams. The following self-check list may stimulate ideas and assist in the cost anticipation process:

- Is there an adequate equipment and work based costing database at your disposal? If one is not at hand, you need *not* have to 'reinvent the wheel'. You may be able to learn much from similar projects in Australia or overseas, provided that you carefully discriminate between similarities and differences. Do not underestimate costs of definition studies, Research and Development, prototype/modelling facilities, AII (Australian Industry Involvement), training, test and evaluation costs, management information systems, consultancies and Integrated Logistics Support.
- Have you made the mistake of letting ILS 'look after itself' and put all your effort into defining the prime equipment? Remember that specifying ILS requirements (including spares and training) is usually at least as difficult as specifying the prime equipment.
- Will placing a 'cost cap' on the (high risk) project during the approval process enforce discipline and assist in making cost/capability tradeoffs later?
- Has allowance been made (by overseas firms) for cost penalties associated with conforming to the requirement to enter into AII Programs and related Defence Offsets obligations?
- Have you taken into account what can be very extensive through life costs of all major and ancillary systems? There is a frequent failure to take into account all costs of a 'system', including accurate estimates of research and development, procurement, facilities, stock holding, training, test equipment and through life operating costs. Obviously, a lot of effort has to go into recognising downstream cost effects over a twenty year program, but costings frequently end up as 'guesstimates', sometimes involving 'contingency factor' loadings of up to 40 per cent being placed on them – 'cost garbage' in yields 'cost garbage' out.
- Have you made sufficient allowance for the long term nature of project financial commitments? Many things can compromise these estimates, including markedly different time/investment/activity streams, life of type and the varying natures of alternatives. Moreover, discount rates applied to compare the present value of alternatives assume unknown aspects of the economy

over a long time – five, ten, fifteen or even twenty five years. Also, restructuring project organisations to meet changing demands at different project phases often involves substantial cost and is often forgotten – just what should the project organisation look like in three years? in five years?

- What infrastructure is needed for the project, and what does it cost? Be very careful with this one, especially if facilities construction is involved. Serious slippage will occur if key facilities are not ready on time.
- Are you sufficiently aware of cost effective, alternative materials and production processes for your project? This may involve quantifying the premiums involved in using Australian materials and production processes to show that it is sometimes better to import materials and skills. For example, if building to an overseas design in Australia and Australian industry does not produce the appropriate grade of steel, is importing the appropriate steel more cost effective than 'tooling up' for a relatively small Australian metal production run? On the other hand, if the Australian steel is similar to the grade specified, you may be able to demonstrate that the Australian alternative works. Estimate changes in cost and performance relative to the overseas steel specification as a baseline, and determine whether it is worth switching to the local alternative.
- How old is the production plant and equipment of your potential contractors? Could significant additional fund injections be called for during the production process?
- Have you properly provided for training costs? – Do not forget to provide for the training of your own team, especially in skills to monitor contactor costs and scheduling?
- Were all travel and associated expenses factored into project costs? These include the requirement for regular, 'face to face' program management reviews with contractors.
- Is an Environmental Impact Study (EIS) necessary? If so, how much will it cost and how much time will it take? How much will this time *cost*? Similarly, have you taken into account possible discontinuity of resources eg. political 'hiccups', protest movements, rearrangement of government priorities and effects on budgets due to government change or economic downturn?
- Are slow approval procedures likely to affect costs? If so, what can be done about them?
- Is insurance available for parts of your project; if so how much does it cost and does the risk warrant the expense?
- What, if any, is the full life impact on project costs of royalties?

We can now look at the complexities of measuring effectiveness.

Measuring effectiveness

An *effective* choice is one that achieves an acceptable result or return as measured against specified requirements. Requirements are derived from objectives, and the degree of effectiveness is ultimately judged from the *extent* of goal achievement. If objectives are simple and obvious, effectiveness can be directly related to goal. For example, a better performing army boot can have measures of effectiveness such as comfort and durability which can be assessed by extensive trial. Both measures can be related back to infantry effectiveness, but even this has problems when trying to decide how much cost and effectiveness 'is enough'. While every effort should be made to make measures of effectiveness as simple as possible, effectiveness usually involves many variables which in turn may 'vary in the way they vary' from contingency to contingency. Also, attempting to measure effectiveness in dollar terms is not always appropriate and a high level of arbitrariness often exists in effectiveness comparisons between dissimilar options.

Effectiveness evaluation becomes much more complicated when we have to chose between, or decide on, mixes of markedly dissimilar sub-systems and integrate them to contribute to an overall goal. However, despite the multidimensional nature of measuring effectiveness and the frequent lack of common effectiveness denominators, very good methodologies for linking effectiveness and cost do exist. See, for example, the article by Dr S.R. Heller, 'On a Quantitative Expression for Cost Effectiveness and Its Use'.[1]

Project Effectiveness considerations

Carefully establishing and maintaining project objectives is critically important. The following self check questions reflect issues which should be borne in mind when considering effectiveness and performance specifications in the planning and implementation phases:

- Has the technological 'tail' been wagging the operational 'dog'? Are objectives starting to be exceeded at unacceptable cost?

Is what you or the user 'want' the same as what the user really 'needs'? Has the 'best' equipment or facility become the enemy of the 'good enough'? Beware of scientific theories in need of a project!

- Is appropriate technology being used, or is new technology used simply because it is there? What are the more conventional alternatives, and how do they perform against new technologies *at the cost margins*? For example, is it worth paying an 80 per cent premium for a 20 per cent performance enhancement?
- Is a 'first of class design', new system or new component really needed to achieve the *required* level of effectiveness? What problems exist with the use of any new materials and equipment, and have equipment interfacing difficulties been underestimated (as is frequently the case)?
- Are Departmental R & D personnel and resources really up to the task ? Can these people do the things they say they can do in terms of effectiveness? For example, is the level of design and analytical expertise available really adequate? Have assumptions and calculations been checked by independent agencies to guard against 'sloppy' in house analytical work which can have very expensive, long term consequences?
- Have you been 'gold plating' or over specifying requirements? How many components really need to be MILSPEC or *exactly* as specified by the manufacturer? Can you still achieve some project objectives by applying the 80/20 rule, and settle for perhaps 80 per cent of performance at a substantially reduced cost, especially if this means using materials and processes readily available in Australia?
- Have you set an appropriate time to 'freeze' design so change can be minimised?
- Is project definition sufficient? Have you produced adequate, unambiguous specifications and documentation to absolutely minimise later equipment modification and configuration changes? Are your specifications accurate and achievable?
- Have you developed a system to enforce CEA discipline of working out marginal effectiveness/marginal cost for all post contract signature change proposals?

Importantly, key members of a prospective project team should be involved in CEA at the earliest possible stage to gain an intimate knowledge of the project's aims and establish baseline evaluation, costing and acceptance criteria. Ideally, this should be as early as the Defence Force Capability Proposal (DFCP) Stage. Solid CEA, in the form of capability analysis, is essential in converting a good Strategic Concept (STRATCONCEPT) to a formal DFCP and, after endorsement, to a Major Capability Submission (MCS).

Capability analysis demands establishment of a 'baseline' by assessing the ability of current and programmed assets to carry out tasks in relation to strategic guidance. From this baseline proposed ways of boosting effectiveness and/or efficiency by adjusting the capability at the margins should be carefully measured. After all, defence capabilities are seldom completely new. Some significant capability exists in most areas and much of the time we are really proposing adjustments at the margins of current defence capabilities, that is, what happens to our overall capability if we buy a little of this equipment, or scrap a little of that? Also, capability shortfalls should show up during good analysis and DI(N) ADMIN 05-1,The Force Development Process AMDT 2, is an important guide in this kind of work.

Besides generating and involving elements of a prospective project team in the feasibility stages of a project – as opposed to leaving it all to 'boffins' in a separate area – staff changeover in the first few years of the project should be minimised. Project managers must do their utmost to carefully select and resource their team, train the team, develop a sense of 'ownership' and keep them together as long as possible. Project staff turnover can often be 40 per cent or more per year.[12] Certainly, in the early years of major projects, stability of staff is usually *decisive* in terms of long run project success. For example, the B707 Tanker and the Steyr Rifle projects experienced the adverse consequences of inadequate staffing in various phases. If the ideal situation of early involvement in analysis of alternatives is not possible, members of the project planning team should be thoroughly briefed on analyses to round out their knowledge of the project parameters and its goals.

The Systematic Planning Stage

The painstaking *process* of Cost Effectiveness Analysis should have yielded a thorough understanding of project cost and effectiveness baselines, practical difficulty and technical risk. The project team should know exactly what is wanted, why it is wanted, how it is put together and be aware of most alternatives. At this point, the key scheduling mechanics of the actual project plan can be worked out through the following 10 steps[13]:

1. Order major project objectives hierarchically. Make sure that senior management has been exposed to core issues, and communications links have been set up with interested agencies to get agreement with direction.
2. Divide project objectives into discrete activity phases, with each phase comprising groups of jobs aimed at achieving a major project objective. Work out the 'Who and hows' of each activity phase in terms of accountability and responsibility.
3. Identify intermediate objectives for each activity phase.
4. Identify inputs, outputs and processes for each intermediate objective. Consistently test assumed cause/effect relationships by asking: '....will input "A", acted on by process "B" *really* cause output "C" ?' style questions for each intermediate objective.
5. Identify significant secondary effects — for example, impact on government, private sector and individual activities.
6. Confirm the developing project plan with the other key 'players' and interested agencies. Make them aware of overall directions so as to minimise expensive changes or obstacles later in the process.
7. Identify and test key assumptions in the planned project model — use sensitivity analysis to determine the flow on effect of 'shocks'. Sensitivity analysis uses alternative assumptions about the values of key variables within the system to anticipate consequences. (Genuine contingency allowance can now be allocated to each risk factor, and reasonable cost estimates for the project should be pinned down even before going to tender!).
8. Develop key project evaluation questions for the life of the project.
9. Specify and explain key performance indicators to tenderers, to ensure the RFT carefully specifies the essentials. Note that you have now spent two or perhaps even three times as long as usual at the planning stage! Nevertheless, you should have a firm 'handle' on your project environment, and the time spent planning is likely to be less than the time spent in 'cleaning up the slippage mess' that could well have occurred later. Also, make maximum use of competitive pressures between tenderers/countries/agencies right up to contract signature if possible. Refer to the Submarine Project and FA-18 project contracting strategies in Case Studies 3 and 6, for example.
10. Negotiate contract.

Contracting and Contract Administration

.....Caveat Emptor – Let the buyer beware!

Some risk can, for a price, be deflected or transferred by contracting it to another party. The conduct of insurance is an obvious example of risk shifting for a price. Contracting out a particular requirement may also involve an element of risk shifting in that the contractor not only undertakes to deliver the goods to specification but also to absorb risks associated with the delivery. But this is only likely to work if the contracting firm itself has a level of control over the particular risks involved. For example, transferring risk to the contractor in the form of a fixed price contract for a high risk project can often involve either paying an exorbitant up front premium or the contractor cutting corners to achieve milestones with the minimum specification possible. Ultimately, responsibility for identifying risks and dealing with them so as to bring the project in on time, at cost and up to specification is vested in the project manager and his or her team. Working *with* the contractor to identify and deal with risk is prudent if not essential.

Ideally, relationships with contractors should be based on goodwill and a sense of partnership. This pleasant state of affairs is easier to accomplish if a clear vision of what you want can be communicated to the contractor and be supported by appropriate documentation. Adversarial relationships between project managers and contractors often arise from blame and misunderstanding because a common vision of requirement does not exist.

It is imperative to check that prospective contractors can do what they say they can do. Consequently, an intimate knowledge of contractor capability is needed as part of the tender process and a short list of contractors should have detailed commercial profiles built up on them. When doing this reliance should not be placed on data from the prospective contractor. An 'active search' process is needed where the project team visits the contractor and builds a commercial profile; the process of which is dealt with shortly. Commercial profiling could save the contractor time and effort spent on preparing tendering documents, as well as giving the project team an intimate knowledge of contractor capability and 'culture'.[14]

Intimate knowledge of contractor capability is especially important when tempted to go for 'industry solutions'. Beware of relying too heavily on 'industry solutions' or 'turn key' approaches which lead to difficulties, particularly when substantial developmental work is involved. This point was emphasised in the B707 Tanker project (Case Study 4).

Often, there is little choice of contractors and the situation can even reduce to a matter of choosing the lesser of evils. Sometimes, political imperatives leave little real choice in terms of contractor. Nevertheless, there are usually ways of mitigating the consequences of these situations through demonstrating a sound idea of a company's strengths and weaknesses. As emphasised previously, great care must be taken to ensure that the contractor has correctly interpreted your project requirements. Furthermore, looking in detail at a contractor's track record, technical capability, management information systems and management structure can increase understanding of the strengths and weaknesses of the people (contractors) who can make or break your project.

Building a Commercial Profile

The time spent on developing a commercial profile, the number of factors covered and the depth to which each factor is investigated will depend on the risk classification of the project, as well as the potential losses if things go wrong. Throughout this profiling process the project manager and his team must be sensitive to the balance between getting a good idea of what the contractor's capabilities are, and the need to avoid dictating to the contractor how to conduct business. The first step in building a company's commercial profile is to define the *company's track record* and establish a *current capability baseline*. The following self check questions may help focus investigations:

Track Record

- Has the company previously delivered what it promised? If not why not? Determine from customers whether the company has consistently been able to deliver within budget, on schedule and up to specification. Document significant cases of poor interaction with clients, as well as conspicuously successful interactions and the reasons for them.
- Have you *seen* and evaluated the company's products and workmanship? Compare these aspects with those of its competitors.
- Is the outfit cleared to relevant quality standards in all respects? Are there any deviations in compliance?
- What do sub-contractors say about the company? Are Prime Contractor/Sub Contractor communications and working relationships good?
- Does the company have a good industrial relations record? Have previous industrial disputes led to major cost overruns, schedule slippage and changes to working conditions? Is this pattern likely to continue? Some may argue that this is 'their business' but when industrial problems may impact on your cost/schedule/performance requirements it becomes your business.
- Are there any examples of dishonesty in pre tender estimates? Intentional omission and underestimation of costs can occur to obtain a contract. Has a detailed and impartial check been made for omissions in estimates?
- What do competitors say about the company?

Technical capability

Technical capability must also be looked at carefully while developing the commercial profile:

- Does the company have depth of practical technical experience in dealing with a project of this type? If so, in what specific areas? What are the company's technical weaknesses?
- Does the company have a limited understanding of and inexperience in catering for defence requirements? If so, this can lead to underestimation of project complexity and inaccurate assessment of the difficulty and duration of task.
- Is the company's Quality Assurance (QA) system adequate?
- Ask for key job descriptions and interview selected personnel in those positions

Management Information Systems (MIS)

- Does the company have the ability to formulate a comprehensive task plan; are satisfactory and compatible networking/reporting techniques being used by the contractor *and* your project ?
- Are company scheduling approaches realistic?
- Does comprehensive milestone reporting exist? Establish whether or not there is a record of late issue of important management reporting documents.
- Does the company have a systematic cost/schedule project performance monitoring system such as CSCS? How good are the cost estimating skills available?
- Does a low level of ability to monitor sub contractor performance exist?
- Is there a shortage of project management resources? If so, is there sufficient access to management assistance ie. *good* consultants?

Contractor Management Structure

After establishing the company's commercial track record and technical/tracking capability, the next step in building the profile is to examine the contractor's management structure. Identifying areas of underdeveloped staff management skills is important at this point. In particular, look for indications of historically high staff turnover and lack of management continuity. Also, determine whether recruiting difficulties and delays have been evident and if any reductions in staff ceilings appear to have seriously affected performance. Other questions to ask and get answers to are:

- What is the company's corporate management philosophy, if any? For example, does the firm apply Total Quality Management principles? Are Process Action Teams used systematically and seriously?
- Is the proposed project management structure appropriate? Are company approval processes overly cumbersome and time consuming, and are project managers given sufficient autonomy and authority?
- Are you dealing with a consortium as opposed to a single company? If so, how quickly was it 'put together' and what sort of interfacing problems are likely to emerge?
- Are there competing project demands? Is the company spreading itself too thin?
- Does the company have a deteriorating financial position? How old is its key plant and equipment? Under *some* circumstances ask to check the books!

Twenty Contracting Tips

The following self check questions may help avoid some common contracting oversights:

- Have tender specifications been adequately written and oversighted? Double check using trusted and experienced people from outside the project.
- Are schedules and contractual constraints realistic? Do you really understand company business and pricing policies sufficiently to effectively negotiate and evaluate?
- Is the contract unnecessarily complex? Can your team really supervise and monitor it?
- Have enough incentive provisions been included?
- Did you incorporate appropriate penalty clauses, especially against late delivery and failure to adhere to Australian Standards? Balance these with reasonable, excusable delay clauses.
- Have you emphasised the submission of satisfactory progress reports? Has the methodology and frequency of presentation been specified and agreed on?
- Is the requirement for regular, 'face to face' program management reviews written into contract?
- Have you included implementation of a tailored QA management program?
- Did you read and 'cost' the 'fine print' in the warranty? For example, will you have to take equipment back to the country of manufacture to get particular kinds of maintenance and servicing work done?
- Have you agreed on intellectual property rights while competition for the contract is still 'hot'? In general, emphasise access rather than ownership.
- Have you finalised Australian Industry Involvement agreements before placing any FMS contracts?
- Is adequate allowance made for the likely volume of design changes?
- Have both parties set an agreed time for notice pending contract change proposals?
- Is there a mutually agreed provision for resolution of contract disputes built into the contract? For example, who will arbitrate if the production package is not seen to be in accord with original specifications?
- Has a high level of cost visibility for contractor activities been made an essential criterion for moving forward to contract in a sole sourcing situation?
- If the project is 'international', has the impact of local procedures and customs been identified and understood during the project planning stage?
- Have you taken into account, and hedged against, possible interruption of the project in terms of discontinuity of resources? For example, withdrawal of staff or budget reduction as a result of rearrangement of government and defence priorities, (possibly due to government change, economic downturn or a rationalisation like the 1991 Force Structure Review)?
- Have you checked all licenses and patent rights?
- Has adequate provision been made for contractor involvement in trialing and testing of the product?
- Are satisfactory contractual mechanisms in place for remedial action to be taken if the product fails trials?

With construction/production contract(s) signed, project implementation begins.

Implementation

Put your faith in God, but keep your powder dry!

The Implementation Phase involves production, trials and evaluation. The following 10 actions are of critical importance during this phase:

- MAINTAIN the aim of your project. Avoid using unspent contingency allowance as a 'slush fund' to enhance capability and change the project's scope. A project manager *cannot* decide on an increase or decrease in an approved military capability, a change in number of prime equipments or a shift in the concept of operation for the required capability. Contingency allowance should be used only against the project element for which it has been provided, and if a change in scope is needed, Project Approval must be gained before any contingency can be used.
- MINIMISE change to specification: Avoid 're-engineering' the project requirement. Force those responsible for post contract signature change proposals to quantify costs and benefits for each important choice as far as possible. Any approved change should show a clearly advantageous ratio of marginal effectiveness/marginal cost.
- IDENTIFY sufficiently experienced people who can overview the net effects of all individual configurational changes on a net impact on total performance basis.
- CONSOLIDATE a strong, centralised project team that is largely independent of resources from elsewhere within the Department. Make sure team members have the authority to make decisions on as many technical matters as possible.
- CONDUCT regular, 'face to face' program management reviews with the contractor.
- COMMUNICATE with the end user, especially to glean feedback on ILS.
- FIGHT the temptation to automatically source all ancillary and support equipment from the platform/equipment supplier. Sometimes, articles like test equipment can be far too expensive, and one should undertake a cost effectiveness analysis to determine if it is better to source elsewhere, or even undertake 'in house' design of *some* support equipment.
- RESIST deferring ILS acquisitions as the project progresses. It can be difficult to get them back.
- RESTRUCTURE the project organisation to reflect the project's changing environment. Difficulties can arise if project organisations are not restructured to meet changing demands at different project phases. Beware of drifting into an overstaffed situation involving the risk of talented people 're-engineering' the project to keep occupied and look impressive.
- DEVELOP a comprehensive project 'wind up' or transition plan.

Production

Depending on the size and nature of the project, it is important to have good On-Site Quality Assurance (QA) team representation, either permanently as with larger projects, or on a rotation or even short visit basis in the case of smaller projects. Quality assurance is not only concerned with the production phase, QA provisions should be in place during the design phase as well. Furthermore, whenever possible, quality and progress monitoring efforts should be integrated rather than being treated as separate functions.

The QA Team should be able to work with the contractor(s) to ensure that:

- inadequate or ambiguous specifications are eliminated;
- new procedures are adequately distributed to the workforce;
- calibration techniques, equipment and personnel are up to standard and checked regularly, that is, calibrate the calibrators!;
- approval processes are minimised by shortening departmental decision making time;
- mixes of specifications are not used;
- contractor/sub contractor work sharing arrangements are efficient;
- adequate contractor staffing arrangements remain in place to ensure contract specifications are met;
- changes to key personnel are monitored;
- recruitment delays are minimised;
- the weight monitoring system (where applicable) is adequate; and
- purchase order processing time is minimised.

It is also important to remember that, if the product is found to be compliant but you do not like the way it is developing, then there is no choice but to amend the contract to change/clarify the requirement. Efforts to

persuade contractor staff to make specification changes 'under the counter', as it were, must be deterred. This could easily lead to recriminations and damages claims if the project gets into trouble.

The On Site QA representation should also take steps to ensure that configurational modifications and specification changes at relatively short notice are minimised. They must also ensure that the 'follow on' effects of all configurational changes have been traced on the basis of net effect on *total product performance*.

Trials and Evaluation

The moment of truth has now arrived. Cost and schedule now become almost irrelevant and it is necessary to prove that the unit built comes up to specification – that it can actually do what it is supposed to do. The following self check questions should have been considered during the detailed planning phase.

- Are you using sufficiently experienced people to trial and evaluate?
- Have you made special time and conditions allowances for first of class or prototype testing? Disproportionate savings in both time and money are likely to arise in the long term from objective, statistically valid production trials. Properly conducted evaluation tests and trials will cost time and money in the short term, but are essential in proving to the end user that he or she is getting what he or she needs. See, for example, the consequences of the Army's initial failure to adequately production trial its Austeyr Rifle (Case Study 2).
- Are satisfactory contractual mechanisms in place for remedial action to be taken?
- What problems can be anticipated for operators due to unfamiliarity with product type? Have you ensured that the end user or operator is sufficiently well trained? Otherwise he or she will not get the best results from the equipment. Make extensive use of 'quality assured' mobile training teams, training videos, wall charts and inserts in service/departmental news papers, bulletins and journals.
- Are training courses properly developed, documented, resourced, quality controlled and validated? Build these substantial costs into the ILS budget.
- Are all construction, maintenance and operation publications available? Are they sufficiently user friendly and written in English?
- Is an adequate test and repair facility equipped and available?
- Has sufficient stock, spares and test equipment been ordered in advance of requirement? Pay particular note to likely close down times of foreign production lines, and bear in mind that you may need to keep your product going many years after parts production ceases.
- Has all warranty/guarantee information been received, checked and agreed?
- Is an appropriate outstanding action and defect reporting system in place?

Conclusion

Defence project management involves a host of diverse activities, usually conducted over a long time, that should deliver a specified product to a user on time and within budget. Furthermore, an outstanding defence project ensures high performance and availability of the product throughout its operational life.

Successful project management involves doing as many things as possible 'right', but of equal importance is the need to minimise the number of things that can go wrong. There is much in project management literature and Departmental guidance covering correct processes and how to properly go about managing projects, and this article offers some additional guidance on doing things right. However, the article has focussed on the 'other side' of the project management equation that involves minimising mistakes and oversights, with the objective being to eliminate avoidable risk.

This article offers practical pointers on risk reduction in defence projects. Pointers focus on anticipating causes of cost/schedule/performance problems in four key project phases: initial risk assessment, planning, contracting and implementation. Probably the single most important pointer in reducing risk of cost/schedule/performance variation in projects is to minimise change during the Implementation Phase of your project. However, minimising change during the implementation/post contract signature phase is contingent on a disciplined and comprehensive project plan that has worked out 'up front' just what the product is supposed to look like, how it is going to be put together and what is needed to put it together. Two factors are critical in planning: First, the ability to *anticipate* which stems from the project team developing a solid baseline of corporate experience of the product type. Second, the consistent use of systematic, cost effectiveness analysis to fully define the scope of the project; consider alternative solutions, understand technical limitations and risks and identify tradeoffs. CEA yields an early, comprehensive understanding of the cost and effectiveness dimen-

sions of the project environment. This detailed understanding gives the best possible basis for assessing tenders and designing and administering contracts by generating solid evaluation and monitoring capabilities. Consequently, achieving this depth of understanding in the project planning phase could take as much as three times longer than has generally been considered appropriate in the past for high and medium risk projects.

Comprehensive planning sets the benchmarks – the comprehensive cost and performance indicators that can improve contracting, monitoring, evaluation and managerial response to contingencies throughout the project. But levels of planning and project resources are determined by initial risk assessments. An initial risk assessment should identify and expose core issues early, as these are important guides for designing the project organisation, that is, selecting numbers and types of project planning staff together with the resources needed to get the project off the ground. Risk assessment is also instrumental in an early decision on key inter-agency links that need to be built up to facilitate the project in the long term, particularly in rendering advice and reducing obstacles.

An appropriate planning phase gets the specification right so that less 'holes' will appear in the contract. However, contractors can make or break your project despite the best planning and organisation from 'your side'. Consequently, you must know clearly what your contractors can and cannot do. This involves developing comprehensive commercial profiles of the firms you will have to count on to minimise slippage and cost overrun. Solid commercial profiles enable you to understand your contractor's strengths and limitations. This can help establish an informed and professional basis for genuine partnership in overcoming problems.

With contract signature the implementation phase begins and, above all, you must avoid 're-engineering' the product and changing specifications. Force those responsible for change proposals to quantify costs and benefits for each important choice as far as possible by proving marginal effectiveness/marginal cost advantages for all post contract signature change proposals. Arguments for significant change should be looked at on an 'impact on total performance' basis, and identification of who is overviewing the net effects of all individual configurational changes is critical.

Once the product is ready for evaluation, rigorous trials must prove that it performs to specification *and* expectation. Just having the working product does not guarantee that it will be used to anywhere near its potential. Importantly, project managers must have a plan for 'selling' the product to the end user and developing high confidence in it. The end user should be well trained and examined in formally documented courses and not in casual 'acquaint' sessions, otherwise, he or she will never get the best results from the equipment. This highlights the common mistake of neglecting training aspects of ILS in the planning phase and focussing only on the prime equipment.

Finally, the project should be systematically 'closed down'. An important part of this process is to ensure that a short, frank and readable Project Completion Report is added to Defence's 'corporate memory', so that other projects may benefit from your experience and success!

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Notes

1 See Hassen, N, 'Effectiveness – Is it the Forgotten Objective in Project Management?', Department of Defence *Project Managers Bulletin*, Issue No 11, March 1994; pp.4-8.

2 Linard.K and White.A, 'Project Management in Public Administration: Integrating Policy and Process Management with the Management of Projects', a paper presented at the INTERNET (International Project Management Association) 1992 Conference, ' Project Management without Boundaries' in Florence, p. 7. This paper is available from the Department of Civil Engineering, Australian Defence Force Academy, Canberra.

3 See Annex B, Chapter 2 of CEPMAN. Contingency allowances should be specific provisions for unforeseeable costs within the Project Scope, and are especially important where previous experience of relating estimates and actual costs has shown that unforeseeable events which increase costs are likely to occur.

4 'Earned Value' is a key concept used in Cost Schedule Status Reporting (CSSR – see Australian Defence Standard DEF(AUST) 5658). Earned value aims at an accurate expression of the critical linkage between cost and effectiveness in projects. It is also known as BCWP (Budgeted Cost For Work Performed).

5 Fixed price contracts were considered reasonably safe in the 1980's but are less attractive now. Contractors will often take shortcuts with time and quality, causing long term slippage. The cancelled US A12 project, for example, reflected this problem. Also, less visibility of cost often exists for the buyer. Cost incentive type contracts are now looked upon as lower risk in some quarters.

6 Substantial padding out of cost was arguably unavoidable in the New Submarine case during the mid to late 1980s. The contract was signed on a *fixed price* basis in June 1987 only one year after a major investigation comprehensively detailed the parlous state of defence project management (see footnote 8). A very poor infrastructure and skills base existed with which to take on this demanding project that had to be undertaken in Australia.

7 Baumgartner; *Project Management*; p. 15.

8 Joint Parliamentary Committee on Public Accounts, Report 243, Review of Defence Project Management (AGPS, Canberra, 1986). Referred to as JPCPA 243. The Committee selected sixteen major projects provided by the Department of Defence plus the JINDALEE project managed by DSTO. Note that the comprehensive Department of Defence 'Costs of Tendering Survey' (AGPS,1994) stated that one of the main reasons given by companies for failure while tendering for defence work was that defence criteria were neither clear nor prioritised. Moreover, the survey suggested that the Department made use of inappropriate and onerous contract terms and conditions, together with long and unpredictable tender evaluations (and other processes). These problems and others are reminiscent of, or stem from, the key problems described in JPCPA 243.

9 Helen Mayer MP, Chair of the Sectional Committee on Defence Project Management at the time of the review, gives a good summary of the report in, 'Management from a Civilian Point of View', *Journal of the Australian Naval Institute*, Vol 12, No 4, November 1986; pp. 29-32.

10 Key references on cost effectiveness analysis are detailed in the bibliography.

11 For example, readers are referred to the excellent article by Heller, where the author explores the dilemma of comparing quantitative costs with often qualitative effectiveness and develops a simple and practical method for relating the two. S.R. Heller Jr, 'On a Quantitative Expression for Cost Effectiveness and its Use', *Naval Engineers Journal*, February 1973; pp. 70-74.

12 Linard and White, op cit; p.2.

13 Adapted from ibid, pp. 5-6.

14 Costs of tendering can be high (see Chapter 3 and also Thompson, D. 'Cost of Tendering – Industry Survey', *Project Managers Bulletin*, Issue No 11, March 1994; pp.17-18 which outlines several reasons for high costs and difficulties experienced by firms in responding to Defence's demand for tendering information). Project team assessment visits could reduce the paper work burden. Of course, visits would have to be systematic and on 'equal time'/identical agenda basis.

Doctrine — Issues for the RAN

(From page 14)

An important point about these publications is that they are produced by a USN/USMC command and therefore tend to project a dual Service rather than joint image. However they describe the application of sea (USN), air (USN/USMC) and land power (USMC/USN) in maritime operations. For most other countries, therefore, they describe operations that are joint, but without the need to address some of the complications of interservice command, control and communications.

Reorganisation of the NWP System

NDC is also setting out to rationalise the large body of tactical doctrine contained in NWPs. The intention is to reduce the number of publications from over 700 to about 360. As in Australia, this is an indicator that there is little shortage of tactical level doctrine. Rather, the problem is to keep this doctrine current and usable by eliminating unnecessary duplication.

Multinational Naval Doctrine

NDC is also working in conjunction with NATO sources on the production of doctrine for multinational naval operations. At the tactical level this is taking the form of the development of unclassified Experimental Tactics (EXTACS), available for general release, based on existing NATO doctrine. Specific areas include manoeuvreing, search and rescue, replenishment at sea, helicopter operations, communications and exercises.

NDC believes that there is also a need for an operational level capstone publication to head this series of documents, and is presently developing a draft. This publication will be aimed primarily at navies that are not used to operating regularly together, but which may contribute forces to an ad hoc coalition. Additionally, both NATO and the US are producing joint/combined publications to guide the conduct of multinational operations, including those that are maritime in nature. While all these publications are aimed at slightly different audiences, there is a high degree of commonality in the content.

Concept and Tactical Development

NDC is also developing new naval concepts for the employment of forces in the future, which may eventually form the basis of new doctrine. They are also developing new tactical level doctrine, such as for the Tomahawk system.

Training and Education

Lastly, doctrine command is putting a lot of effort into incorporating this material into the naval training system, including development of a modelling and simulation strategy and refining the Navy lessons learned system. This work does not have a high profile, but is vitally important. No matter how many doctrinal publications are produced, doctrine is ineffective unless it is widely understood, so it must be covered in the education and training system. Well trained and educated personnel also produce a long term benefit; if they have a good understanding of their doctrine they are well equipped to improve it, rather than ceding the field to a small number of specialists.

Lessons for the ADF and RAN

One observation that can be made about USN doctrinal development is that the RAN is already working in all these areas to some degree. A comparison of US and ADF/RAN doctrine suggests that our present hierarchy of publications covers much the same areas as US doctrine. For example, the contents lists of the NDPs reveals much subject matter that is already addressed in the ADFPs; what differences there are will be further reduced with the publication of ADFP 18, Joint Maritime Operations. This suggests that the ADF/RAN has no major doctrinal shortfalls to rectify, at least that ongoing work will not cover. It also suggests that there is no need to mimic the structure and organisation of USN doctrine. Doctrine should parallel the structure and organisation of our forces, and current ADF/RAN doctrine already does this.

On the other hand, there is much to learn from the content of US doctrine. The USN is putting a lot of effort into doctrinal development, and the output of this work should be of great interest to the RAN from two perspectives:

a. It may provide lessons that should be incorporated into our own doctrine.

b. As our most important ally, USN doctrine directly affects our ability to work together.

DEVELOPMENT OF ADF/RAN DOCTRINE

The foregoing suggests that questions of the structure and form of ADF and RAN doctrine, and the organisation necessary to develop it, have already been largely resolved. The questions that need answers therefore relate to the content of our doctrine. There are three areas where RAN doctrinal development efforts should be focussed.

Maritime Doctrine

There is no requirement to develop new RAN single Service doctrine such as the USN NDPs; the proper place for such doctrine is in the ADFPs. Doctrine in this form is more likely to be accepted by all three Services, promoting a better understanding of the factors driving the employment of all ADF assets. The RAN, and the other Services, have a very important role to play in influencing the development and content of these publications. RAN input is shaped by RAN officers at the ADFWC, by Navy Office and Maritime Headquarters reviews of the ADFPs, and by the work of the MSP. Additionally the RAN now has access to the work of USN Naval Doctrine Command and the Canadian Forces Maritime Warfare Centre through the new liaison officer positions there. There is, therefore, no shortage of doctrinal material available to the RAN and ADF, but coordination of all the potential sources and inputs will be an ongoing task.

Doctrine for Multinational Operations

RAN interoperability with our traditional allies is good, due to shared doctrine and a considerable degree of equipment commonality. However, our ability to operate with other regional navies is significantly less well developed. In the doctrinal area, interoperability is hampered by lack of common publications, and by different change status on those publications that are common. The problem is particularly pronounced in multilateral rather than bilateral exercises, due to a regional predilection for bilateral military relations. Given the increasing focus on coalition/multinational military responses to crisis situations under the auspices of the UN or regional organisations, and our policy of strategic partnership with the nations of South East Asia, there is plenty of scope for doctrinal development in this area, from both a regional and international perspective.

In the field of multinational naval doctrine much work is already going on, at least at the tactical level. The unclassified EXTACS presently being developed by the USN and NATO have the potential to provide a common basis for multinational naval operations around the world, and reduce the number of publications presently in use as a result of different bilateral arrangements. At the operational level, similar work is proceeding in both NATO and the USN. However, this work has a rather Eurocentric basis, and may not take into account regional sensitivities.

RAN input to this work would be most useful, providing an Asia/Pacific rather than a European perspective. The RAN can also encourage coordination between international and regional doctrinal developments. Finally the RAN can encourage the process and give it additional credibility by taking an active role at the International Naval Symposium, and in other high level discussions with other navies.

Doctrine, Training and Education

Doctrine is only useful if it is widely known and understood within the organisation. At present RAN personnel are well trained in tactical level doctrine, but higher level training and education is less certain. Those officers who attend RANSC are exposed to RAN and ADF strategic and operational level doctrinal thinking, although the ADFPs are not strongly emphasised. Those officers who receive joint training at the ADF Warfare Centre do receive training in the ADFPs, but without a strong navy emphasis. There is scope for the RAN to emphasise the ADFPs more in its single Service training, both to increase the exposure of all RAN officers to our maritime doctrine and to familiarise RAN officers with the whole range of ADFPs, improving their knowledge of the other Services and joint operations in general.

CONCLUSIONS

The issue of doctrine has attracted increasing attention in both the RAN and USN recently. Neither navy has been completely comfortable with the concept, and the argument is sometimes advanced that navies have never had, and do not need doctrine. This is quite wrong; both navies have always used doctrine, although not necessarily promulgated in authoritative publications. To be most useful, therefore, doctrine must be defined broadly to include formal and informal, written and unwritten guidance at all levels of war.

The RAN uses a wide variety of single Service and joint doctrine, much of which is, or has developed from, RN/USN/NATO doctrine. Joint doctrine is developing fast through work at the ADFWC and MSP. A comparison of work in Australia and the US suggests that existing ADF and RAN organisations are already involved in much the same areas as the USN. The hierarchy of ADF/RAN doctrine that has been created reflects ADF organisation, and suits the way we are likely to employ our forces. This leads to two significant conclusions: fears of major doctrinal shortcomings in the RAN are largely unfounded, and there is no need to change the structure of ADF and RAN doctrine.

There is, however, plenty of scope to develop the content of our doctrine, and work being done in the USN should certainly influence our thinking. The RAN should continue to provide an input to the development of the ADFPs to fill maritime doctrinal voids as they are identified.

There is also an increasing need for multinational

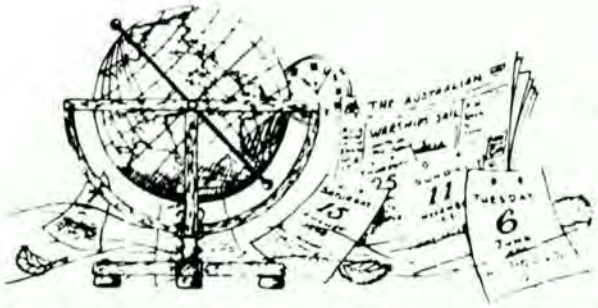
doctrine to facilitate the operations of ad hoc naval coalitions. Such doctrine is being developed in several places, and Australia has a role to play, particularly in encouraging the coordination of efforts around the world so that the doctrine from different sources remains compatible. In this regard it is in Australia's interest to support NATO/USN work in the field, as this doctrine is already closely aligned with our own.

Lastly, there is a continued need to sell doctrine to our officers. Single Service doctrine is already well covered, but we are not focusing sufficiently on the excellent material in the ADFPs. These have wide single Service as well as joint applicability and should be emphasised as an important part of officer training and education.

The conclusions of this essay may seem 'steady as she goes'. It is true that no major changes in the RAN's current approach are required. However this belittles the task ahead. The production of current, useful doctrine that is well understood throughout the RAN and ADF is a major task that merits close and continuing attention.

Notes and Acknowledgements

1. The views expressed are the author's alone. The author would like to acknowledge the contribution of Dr James J. Tritten of USN Naval Doctrine Command. While his work has not been quoted directly, it has significantly influenced the general discussion of doctrine in this essay.
2. ADFP 1, Doctrine, p 1-1.
3. ADFP 101, Glossary, p S-14.
4. Ibid, p O-3.
5. Carl A. Summers, *On Strategy*, Novato, California: The Presidio Press, 1982, p17.
6. ADFP 101, op cit, T-2.
7. *Defending Australia*, Defence White Paper 1994: Australian Government Publishing Service, Canberra.
8. Strategic Review 1993, Robert Ray, Minister for Defence, Canberra, December 1993.
9. In the US context, 'naval' means the US Navy, US Marine Corps and, when under Navy operational control, the US Coast Guard. Naval Doctrine Publication 1, Naval Warfare, US Government Printing Office, 28 March 1994, p 6.
10. Department of the Navy, *Forward...From the Sea*, Washington, D.C., September 1994.
11. SECNAV Instruction 5450.16, Naval Doctrine Command, 25 September 1992.



I was there when...

KOREA

It was during the Korean War. The young aviator was sitting in the Bridge Mess of *HMAS Sydney* telling his Air Group Commander (the late Vice Admiral Sir Michael Fell KBE DSO DSC) how the mission he had just flown had been a failure due to the lack of a gyro gun sight (GGS) picture. The SBLT explained how he had found after starting up that the GGS was not working and how he had checked all his switches and had even changed the bulb without success. As time did not permit the "Greenies" checking the system, he had decided to launch with the sight U/S. In any case it wasn't used for low-level bombing and they hadn't found much to strafe recently.

The SBLT went on to tell his Air Group Commander how it was just his luck that the Flight had come across some Chinese troops in the open "All I could do Sir, was to point the nose in their direction and spray–it's a pity my gun sight wasn't working–we will have to sharpen up the "Greenies" on their maintenance."

Just then there was a knock on the door and a Petty Officer "Greenie" enquired for the SBLT –"We found out what was wrong with your gunsight Sir". The SBLT feeling that the Air Group Commander was giving him a sympathetic ear, gave the Petty Officer his views on the current maintenance standards and at the end enquired as to who had been responsible for his lack of a gunsight that morning.

The Petty Officer waited patiently until the SBLT had finished–"I don't know about all that Sir, I only came to tell you that the cockpit brilliance control was turned right down".

N.E.L.

VIETNAM

I was there on the bridge of *HMAS Sydney* in Vung Tau harbour, South Vietnam, with the ship about to leave on the return passage to Sydney; after what had become an almost routine operation, the dis-embarkation/embarkation of about 1000 troops and their equipment.

Throughout the 9 hour stay, the ship and the immediate vicinity had been a hive of activity, the large Chinook helos landed on and discharged their load of combat weary but happy soliders, and in a very short space of time were on the way back to shore with an equal number of fit but slightly apprehensive replacements.

The possibility of attack by under-water swimmers provided the main enemy threat and as a defensive measure the ship's force of swimmers carried out a constant surveillance whilst the trooping operations were being conducted from the flight deck.

With the ship about to weigh anchor and the last ship's swimmer on deck, a U.S. harbour patrol craft sped past broadcasting a loud hailer message to clear the harbour ASAP, because enemy swimmers were known to be in the area. The Captain's voice reflected the need for more urgent action by the ship's company as he gave the order to weigh. At almost the same moment, the bridge phone rang and the caller reported that the Engineer Officer of the Watch, in the midst of his rounds of the lower spaces, could hear a loud ticking just forward of midships on the hull below the waterline.

Though of vintage years, the *Sydney*, commonly known as Port Jackson/Vung Tau ferry, was an attractive target and this was undoubtedly in the Captain's mind as he gave orders to prepare for a search of the ship's bottom.

In the process of quickly making my way aft to the chart house, I asked the Captain to stay his order to the ship's swimmers. After the Echo Sounder had been switched off, the EOOW was requested to check again for a ticking noise. Thankfully, that was the finish of the *Sydney's* "bomb scare", it being the first occasion that this particular EOOW had carried out rounds with the ship at special sea duty stations.

L.G.F.

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