DEFENCE FORCE JOURNAL

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WRAAF Aircraft Plotters at work at RAAF Base, Williamtown, New South Wales.

(Defence Public Relations)
THE replies to the questionnaire have been encouraging and helpful. As each ship and unit has presented the answers in a different way, no accurate statistical summary can be made, but general trends can be deduced and many helpful and constructive suggestions followed up.

The Board of Management is most grateful to Commanding Officers and to all those who helped to compile the replies, for the time they gave and interest they showed.

The main criticisms of the Journal seem to be: a feeling that the work is being "censored"; drabness of presentation; lack of lively debate; and bad distribution.

Let me take the points up one at a time. Firstly I should like to state categorically that there is no censorship of content. The only criteria for not publishing work as presented are: that the style is too stilted (eg. like a military operations order); that the English is past saving; that there is a direct and possibly libellous criticism of a named individual—any publication would jib at that. If there are small problems—I am not sure if a stated fact is correct or I think a phrase is too ambiguous, I get back to the author and query the point.

As a retired serviceman of twenty-six years service, I am well aware of the problems associated with the extra-curricular work required to produce an article, particularly when a watchkeeper in a small ship at sea. But the old maxim holds true: "If you have something you want done, ask a busy man." So, don't be discouraged. Send in your work, but please, to save time, take a look at a few articles and analyse the sort of style which fits into the Journal. This holds true of any journal or magazine you want to submit work to.

As far as drabness of presentation is concerned, I must accept sole responsibility. As a one-man band I do all the make-up and subbing. What is required is more space. Most people feel the Journal is about the right size at present, and I agree, so only if we went to a monthly issue could we start to solve this problem. But the use of colour, space and other improvements costs money, and that is another problem these days.

Lively debate can only come from you. I offer a few suggested subjects which you have put forward in the answers to the questionnaire—there are many more: Integration of the Services; Counter Terrorism—the role of the Defence Forces; the Serviceman in Society; Australia in the SE Asia and South Pacific Regions; the problems of the 200 mile EEZ; Self-sufficiency. What does it entail?

Lastly, distribution is so bad that I wake up at nights screaming. Although it is outside my sphere, I am naturally anxious that the Journal gets to you, the reader and potential writer as soon as possible. That a lone Australian in a far flung outpost of Empire does not get his copy early is understandable, if not entirely tolerable, but that a branch in Russell or a unit in Melbourne, where the Journal is printed, fails to get copies in good time is unacceptable. If you are one of those unfortunates, then please let me know, naming, if possible, the source from which you should be getting your copies.

We have a number of back issues available here; but we are short of copies of issue No. 4 (May/June 1977). If anyone knows where there is a cache, please let me know.
LEAD TIMES FOR WEAPONS — AN EXPERT VIEW

After reading in “Editor’s Comment” of your frustrations and hope for some debate on the articles in the January/February issue, I decided to respond to your appeal.

I was most impressed with the article by Lieutenant Commander Speedy on “The Trident of Neptune” as this is the first occasion that I have seen the material used in the chart and tables brought together in this way.

I am unable to make any contribution to the discussion on strategy but having been directly involved with a number of the World War II projects listed in his Table 4, I am well acquainted with the total project time problem and can understand the relationship with perception and warning time.

In July 1959 I wrote an article for the Australian Army Journal on “Some Problems of Industrial Mobilisation” with particular reference to the production of the 2 pdr. and 6 pdr. A.T.G.s as well as the 18 inch aerial torpedo. In an earlier talk to the United Service Institution of Victoria I also included the Polsten 20 mm MK. I A.A. gun. I used a chart with my talk to relate the development period and rate of production for the various guns to major events of the war which resulted in many changes to the programs.

Emphasis was given to the lengthening of the total project time as more items of service equipment were needed when factories were already heavily committed to a number of projects and I quoted from a speech made by the U.K. Minister of Production who said:

“In the future it may be of greater importance to have a few of the latest weapons very quickly than to have a bulk of the same weapons a few months later. I would ask whether in certain cases some halfway course cannot be followed.”

I also referred to the loss of flexibility and inability to adapt to changes in requirements with a mass production program particularly where special tools and equipment are involved.

For those interested in reading further on the problems encountered by industry I would recommend “The Role of Science and Industry” (Vol. V of series on Australia in the War of 1939-1945) by D. P. Mellor. One quote refers to the torpedo I have already mentioned:

“All too often by the time the materials for a project had been ordered and the administrative organisation set up, the manufacturing capacity assembled and the technological difficulties overcome, the need for it had passed. . . . It is perhaps something of an anticlimax to have to record that Australian made torpedoes were never used in action. Even before the torpedo had come off the assembly line the tide of battle in the Pacific had turned . . .”

I fully realise that the emphasis in Lieutenant Commander Speedy’s article is in relation to the probability of reduced warning time and the need for adequate equipment being available in advance which would provide a basis for expansion. He then sounds a note of warning that “although Australia produced much of its own equipment during World War II, whether or not this could be repeated in the context of present or future technology is open to question”.

As I wrote in my earlier article in 1959: “If ever there was another war, it is obvious that the problem will be quite different and made much more difficult because of the technological advances in many fields. It may well be a problem of first mobilising the technical staff to deal with the production of specialised equipment and again time would be the big factor”.

In the 19 years since I wrote the article mentioned I have become much more aware of the speed of changing technologies and realise the widening of the gap between today’s sophisticated equipment for the services and that being manufactured in Australia.
This in itself could present problems in the local sourcing of equipment requirements and as mentioned in Lieutenant Commander Speedy's article: "War goods do not exist in quantity and as evident in Australia even the facilities required to produce them 'en masse' are not available".

There is of course another problem coupled with any desire to reduce the time span from what is considered as the first indication of impending war to the availability of locally produced new equipment. I refer to the decisions that would need to be taken to order equipment and then start to mobilise industrial resources. Our record in 1939/1940 would not be a good example and I quote again from Mr. Mellor's book:

"In the first few months of the war a curious situation arose whereby some government munition factories having then been brought up to their full capacity were faced with the possibility of not having sufficient orders to keep them going. . . . For a time the government factories did produce a surplus of some items. . . . Early in 1940 Jensen (Assistant Secretary, Departments of Supply & Munitions) began to press for more orders from the services because he knew that unless there was sufficient notice of requirements it would be impossible promptly to meet demands for new kinds of intricate weapons. . . . The time lag, inherent in the mass-production technique, was not always fully appreciated by members of the services."

A reference to the lack of work for the government's munition factories as well as for the private munition annexes some six months after war had been declared is made in Geoffrey Blainey's book "The Steel Master" (a biography of Mr. Essington Lewis who was Director General of Munitions during World War II).

I must emphasise that there were special circumstances attached to the project time of 9 months for the 2 pdr. A.T.G. which could be misleading in judging the relationship for such a project with perception and warning times. Part of the story is covered in the book "Big Wheels and Little Wheels" by Sir Laurence Hartnett who was Director of Ordnance Production under Mr. Essington Lewis. Perhaps we need some of the vision associated with the formation of C.A.C. and the building of aircraft which is also described in the same book.

I would also like to add that in giving any consideration to Total Project Times, experience has shown that it takes Industry a long time to adapt their operations to meet not only the type of production required but also the exacting tolerances and tests required by the inspection services.

It is with this background that I support Lieutenant Commander Speedy's approach that if it is agreed the possible warning time may be no more than 10 months then starting projects essential as a base requirement (but for all the services) which give the opportunity to demonstrate the effectiveness of national participation in a significant manner is an effective form of insurance.

North Balwyn, Vic.  A. G. Gibbs
Chairman
Victorian Railways Board

TOwards better english
One must welcome the spirit of the article by Colonel Lloyd J. Matthews in the Defence Force Journal No. 9. We all know the kind of so-called military writing which he castigates; and some of us spend a good deal of our time trying to teach others to avoid these pitfalls. But what a classic case of physician, heal thyself! Take the author's first page: "the military's fondness for acronyms." Fondness for? You will also find fashion-oriented, popularization and overused (no hyphen).

The third page produces a fine crop of foul phrases: "If you wish to distinguish between something accomplished by the Army with its organic resources and something it hires done, then specify: as, the Army contracted for a study." Further on we come to: "Unless you are doing technical writing, the best course at this time is to . . . ." Colonel Matthews points out the verbosity of at this point of time, but he cheerfully writes at this time. What happened to the good old word now?

There is a fine irony in the fact that the author is Associate Editor of Parameters, a word whose use, says Colonel Matthews, should be confined to its specific technical meaning. UK Exchange Officer Giles Bateman RMC, Duntroon Major The Queen's Regiment
FORMATION OF AN RAN AMPHIBIOUS BATTALION — THE AUTHOR REPLIES

I have read with interest the comments by Major Avery concerning my article "Formation Of An RAN Amphibious Battalion". All the points expressed by the Major have been carefully considered in the light of his professional background. The following points have been selected for comment:

The Threat: The threat cannot be clearly defined these days, so therefore we must train to cover as many possibilities as we can. An overt threat from a major power would probably be preceded by sufficient warning to be countered by the Continental Defence Plan. My concern is toward limited outbreaks of hostilities particularly those that may occur in the remote islands near Australia. Under these circumstances I consider a Naval Battalion to be a suitable quick reaction force to counter such a threat.

Strategic Mobility: Because the battalion is small, compact, lightly armed and equipped, it can be transported by a variety of fleet units even two or three escorts if necessary. The problem of HMAS Tobruk being in refit is not really a problem at all.

Training and Manning: Major Avery has missed the point in his statement “the Australian Citizen is automatically the epitome of fighting skill as soon as he dons a uniform”. The men I have in mind for this battalion are disciplined sailors who have already undergone at least some form of basic service training. As regards stationing the battalion, I have attempted to strike a means between accessibility to the Ship and closeness to training facilities. Either way it doesn’t really matter, the distances involved are not too great.

Force Structure: I agree that there are a lot of extra support measures which would make the battalion structure more powerful, for example: artillery and transport. However, in order to make the force quick reacting, I feel that supporting arms and equipment must be kept light and portable. For that reason, I chose 81 mm mortars for close support work leaving Naval Gunfire Support to handle the more distant targets.

Conclusion: I consider that there is a gap in Australia’s defence capability which requires a quick reaction amphibious force to counter. I have propounded what I consider to be a solution to the problem. I appreciate Major Avery’s comments and would be interested in any further constructive comments on the problem.

R. M. Smith
Lieutenant, RAN
RAN Trials and Assessing Unit,
North Sydney, NSW

In reply to the article entitled "The Formation of an RAN Amphibious Battalion" (D.F.J. No. 8, January/February 1978) I believe there are several factors worthy of debate and correction. Generally, it should be noted that the cost involved, and the training time required would not be task-effective. The overall effort would be better directed to existing RAR units which are under-financed and in need of more varied and more specialized training.

Maintenance of standards

Assuming that sufficient ARA staff could be spared to train an RAN Battalion, there arises the paramount problem of maintaining land warfare standards whilst at sea for extended periods. It should be remembered that the enemy landing force, by virtue of its role, will be a highly trained military organization, fully supported by Naval and Air power. The isolated introduction of one RAN Battalion under these probable conditions would no doubt prove disastrous if major confrontation occurred. It is unlikely that one battalion could even be used as a delaying force against an enemy landing. The only possible use for an isolated unit such as this would be small group guerrilla warfare action. This is highly specialized and in need of considerable and constant training, which could not be achieved on board ship.

Reaction time

Reaction time is the length of time required to insert a viable force to the point of entry. It is not a race between the services to be first at the AO. A viable force in terms of continental defence at the point of entry could not be anything less than a Task Force, and even then only as a delaying force for Division. The most rapid and safest form of insertion for the Task Force is by air-lift of men and equipment to the AO. It should be remembered that the air-lift would include sufficient motor transport
to move the military units from the currently existing tactical air fields to the FEBA. It is considered that the RAN will be more concerned with disrupting enemy supply ships out to sea than venturing close to shore in the initial stages of conflict.

The other factor here is that the RAN will need maximum available steaming time to reach suitable enemy intercept points along their supply routes. If the fleet is cruising north when conflict arises, extra time will be required to dispatch the necessary vessels to pick up the amphibious unit, if not already on board. If on board, the fleet will need to split up in order to support the landing, further delaying the critical need for disrupting enemy supply lines.

There is no doubt that the Navy must always maintain landing parties on board ship to meet specific tasks. However, it is not feasible for the RAN to secure a role for major insertion against attacking military forces. The presence in the AO of an amphibious unit already involved in a fire fight could easily compromise the effectiveness of initial air and ground fire power from RAAF and ARA units. Link up problems could arise and an unnecessary state of confusion would probably result. When considering anything but a skirmish, the problems involved with the introduction of the proposed unit are such that effectiveness of the other Naval, Military and Air units is severely and needlessly minimized.

DSU, Puckapunyal, Vic. R. S. Gluer Captain SO3 (AW)

AN AIRCRAFT CARRIER FOR THE ROYAL AUSTRALIAN NAVY

The requirement for Tactical Air Support in the Maritime Area in the form of an aircraft carrier will now be firmly placed in the minds of all the readers of Captain Richard's article (D.F.J. No. 7, November/December 1977).

Unfortunately it appears that none of the economically acceptable options for a replacement carrier will provide the RAN with an air capability equal to or better than that which the Navy currently has with HMAS Melbourne in her role as a CVS.

Melbourne can operate a variety of aircraft (e.g. 8 x A4, 5 x Seakings, 4 x S2E/G and 2 Wessex 31B) and is therefore capable of fulfilling the Air Defence, ASW, Recce and Attack requirements of the fleet. On the other hand the VSTOL carriers are limited to operating VSTOL aircraft and helicopters. Therefore their ability to meet the fleet's tactical air requirements will be entirely dependent on the future developments in VSTOL aircraft. Currently the Sea Harrier is highly regarded as an attack aircraft (mainly in support of amphibious operations) but its Air Defence and Recce capabilities have yet to be operationally evaluated. Even if the Sea Harrier proves to be tactically equal to a combination of the A4/S2E/G the paucity of numbers carried in the smaller type VSTOL carriers, e.g. Harrier Carrier—8 x Sea Harrier, 2 x Seaking; Through Deck Cruiser (Invincible) 4 x Sea Harrier, 8 x Seaking, will inevitably limit the VSTOL carrier to providing either Air Defence or Recce or Attack or ASW Support, but not all simultaneously. Melbourne has successfully operated in all these roles concurrently and also by virtue of her ability to operate both VSTOL and Conventional aircraft has the flexibility to adjust her Air Group to meet a variety of operational requirements.

Therefore in order to maintain our standing as an Air capable Navy in the South-East Asia and Indian Ocean regions I believe it is imperative that Melbourne’s replacement should be a carrier capable of operating both conventional and VSTOL aircraft. The high cost of obtaining and operating a 30,000 tonne carrier is a fact of life we will have to accept. We cannot expect to find a cheap solution to our most important defence acquisition this century.

RAN Gunnery School G. F. McLennan HMAS Cerberus Lieutenant, RAN Westernport, Vic.

PROFESSIONALISM THE BEST DETERRENT

It is indeed interesting to note that the two articles in the Defence Force Journal No. 8, January/February 1978: “The Trident of Neptune” and “The Formation of an RAN Amphibious Battalion” should have failed to mention the logical possibility to which both writers lead their readers, namely that the numbers of trained sailors required to keep the fleet at sea can only be increased at the cost of providing manpower to the Army and the Air Force.
Taken further this inevitably raises the “green suit” hypothesis. I am reminded forcibly of the threats by Captain I. B. B. Tower, Royal Navy, early in the World War II to send two Midshipmen who had failed their examinations in Seamanship for the rank of Lieutenant “to the trenches” if there was not a marked improvement in their performance. Nor must we be misled by the notion that we could get all the young, eager manpower we need simply by putting the unemployed into uniform and saving the cost of Social Security payments (shades of the 6th Division, 2nd AIF).

In the last twenty years we have had ample evidence that professionalism is the name of the game. Orders of Battle can look formidable to a potential aggressor, but it is the ability to intercept and destroy at the right time which will prove the better deterrent. Unfortunately it is a fact that each Service sees itself as the only real saviour the country has and history is raked over very often to bolster this view (shore-based aircraft arrived late over the ships at sea or not at all, the soldiers were landed in the wrong place, the motor transport could not be kept supplied, and so on).

The Department of Defence which “is swallowing officers at an incredible rate” may not be the perfect administrative instrument, but it is the organization charged with the responsibility for recommending to the Government those measures which it would be prudent to take for the adequate defence of Australia. It is my opinion that for too long we have been obsessed with the notion of Australia as one vast continent when in reality we conduct our affairs more as if it were an island chain, with the singular advantage that we do not have to hunt submarines in the area between Bourke and Derby.

In assessing the threat to Australia I suggest that the most worthwhile historical parallel is the World War II reduction of the Japanese held island chain by United States Forces. To an enemy, would gaining Australia justify the cost?

Department of Defence
Canberra, ACT

W. G. Wright

THE OUT OF DATE FRIEND
I read with incredible disbelief the article by Major J. Wood’s “Friend” (DFJ No. 9, March/April 1978). It would appear Major Wood’s friend is either out of touch with reality or using the Journal to test his powers of English expression.

Far from living in the past the major field force units of the Army have been practising and testing many of the techniques he suggests. For example, Major Wood’s friend asks when did he last change his basic infantry organization let alone his tactics! He should note the TIB 28 organization of the Infantry Battalion, particularly the additional mobility given to the Mortar Platoon, the addition of the Air Defence Platoon and the Recon Platoon all designed to improve the battalion’s suitability in the concept of Continental Defence.

He questions the sudden lack of use of helicopters as a form of mobility, he should therefore be delighted to know the RAAF and Infantry/Artillery components are practising night movement and deployment (successfully).

Major Wood’s friend suggests TEWTS should be the medium of practising the principle of mobility, again he should be delighted to know, not only is the Army using TEWTS but Ex BRAHMAN DRIVE provided valuable and practical information as a Brigade advance (in a Divisional setting) over 250 km in 10 days. (Oh the tyrannies of distance!)

There are many other examples worthy of comment but my letter would be as long as the

HISTORICAL FLIGHT
Although I know nothing about Group Captain William’s exploits in the S.W. Pacific (D.F.J. No. 8, January/February 1978) I must admit that there is little doubt that the photo on p. 29 was taken at Rabaul.

The two islands in the middle distance would be Dawapia Rocks located in the middle of Simpson Harbour. These rocks are unusual in that they rise sheer from the water. The taller one being 196 feet and the smaller one 91 feet high.

Tulagi Harbour on the other hand has no such islands.

My congratulations on an interesting Journal.

Northbridge, NSW

J. M. Gibson
Chief Draftsman
RAN Hydrographic Office
article itself. Generally however, mobility is being practised throughout the Army and new techniques sought.

Many limitations are placed on the services, such as shortages of money and equipment but I firmly believe that currently there is no limit on the use of imagination. Many new ideas and concepts are being tried, practised or tested in TEWTS and exercises, and unfortunately, Major Wood's friend's article belies the current very real attempts to update our thinking.

Watsonia Barracks  
D. R. Bird  
Macleod, Vic.  
Captain

I have it in mind to respond to my friend and at that time will pick up a number of points Captain Bird and others have made.

J. Wood
Glen Waverley, Victoria  
Lieutenant Colonel

AIR POWER

In D.F.J. No. 8, Dr. O'Neill responded to an earlier critical article by Group Captain Sutton (D.F.J. No. 6) and briefly reiterated several theories on technology, airpower and the TFF procurement. Dr. O'Neill's views do not appear to be adequately supported by current realities.

Large air forces today employ and continue to develop a mix of fighter types to satisfy high-low technology/force needs and the high and low altitude flight regimes. Typically each type is optimized for (though not necessarily dedicated to) air combat or surface attack and these categories seem to be further discriminated into all-weather interception, air-superiority dayfighting and interdiction strike, CAS respectively. This proliferation of types must stem from the subjective assessment by large air forces as to the tactical and/or capital costs inherent to the alternative all-in-one fighter.

Trade-offs may be mandatory for the smaller air force but could an outstanding ACF in fact serve as a free-standing deterrent for any power. The ability to achieve local or general air-superiority will not axiomatically eliminate hostile air-space nor will it prohibit surface movement. The main component of air-power and of airborne deterrent is surface attack capability.

PGM and ECM technologies have not yet combined to render surface attack aircraft omnipotent or invulnerable at any altitude and it is widely accepted that such aircraft must have a refined low-level performance. An ACF may be outstanding by virtue of a LRAAM capability but, by definition, the aircraft platform will not be optimized for low-level endurance and flyability, resistance to buffering and AAA or minimal CEP. Its high-low-high rapidly tends to high-high benefiting only fatigue life. Like the all-in-one Xmas tree the outstanding ACF may appear to be formidable at low-level but its viable role is to dominate the attic. An ACF may be considered to possess a reserve surface attack potential, but in all vital parameters this will be grossly inferior to that of an aircraft designed to perform and to survive at low altitudes. Fortunately the F-111C is available as a genuine platform for interdiction strike but its utility for CAS is limited and it cannot remain in service indefinitely.

The TFF procurement is to be for the long term. One announced objective is for currently realizable technology and the ongoing study involves a co-ordinated appraisal of future air combat and surface attack needs. Presumably this includes consideration of an effective supplement to or a replacement for the F-111C. Within the constraints imposed by the incremental nature of current technology and attainable levels of defence funding could an outstanding ACF truly fit the TFF bill? In terms of tactics, technology and funds the more credible alternative is for two fighter types in a high-low altitude mix. It is obviously desirable that each type should be outstanding in its intended environment and perhaps a total of 2½ types could be regarded as even more supportable.

D. Churchius  
Defence Signals Directorate

CONTINENTAL OR MARITIME DEFENCE?

In his letter (DFJ No. 9, March/April 1978) Commander Foster is disturbed by the presumption contained in Captain Tonna's article (DFJ November/December 1977) that Australia has adopted a military strategy of continental defence. Commander Foster claims that a cursory glance at the Defence White Paper of 1976
would indicate that we have adopted a maritime strategy.

The Defence White Paper states, “The Australian environment also calls for emphasis on strike against maritime targets at sea”. Such a sentence is not indicative of a maritime strategy for a maritime strategy involves far more than just the ability to operate naval and air forces far out to sea. In its true sense it involves the use of the sea and sea power to project military power overseas.

The policy which we recently called “forward defence” is clearly an example of a maritime strategy. But forward defence, and with it, maritime strategy was explicitly revoked by the Labor Government in favour of a continental strategy. The maritime strategy has never been re-instated with any vigour by the Liberal government. This new strategy by no means overthrows the need for a strong navy but its role is now subtly changed. It no longer involves the projection of power overseas but is limited to securing the maritime approaches to Australia and protection of trade routes. To achieve its role in a continental strategy it is by no means necessary to reduce the navy to a coastal force. It can control maritime approaches far out to sea, in the tradition of a blue water navy, BUT this control will have to be exercised from naval bases within Australia.

It is true that the Defence White Paper of 1976 does not completely rule out the possibility that land and air forces may be projected overseas by sea power. However the main weight of the paper makes it clear that the basic policy of the government is to employ a continental strategy.

Without arguing the case of whether this strategy is right or wrong, Captain Tonna has correctly identified our basic policy as a continental strategy and used that as the start point for a very interesting article. 

Infantry Centre D. N. Mason-Jones
Singleton, NSW Captain

DR O'NEILL REPLIES (See previous page)

In his letter Mr Churchus contests my view that the Tactical Fighter Force procurement should be of one rather than two aircraft. Let me re-state my arguments in concise form.

The TFF should be seen as a major element in our posture of deterring potential enemies from consideration of a major attack on Australia. The most serious obstacle facing an enemy in attempting to use force on Australia is the water and air gap which his men and weapons would have to cross to strike at us. If we can contest his passage of this gap by naval and air action in considerable depth, he is likely to be faced with an insoluble problem, or one whose solution would be inordinately expensive in terms of the gains he might achieve. Hence the role of the TFF should be to defend this gap, by air to air combat and by striking at shipping. Therefore the TFF should be based on aircraft with a long range and a high weapons carrying capability, emphasising both air to air combat and the maritime strike roles.

If there are two roles to be carried out, then why not two aircraft types to fulfil them? First, I do not believe that the small force which we are likely to buy will justify the heavy overheads involved in supporting a further two aircraft types. If the RAAF was likely to purchase more than four squadrons of aircraft, I would be inclined to reconsider that view. The current outlook is for one squadron to be purchased by the mid-1980s, with perhaps two more to follow.

Second, within the range of aircraft currently on the short list for the procurement there are types which are highly capable in both roles. Of course some compromises have to be accepted but the development of aircraft technology has, I believe, reduced these to a very low level. In particular I question Mr Churchus’ view that the low altitude performance of these aircraft is insufficient for our purposes, particularly when they are carrying stand-off weaponry.

Of course, we could still be saddled with a poor aircraft in a single type purchase. Some of the aircraft on the short list appear to be unsuitable for the fulfilment of a deterrent role by the TFF. Nonetheless, there are at least two aircraft on that list whose purchase would make excellent sense as a single type procurement within the guidelines recently spelled out by Mr Killen.

Canberra ACT R. J. O'Neill
Head Strategic and Defence Studies Centre
THE military profession is one of the few true professions that does not formally recognize and reward the contributions its members make through writing for professional journals. Extracurricular military writing, despite a few extant options or requirements to prepare articles for publication, receives neither the encouragement nor the rewards commensurate with its value to our profession as a whole and to our personal development as soldiers. Such recognition for the soldier-author is overdue.

Of course, there are lots of reasons for not writing for publication. Manuscripts are often rejected (but most often for lack of research and faulty logic and not, as many seem to believe, for poor style or failure to adhere to a 'party line'). Other excuses are easy to find. One of the most common and self-persuasive, for instance, is the notion that a good soldier is kept so busy with challenging duties that he has little time to think or write creatively.

It is not time or energy that is lacking, although, like good staff work, publishable extracurricular writing takes time and more energy than is normally appreciated. Rather, it is desire and incentive that are lacking. We value the individual who gets things done, and it is well founded in our folklore that if you want something done right the first time you give it to a busy person. If the rewards are right (and for the professional, getting the job done right is one of the highest rewards), the busy soldier will find the time and energy to produce what is needed.

While in some duty positions the priorities for time and energy exclude journal writing completely—even for the most dedicated writer—there are many other jobs that foster opportunities to write. The question remains one of incentive.

Until the recent conversion of branch journals to appropriated funding, authors published in most of them received payment for their work. This minor incentive is now gone. Armor and the Field Artillery Journal have replaced it with handsome full-colour certificates acknowledging the author's professional contribution. The Assistant Commandant of the Infantry School acknowledges major articles in Infantry with a letter of commendation.

This is quite different from the problem faced by most academic and many industrial and government professionals, whose original research and reports of that research are principal concerns. For those individuals, a review of their published works constitutes one of the major assessment tools used by educational institutions to assess their past and present interests, their areas of expertise, and their potential value to the institution. The volume

* Reprinted from Infantry with permission.
and consistency of their publications are used as indicators of their past and present contributions to their fields and can quite reasonably be used as objective criteria since the competition for publication space is open to all. The number and quality of publications is, therefore, a highly visible indicator of an individual's professional competence and motivation.

Comparisons

How does our process of personnel evaluations compare? Despite continual revision, the efficiency report system for officers and non-commissioned officers is still lacking in objectivity and we do not have effective control over inflated ratings. Although many reasons for this have been proposed, among the most significant may be simply the physical and functional proximity of the rater to the rated. (We are now returning to a system where the rater's writing skill will be of major importance.) Likewise, the awards and decorations system is subject, at best, to arbitrary and variable implementation within official guidelines.

We do, however, have some excellent objective criteria, including service school performance, civil schooling, and the enlisted system of proficiency testing. One of the most readily accessible additional criteria is the published works of each professional soldier, whether officer or enlisted.

With our current records procedures, it should be a simple matter to establish a system of recording the title or subject and the journal edition of each soldier's efforts, and to make this record an addendum to his official file. The articles, or abstracts of them, could be microfilmed and made readily available to promotion boards and other career management panels.

As an additional criterion for aiding a board in its final determination of an individual's qualifications for civil schooling, for OPMS specialty, or for assignment to a staff, research, or teaching position, the record of publications would be hard to beat. Here would be information (often not available elsewhere in official files) on a soldier's interests, special skills or knowledge, analytical ability, organizational skill, and ability to communicate; most of all, it would indicate a dedication to self-improve-

ment and a willingness to share with others the benefits of personal experience.

Measure

Unlike the narrative portion of an efficiency report, a record of publications would be an objective measure of those qualities provided firsthand by the soldier and one that could be verified by a review of the articles themselves. This review, however, should rarely be required, since military journals, like their academic counterparts, utilize review boards of subject matter experts to pass judgement on content, potential impact, and value to the service. Published articles are, in effect, a form of rating given by peers or superiors that is unbiased by close personal contact and face-to-face emotional feedback.

Recently, professional reading has been the topic of fine articles and commentary. In these, the authors suggest a series of books of special interest and importance to the soldier. Unfortunately, our service journals are never mentioned even though they serve as a primary source of current information and controversy. Branch journals are an important part of our communication system, and one sure way to increase their readership is to encourage more soldiers to write.

Although extracurricular military writing is occasionally just reporting, more often it is a form of persuasion, employing logic, coherent presentation of facts, theory, and challenging ideas. Good leadership is essentially the art of persuasion and applied influence. For those who aspire to leadership positions, the development and exercise of persuasive skills is a mandatory pursuit. We cannot afford to be "too busy" to train ourselves in this capacity, any more than we can neglect our tactical or technical expertise. The present period of peace and reorganization provides us with an opportunity to devote a significant portion of our efforts to studying the problems of our profession and to postulating solutions.

Professional writing, both on-the-job and extracurricular, requires organizational skills, knowledge, research ability, integrative dexterity, imagination, insight, dedication, courage, and most of all, perseverance. These are undeniable virtues in a military professional, and their demonstration should be recognized and appropriately rewarded.
Sensible

The Theory and Some of the Practice of Military Stocking
Colonel G. J. Loughton,
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INTRODUCTION

The standard equipment of each of Genghis Khan's soldiers included a needle and thread. Not to have this item of equipment was punishable by death. Rommel said in 1942: "The first essential of an army to be able to stand the strain of battle is an adequate stock of weapons, petrol and ammunition. In fact, the battle is fought and decided by the quartermaster before the shooting begins". A military stocking policy lays down what equipment and stores are to be held and where, what is to be an order and what risks to take. While GK required 100% certainty for needle and thread, military stocking policies usually require somewhat lower availabilities or service levels and for good reason. Nevertheless, it is important that our military stocking policy has some minimum of effectiveness in order that our quartermaster may give our Rommels a sufficient chance of success.

Each of the Australian armed Services has a military stocking policy. Each shines in certain respects but none is as efficient as it might be. An efficient single military stocking policy would:

- be comprehensive, in that it would apply to all items in the military inventory whether held by units, as depot working stocks, as reserves or pools, or on order;
- recognize the needs of different users at different times by specifying different service levels to be achieved;
- use standard definitions for each component of stock;
- use standard methods for assigning numeric values to each such stocking component;
- use methods which are cost effective in relation to the value and importance of each item or group of items; and
- facilitate the controlled manipulation of the numeric values of the stocking components and the service levels in order to meet current policy goals.

The physical manifestation of military stocking policy is the military stocking organization. Each of the Services has a very large, though unqualified, investment of manpower, accommodation, equipment and stock tied up in its stocking organization yet none meets the criteria above. In particular, service levels are not specified, stocking components are not rigorously defined and methods of assigning numeric values to components are not cost effective. A more standard and more effective military stocking policy would give better service for the same or less investment. Such an improvement should be of interest to us all, whether soldier, sailor, airman or civilian defence officer and whether commander, strategist, logistician, financier, resources planner or whatever.

The primary purpose of this article is to suggest the steps necessary for arriving at a
better and more standard policy. A secondary purpose is to set out the matters which will be at issue during the development of the policy and in so doing to indicate why the recommended steps are necessary. This secondary purpose will necessarily receive the most space. Briefly the steps required to produce a standard military stocking policy would be:
• to analyse each stocking component in order to produce a standard definition for each,
• to develop cost effective methodologies for the allocation of numeric values to each stocking component, and
• to state a set of military stocking principles to guide the design and operation of the military stocking organization.

First, however, it would be as well to grasp one central concept: there is no such thing as a correct stocking system. Unfortunately, stocking systems are designed (unless they just happen) to meet two criteria. That makes it awkward. The two criteria are:
• service level, and
• economy, or minimum cost.

That is awkward because some commanders think they want 100% service level (which would mean infinite cost) whereas the financiers want maximum economy (which might mean zero service level). The true answer must be somewhere in between and this becomes a matter of human judgement — of command judgement by the way, not technical judgement. However, it is not a matter of ‘think of a figure’. It is a matter of performing an appreciation which applies logic to assessable factors until, finally, a few clear options are identified. Then it does become a matter of judgement. But command always was lonely and it is the commander alone who decides on the service level, meaning that he decides on what risk to take.

Most of this article discusses the methodology for defining and quantifying stocking components including the quantification of uncertainty as far as possible. The theme is that stocking, like logistics generally, can and should be logical. A simple and logical methodology for task force and divisional level stocking has been described earlier in an article by this author: “Logistics Can Be

Logical — Operating Stocks, Reserves and Maintenance Areas” in Army Journal, June 1976. The same logical thought processes, which stress definition and quantification, are equally applicable on the broader canvas of a defence-wide stocking policy. The end product should be a recipe for presenting commanders at all levels with clear, logical options complete with advantages, disadvantages and, particularly, assessments of risk.

Military stocks comprise all items of equipment or stores whether held by units, as depot working stocks, as reserves or pools, or on order. Logically, a stocking appreciation, having specified service levels at least provisionally, needs to make decisions about echelons and range before proceeding to consider working stocks and reserve stocks. Here it is more convenient to treat echelons and range later. Accordingly, this article is structured as follows:
• Introduction
• The three distinct stockholding purposes
  • Working stocks
  • Equipment pools
  • Reserve stocks
• Echelons and range
• Liability assessment Vs Procurement (including financial constraints) Vs Asset management
• A prescription for sensible stocking.

Finally, in the introduction, it is pointed out to the reader that each section of the article ends with a summary. It is hoped that this will make the going easier.

THE THREE DISTINCT STOCKHOLDING PURPOSES

There is official recognition that military stocks can be divided into three stocking components, namely: working stocks, unit and pools, and reserve stocks. This article is structured to address each stocking component separately. However, there is less recognition that the three stocking components are used by different parts of the defence organization for different purposes. This article attempts to demonstrate that the stocking components can be given standard definitions which will meet all purposes. But since different numeric values
are needed for the stocking components according to which purpose they are serving. Different methodologies for allocating numeric values are necessary for each purpose. The three purposes are: liability assessment, procurement decision-making and asset management. That is their logical sequence. Accordingly this article first examines each of the three stocking components in the context of the liability assessment purpose and then later deals with the variations required by the other two purposes.

Liability assessment is the logical start point whether in developing an overall military stocking policy or in arriving at a military stocking plan for a force or other dependency. The stocking appreciation will aim to achieve a particular task while striking a balance between service level and economy. While that balance must be influenced by a recognition of what resources are available, nevertheless an 'ideal' plan should be developed in the first instance, leading to an ideal listing of the stocking liability. What will actually be bought will be decided later and it will alter the actual, real-life service levels. Nevertheless, it is important to start the process of modification, or trade-off, or iteration from some benchmark and that comes from liability assessment.

WORKING STOCKS

Working stocks are held to permit the replacement of any item which is expected to be used up during the intervals between successive procurements or other replenishments. Working stocks should be held for all items which meet this description and in addition should be held for items which have no measurable expectation of usage if their loss would be critical. Working stocks may be held at any stocking echelon including user units. Where they are held depends on the service levels laid down for each stocking echelon. It follows that each capital procurement should contain a working stock element to keep the fleet-in-use up to the authorised level until the next procurement.

The nature of working stocks at any stocking echelon will depend first on the nature of the dependency to be served. In these days of single service management, dependencies will frequently include elements of other Services and may include miscellaneous commitments such as military assistance to the civil community. Any definition of working stocks should include mention of dependency. Then, working stocks comprise four elements:

- consumption period
- supply margin
- usage rate
- lead time.

Consumption Period

It is customary to ask: how much working stock is to be held? It is more useful to ask: what is the re-order frequency; how often are orders to be placed? The concept of ordering a quantity of stock which is planned to last for a designated period (until the next order is placed and delivered) conveys the idea of stock levels moving up and down in a controlled way. This is helpful because it is a better conception of what really happens than the customary conception of stocks being maintained at a level. The stocking element which specifies the re-order frequency is termed the consumption period (CP), although re-order frequency is a more descriptive term. Its effect on stock levels is illustrated at Figure 1. The figure also illustrates the effect of the supply margin which will be described shortly. The quantity to be ordered on each occasion is a consumption period's worth, i.e. CP times the usage rate. Sometimes it would be a little more if a large issue has just been made but this is not illustrated.

It should be asked next: how big should a CP be? The answer is that it is a matter of finding a balance between ordering too often and ordering too seldom. To put it another way, the function of a properly set CP is to achieve an optimum balance between supply, transport, engineer, communications and other resource costs. Every order has a resource cost. Small orders mean more orders and thus higher total order costs; large orders mean lower total order costs. However, large orders mean higher average stock levels and thus higher storage costs. The balance point between order costs and storage costs can be found for each echelon and each group of items by a formula which finds the Economic Order Quantity (EOQ). The effect of using an EOQ approach to setting CPs is to reduce the CPs for expensive items and to increase them for
cheap items and to do so at markedly reduced total cost.

At present the Australian Services make very little use of EOQs. It is true that there are limits to the usefulness of the EOQ formula. For example it must be over-ridden for shelf life items and for items with a particular production frequency. Moreover, since it can be demonstrated that the total cost is not very sensitive to minor inaccuracies in the EOQ quantity (say, within 20%), a CP fixed by judgement will sometimes be preferable to one based on cost collection, since the cost collection exercise bears a cost in itself. However, generally speaking, the EOQ approach is likely to markedly reduce the total cost of the Services' stocking operations. The moral is that the methodology used for allocating a numeric value to a CP should itself be cost effective and appropriate to the value and importance of the item or items.

Supply Margin

One of the design criteria for a stocking system is service level. It is the existence of a supply margin (SM) within working stocks that confers a service level. The more the supply margin stock the higher the service level. Figure 1 implies that usage is steady over the CP and that the delivery will arrive nicely at the end of the CP. Neither is true. There is some probability of a stockout occurring. The SM exists to protect against both high usages and late deliveries. It can be shown that the probability of a stockout is proportional to the length of the lead time and to the variability of demand. If the variability of demand over lead time is measured, it is simple enough in principle to read off how much supply margin stock, or safety stock, is required for each service level. (A 90% service level is a 10% probability of stockout.) In practice the calculations can become tedious unless a computer is available. When it is not, arbitrary standard SMs for all items are usual. It is then possible to know what the average service level is but unfortunately it is not possible to know what it is for any particular item.

With SMs, the law of diminishing returns applies. A moderate service level of say 90% can be met economically with low safety stock. A high service level of say 97% is disproportionately more expensive. And 100% is unattainable no matter what the safety stock! (This leads to the concept of intensity of management which is an alternative to SMs—see below.)

Sometimes usage will be high and/or delivery will be late. Then some (or all) of the SM will be used. But sometimes the opposite will happen and not all of the CP will be used. It follows that, on the average, the MINIMUM equals the SM. Thus the AVERAGE, which is important for resource allocation purposes,
is SM plus half CP, ie. SM + CP. Figure 1 illustrates the planned, routine movement of stock levels, assuming steady usage and regular deliveries. A CP’s worth is ordered once every CP and arrives nicely when the planned minimum is reached. This is the plan though not the actuality. In reality some or all SM is used from time to time and the actual order quantity will vary somewhat from a CP’s worth. However, it is an important feature of the working stocks system that each order is placed at a fixed part of the cycle and that the stockholding is brought back into control such that actual maximum and minimum holdings average out to the planned or approved levels.

**Intensity of Management**

One strategy for protecting against stockouts is to invest in additional stock in the form of supply margins. An alternative strategy is to invest in additional people to watch for trouble and then to take corrective action so as to prevent the stockouts. This is the ‘intensity of management’ strategy. But it is manpower intensive and it is too expensive for most items in the military inventory. A composite strategy is appropriate: intensive management for the few important items, with the great majority to be protected by supply margins and a moderate sized middle group to get some of both strategies.

This means that working stock is always CP + SM. But sometimes, for important items, SM = 0. Moreover the CPs of intensively managed items would tend to be shorter, leading to lower average stocking levels for these items.

**Usage Rates**

Essentially, working stocks exist to be consumed during the interval between replenishments. An estimate of the usage rate which will prevail until the next review is always necessary. What rate is used depends on what is expected to happen. For the greater part of the military inventory, the best forecast of usage rate which is available is that given by averaging usage data from the recent past. If computer support is available, such data can be smoothed and trends may be detected and projected forward. There should also be the facility to apply a modification factor either to a specific item or where some general change, for example in the size of force deployed, is expected to cause a general change to usage rates. However, for most of the inventory, the cost of actively gathering information about the future is not justified.

It follows that the working stocks component of the stockholding system functions mainly by replacing past usage and is not particularly sensitive to the future. Where particular items would justify active prediction measures they need to be detected and given special attention.

**Lead Time**

The lead time (LT) is the period which elapses between detecting the need to replenish stock and some part of the resultant delivery being achieved. It includes several sub-elements, each of which may require measurement in order to control it.

In order to get a delivery of working stocks to arrive at about the right time, ie. when stock will reach MINIMUM, it is necessary to place an order in advance. This is just far enough in advance that there is sufficient stock left to last for the lead time. Each time an order is placed this attempt to predict the future must be made.

In principle, the shorter the lead time the better. Certain types of procurement are on a money-with-order basis and a shorter lead-time reduces the funds tied up. Where pay-on-delivery prevails, no pre-investment is necessary. However, the longer the lead time, the greater the risk of stockout, and therefore the greater the investment in supply margin stock necessary to produce a given service level. On the other hand, price advantages may be achieved if a group of orders can be placed together and this would appear to warrant the delayed placing of some orders. The point at issue is that an economical balance needs to be found.

As well as lead times being short, their prediction needs to be accurate. On the average, a stocking review is performed once per consumption period. At each such review, the reviewer is required to predict the duration of the ensuing lead time. In the main a standard lead time, based on past experience, is used.
for each of many groups of items. In principle it is important to produce an accurate estimate of the lead time since an overestimate produces overstocking which is a waste of resources, and an underestimate produces understocking which lowers service levels. However, the difficult question to be resolved is what quantity of resources can justifiably be allocated to the lead time prediction process.

The Australian Standard Material Issue and Movement Priority System (AUSMIMPS) specifies the lead times that are to be achieved internally within the Services. There is a sliding scale to allow for the user's inherent priority due to the nature of his activity and also for his urgency of need. Reasonably enough, the routine movement of replenishment stocks between stockholding echelons is allotted the longest lead time. One reason is in order that they may use the cheapest forms of transport. The question to be asked is: "What is the relationship between transport cost saved and either service level lost or safety stock investment increased?" The answer is not known. But it should be.

External lead times, ie. procurement lead times, are an even greater problem. Many external lead times are very uncertain and have proved very hard to measure. This is mainly a statistical problem but it may be that our approach has been wrong. It may be that we have been trying to mix unlike data together and then average it. For example, a demand on a seasonal manufacturer will show a short lead time in the three months following production and an erratic or long lead time in the rest of the year. To strike an average between figures taken over several years at different times in the year is to produce a nonsense. Instead of passively analysing data at home, we should be aggressively acquiring supplier information.

**Working Stocks—Summary**

Working Stocks have four components: consumption period, lead time, usage rate and supply margin. The consumption period defines the re-order frequency, ie. the interval between deliveries. The lead time specifies how long before each planned delivery the order needs to be placed. These are both time factors. The usage rate permits time to be converted into quantity. (Time x Rate = Quantity). Then, the supply margin is there to cover uncertainties in both the usage prediction and the delivery or lead time prediction. Alternatively, if there is plenty of manpower, the supply margin can be set at zero and both uncertainties can be monitored and controlled.

Remember too, that the working stocks system is self correcting. But note well that consumption period and supply margin become stock factors once usage is applied to them. Lead time is never stock. It is only ever time, with the single exception that on first procurement or first lodging of a force, a lead time's worth must be provided, too, to get the system started.

The basic conceptual feature of working stocks is that they are stocks which are held to last a dependency for some designated period. They are not a quantity of stock, *per se*, as has been considered customarily.

The second conceptual point is that working stocks should be conceived as showing a one-way flow. (Other components have other flow characteristics which are discussed later.) Sooner or later every item of supply, be it a consumable, a repairable assembly, a minor equipment or a major equipment (an aircraft carrier or a F111 if you like) will be used up and require replacement from working stocks.

A third conceptual point about working stocks is that by their very natures they can only operate to replace usage, except that this may be varied by identifying a few critical items to be held regardless. There seem to be two morals to this:

- A unit commander who permits his quartermaster to demand a lot infrequently is defeating himself because the system won't detect significant usage. His strategy should be to demand a little often, or at least regularly.
- Every equipment or material user should be like the good infantryman on patrol. What will I do, instantly, if a shot comes from the bush? Well, "what is my plan to replace this equipment or this component if it breaks?" And how long will I have to do it in? So do I need a spare equipment (not a dozen) in the store or do I need one spare part in my pocket? I mightn't need it often, but will I need...
it badly? Then tell the supporting echelon what the critical items are.

Figure 2 illustrates the working stocks system.

Points to note are:
- Such a reservoir exists at each stocking echelon.
- The pipeline comes from the supporting echelon and is not full continuously, it pulses.
- The planned maximum and minimum levels are set by the values of CP and SM. The actual level depends on events but its average is midway between the planned maximum and minimum.

**Unit Equipment**

Unit equipment meets this definition. The purpose is the unit’s role. And unit equipment is used as a pool. Whatever the establishment or organization chart says, the unit commander will reallocate his equipment holdings internally as he sees fit. Moreover the formation commander will make inter-unit re-allocations when he sees fit.

Whereas working stocks exhibited a one-way flow, equipment pools show a circular flow. They rotate between use and refurbishment. The RAAF uses the term ‘rotables’ to convey this idea. It is often forgotten but it was never intended that 100% of unit equipment be on-line all the time. Firstly there is servicing

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**THE WORKING STOCKS SYSTEM**

**THE LEAD TIME PIPELINE**

PLANNED MAXIMUM

CP

PLANNED MINIMUM

SM

DEPENDENCY

**NOTE:** 1. Each replenishment pulse is about one CP’s worth.

Not to scale in this diagram.

**Figure 2**

**EQUIPMENT POOLS**

An equipment pool might be defined as: “a quantity of equipment provided for a specific purpose”. If a purpose can be specified, the equipment liability can be calculated. The only other element necessary is the notion of service level. The specification of pool purpose should include a statement of the required equipment on-line percentage.

(mostly done in quiet periods if the commander is clever). Secondly there is first or second line repair. The staff lays down a time limit such that if an equipment will be back from repair within the time limit, the unit has to stand the shortage. If not, a replacement is provided from a repair pool. Even if the required on-line percentage is not stated openly, it is there. It must be. Repair organizations have to be
designed on certain criteria and this is one of them—even if it has to be guessed at. Everyone would be helped if the required on-line percentage was stated formally, even if it changed from time to time. Unit commanders couldn’t get away with crying poor and the staff would be better able to anticipate trouble before things got out of hand.

For purely liability assessment purposes, the appropriate unit role might be the war role. But for procurement decision making or asset management it would be helpful to formally state some lesser role, with service level, in order to calculate the consequential liability. Alternatively, the start-point could be a fixed quantity of equipment from which role and service level might be deduced. However, a task which is not contained within the war role is more difficult. A task such as military assistance to the civil community or peace-keeping may lead to an equipment bill which is different in kind to one flowing from a unit’s war role. The start point appears to be to specify the new purpose formally including service level, after which the equipment liability can be calculated.

**Repair Pools**

Every equipment fleet has to be backed by a repair pool. This includes equipment in other pools. If, for example, a unit equipment cannot be repaired in the designated time, such that its on-line percentage becomes unacceptable, the equipment must be replaced. The source of replacement is a repair pool. Equipment in a repair pool may be:
- Awaiting repair;
- Undergoing repair;
- Fit stock, waiting to replace an out-of-limit unit equipment.

It is customary to set a repair pool as being a particular percentage of the total fleet, say 15% or 20%. This hardly makes sense. Surely the repair pool size must depend, among other things, on the propensity of the particular equipment fleet to exceed the replacement limit, which in turn depends on its age and state of repair, and also on the available repair capacity. Hence there are at least three variables: if the pool percentage is fixed either fleet condition or repair capacity, or both, must be able to be varied. Who controls it? The commander and his staff!

The flow analogy can take us further. Really there are three repair pool components:
- the unit pool with exchange going on between use on the one hand and servicing or first and limited second line repair on the other (dealt with earlier);
- the taskworthy or minor-cycle repair pool; and
- the full serviceability or major-cycle repair pool.

Repairs in the combat zone are to task-worthy standard and this is the minor repair cycle. From a technical viewpoint it is uneconomical because repairers like long production runs in well set up workshops. But taskworthy repair gets equipment back to the user, quickly. The price to be paid for taskworthy repair is rapid fleet deterioration which is why there has to be a major cycle further back to upgrade equipments as they drop out of the minor cycle. However, there also has to be a staff-controlled fleet replacement and monitoring plan. It would not do to have the whole of that part of the fleet in unit hands deteriorate to the point of uselessness all at once.

The major-cycle repair pool also has equipment either awaiting repair, undergoing repair or awaiting issue. Its repair standard aims at full serviceability and is conducted on production line methods. It will be conducted partly in the area of operations and partly, for its heavier types of repair, in support areas. The staff will use its ‘awaiting issue’ component to replace degraded unit and minor-cycle repair pool.

**Force Pool of Construction Equipment**

An equipment pool is permitted to be created when a purpose can be stated for it. For unit equipment, the purpose is formally stated as the unit’s role. For other pools, the precise purpose and hence the contents of the pool may be harder to state but are nonetheless real. A good example is the force pool of construction equipment (FPCE) whose purpose is contingency-related. Required on-line percentages should be stated.

Almost any conceivable deployment will require the performance of engineer works.
Standard engineer units will be deployed. But not all tasks are standard so there will be a need to add certain specialized, seldom-used equipments and, probably, a need to add extra quantities of standard equipments for short term peak use. For several reasons it is undesirable for the engineers to be given this equipment permanently. Instead, it is held as a pool. This, by the way, introduces the idea that equipment pools, except unit pools, are usually not manned. When they are used it is for short term purposes and the user has to switch the necessary manpower from elsewhere.

What size is the FPCE to be? Its size is that which the commander appreciates that he needs. What else could it be?

Other Equipment Pools
It follows from the statement just made that there is no particular limit to the types of equipment pools which may be provided (always remembering that the context is still liability assessment.) The criterion is that there be some identifiable purpose. Obviously the purpose must be justifiable. It should also be measurable which is harder, perhaps. Every situation will differ and the author does not care even to identify the factors. It is enough to suggest the sequence: first a contingency or a deployment, then an operational appreciation and plan, then an administrative appreciation and plan. In that process the factors will emerge and be given due weightings.

Examples of ‘other equipment pools’ which are highly likely to be present in a deployed force are pools of materials handling equipment and of equipment bridging. But there could be many other types. Training pools are often established (dealt with in more detail under asset management) and pools of important components (called ‘rotables’ by the RAAF) are also usual.

Equipment Pools—Summary
Equipment pools are provided to meet some particular purpose which should be specified, including specification of required service levels. Equipment to which units are entitled become a pool, in this sense. Their purpose is the unit role. The purpose of other equipment pools, except repair pools and training pools, is usually contingency-related. The purpose must be specified and then, by means of an appreciation, measured. The purpose of a repair pool is to enable equipments in use to be withdrawn for refurbishment. A repair pool is needed for every fleet, even a fleet of one if its downtime cannot be accepted. Therefore the size of the repair pool is proportional to the size of the whole fleet in use, including all other equipment pools.

It is a characteristic of equipment pools that they are in a state of circular flow. They always flow between use and servicing/refurbishment: some of them flow between the user and a custodian such as a stores depot. A further characteristic of equipment pools, except unit equipment, is that they are not usually provided in a manned state; the user has to find the manpower. Finally, any net loss from an equipment pool must be replaced from working stocks.

Figure 3 illustrates the relationships between equipment pools and their relationships with reserve stocks, which are discussed below.

RESERVE STOCKS
It is a characteristic of both working stocks and equipment pools that they are expected to be used. Equipment pools will circulate and be used and re-used. Working stocks flow forward to replace consumption including net losses from pools. It is a characteristic of reserve stocks that they are not expected to be used. At least they are not expected to be used unless some event occurs. Indeed this is their very purpose: reserve stocks exist in order to become working stocks and equipment pools in the event of a particular occurrence.

There would seem to be no end to the purposes for which reserve stocks might be provided. The notion of probability should be used here in two ways: firstly for liability assessment purposes, secondly for procurement purposes. There must be some threshold level of probability of a contingency occurring to justify providing reserve stocks. But the threshold will differ according to the two purposes. Obviously a higher threshold will need to prevail for procurement. So, at what threshold of probability of a contingency should the liability of reserve stocks be assessed? The answer, which passes the buck, is useful nevertheless: if it is assessed by the relevant commander as worth the staff effort of producing
a contingency plan then it is worth calculating the consequential reserve stocks as a liability. Whether it is worth actually buying them comes later.

If that satisfactorily removes probability as an element in the definition of reserve stocks, the elements which remain are:

- a contingency;
- a force;
- a usage rate;
- a period of time.

The logical start point in calculating reserve stocks is to identify and quantify contingencies. What might go wrong? How wrong? How serious would it be? From this follows appreciation and plan. There may be several things that can go wrong and several alternative plans. The essential idea is that contingencies be identified and quantified (even imperfectly). As a corollary, the reserve stock for each contingency should be identified with a figurative label showing the contingency which justifies it. There is then nothing wrong in saying 'and add 10% for other contingencies'. It is just that it is wrong to guess the whole 100%. Note however that there is no reason to restrict contingencies to those of a warlike nature. If, for example, a natural disaster contingency was sufficiently probable to warrant planning, that planning should include an equipment liability assessment.

The next element suggested was the force. Its size must be known or at least formally assumed. Reserve stocks will be calculated based on rounds per gun or kilos per man, etc. Therefore the number of guns or men must be known. Any commitments to the other Services must be included.

For usage rates there are standard tables available and that is mere arithmetic. It is the concept of activity rate that makes it difficult. There are usage rates for each activity rate. The clever part (the operational part) is to forecast the duration for which each activity rate will apply. Finally, the period of time must be assessed. The question is not: “how long will the war last?” The question must be: “how long will elapse before working stocks and equipment pools can be provided, at the new rates, and continue to be provided thereafter?” This provides a logical link with procurement decision making. The problem is to assess the lead time which will prevail in the circumstances of the contingency. The first solution to the liability assessment problem is simply to state what will be needed to equip the force initially and how much is needed each month thereafter. How many months it will be needed for would seem to be a procurement decision, not a liability assessment decision.

Reserve Stocks—Summary

Reserve stocks are provided in the hope that they will not be used and in the expectation that they may be. Their purpose is to become working stocks and equipment pools in support of a contingency force. The time period and the rate of use need to be specified. Indeed, reserve stocks can only be calculated from an appreciation of a contingency leading to a plan.

Although the range of possible contingencies is endless, the range of probable contingencies is not. If a commander deems it worthwhile to plan for a contingency, that plan should be carried through to a quantification of the reserve stock requirement. Whether that quantity is actually bought depends on procurement decision-making which comes later.

Figure 3 illustrates the relationships between the various elements of reserve stocks and their relationships to equipment pools. Points to note are:

- The calculation of each element is to some degree dependent on the elements beneath it—hence the pyramid.
- The ‘additional force equipment’ is any additional equipment above present unit holdings (the base of the pyramid).
- The repair pool element of reserve stocks comprises the repair pool generated by the additional force equipment and also that generated by the increased activity of the present unit holdings.
- The maintenance element of reserve stocks is generated by any increased need for working stocks up to the time of first replenishment at new rates.

ECHELONS AND RANGE

In the jargon, working stocks, equipment pools and reserve stocks are to do with depth
of stocking, i.e. how much of each is to be held. But in designing a stocking system, logically the first decisions have to be about echelons and range.

Echelons
The ideal stocking system has only two echelons: the user and the central warehouse. The system would buy into the central ware-

**EQUIPMENT POOLS AND RESERVES STOCKS**

![Diagram of equipment pools and reserves stocks]

*Figure 3*
house in big buckets and push stock forward to each user in little buckets, with the ‘bucket’ being a consumption period of appropriate size in each case. For this to work, the system must have three features:

- A very responsive central warehouse, meaning excellent stock control.
- Excellent communications.
- A very rapid and reliable transportation system.

The system has to be good enough for the user to get new stock replenishments up to him within his laid down lead time with a high degree of certainty, even though the pipeline may be very long. More importantly, though, the system has to be able to produce to the user, very quickly, those items which he does not carry in stock. (There will be many items he doesn’t use often enough to justify stocking them—see ‘Range’ later—but when he needs them he will probably need them fast.) The lamentable fact is that, even in peace, the Australian Services (though they are not uniform) do not have the stock control, the communications or the transport to make a two-echelon system work. And in war there would be no chance.

Comparisons, they say, are odious, but the US Services are of interest. Their concept of far-theatre stocking is to minimize far-shore holdings and to rely on good stock control, communications and transport instead. They think it more economical to invest their resources that way instead of in high levels of in-theatre stocks. Maybe they are right. Be that as it may, a two-echelon system for us is not on, particularly for a force deployed in the field. The principle at stake is that stocks must be held forward of any likely breaks in the supply chain. The result for Army is a four-echelon system: first the user unit, second the formation, third the force and fourth the support area. But a word of warning. In World War II, the support area found it necessary to subdivide its stocks into even more echelons. Hopefully our stock control, communications and transport are now good enough to at least avoid this!

The reason that this matters is because each echelon carries with it an overhead. Each has a CP and a SM and probably reserve stocks. Each takes engineering capacity to build and manpower to operate. So why do it? Remember, in the beginning there was service level. That is what it is about. The planner establishes echelons of stock forward of each likely disruption in order to achieve desired service levels for the user. But the fewer the echelons the better.

Range

In the stocking game, or the supply game if you prefer, the law of diminishing returns applies. A very small part of the total inventory range is likely to satisfy most demands at any level. Characteristically about 80% of demands are likely to be satisfied from 10% of the range, about another 15% of demands from about another 10% and the remaining 5% from the remaining 80%.

The relationship shows a steady curve, called a Pareto curve, or the Pareto principle. See Figure 4.

This means that it is simply not economical for any echelon to hold all the things they might need. Instead the aim should be to meet some particular service level. This is a different service level from that dealt with earlier. This one is the range service level. The earlier one could be re-named the depth service level.

What particular range service level to set is a command decision. The urge to make it high comes from the idea that if you hold it you don’t have to wait for it. The urge to keep it low comes from the need to keep holdings low for reasons of mobility and perhaps from commendable laziness—let someone else have the trouble of holding what you need! The usual outcome is that the range service level is set somewhere between 65% and 80%. (That applies at the highest echelon too—not every possible item is held, though a range service level of higher than 80% is likely.)

In practice it is not easy to strike an exact range service level because at the point where the Pareto curve starts to bend, usage rates become quite unpredictable and even hard to detect. The usual thing is to take two steps:

- First, apply a rule-of-thumb, such as “stock everything that has moved once in the last six months”.
- Then, as well, stock all the items which dependent users believe are critical to
their functions. (This probably increases the range by 5% to 10%. While it has negligible effect on range service level it is good for customer relations.)

Out of this will come a range service level which might not be particularly predictable but at least will be measurable after the event.

This is all well and good for the items you decide to stock. You will stock a relatively few items to give you, say, 75% coverage of what you need and each such item will have a depth of holding which carries with it a depth service level of, say, 90%. But what about the 25% of demand you aren't stocked for and what about the fact that 10% of the time you will be out of stock of what you do hold? Obviously you need a back-up system. It is fine for AUSMIMPS to let stock come forward in an economic and leisurely fashion. But there must also be a set of priorities to ensure that non-stocked items get forward fast. This is the function of the Urgency of Need Designator (UND) in the AUSMIMPS system. But the question must be asked: does it work and will it work under pressure? The answer is that it will work if the planners have done their job. That job is, first, to choose the number and location of the echelons, second, to specify a range service level for each echelon and, third, to specify the depth service level for each echelon. Then, most importantly, there must be set aside enough stock control, communications and rapid transport resources to match the two service levels. All a matter of balance and always with risks. And it is the commander's duty to decide on the risks to be taken.

Echelons and Range—Summary

In designing a stocking system, the first two decisions are echelon and range; depth comes later. In principle the fewer the echelons there are the better but it depends on the certainty
with which supply can be got forward come what may. The better the stock control, communications and transport, the higher the confidence and so the fewer the echelons and the lower the service levels forward. Justifiably, the Australian Service's confidence is not high (with partial exceptions) although it is higher than in World War II.

Whatever the number of echelons, each will hold only a part of the full range that might be demanded of it. Therefore a rapid back-up system is necessary for the rest. This requires a sufficient allocation of resources for stock control, communications and rapid transport. In fact that is what the stocking system designer must do: strike a balance between range service level, depth service level and the quantity of resources needed to cover the inevitable extent by which each service level falls short of 100%.

**LIABILITY ASSESSMENT VS PROCUREMENT VS ASSET MANAGEMENT**

**Liability Assessment**

So far this article has been about liability assessment, the calculating of the ideal equipment solution to a particular operational task. The author's view must have emerged that decision-making in this area is substantially the prerogative of the commander. Finance does not enter into it. That is not to say that economy is not relevant. Indeed, the commander (or anyway his staff) has to strike a balance between service level, economy and the quantity of resources needed to cover the inevitable extent by which each service level falls short of 100%.

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**Procurement**

The picture changes when procurement decisions have to be taken. Just because there is an assessed liability is no reason, of itself, to buy. Funds are nearly always scarce and there must be priorities. So what gets the priority? And who has the right to participate in the decision making?

First it must be stressed that the stocking components do not change: they are still working stocks, equipment pools and reserve stocks. What changes is the numeric value to be assigned to each component for procurement purposes. Nevertheless it is as well to get the sequence right. If we don't keep in mind what we need and why we need it we are not likely to make good decisions about what to buy. Nor, later, are we likely to make good asset management decisions about how to use whatever it is we bought.

The major factors which affect procurement decisions are:

- strategic and operational
- commercial/industrial
- financial

Any particular strategic situation implies some different rate of consumption from that previously prevailing. The problem, essentially, is to plan how to convert from the present rate of consumption to the one under contemplation. The nexus between lead time and warning time must be analysed. Broadly, if warning time is greater than lead time, no reserve stocks need be held. That is, the current procurement requirement becomes simply to buy to match
current consumption. If the reverse is the case, then sufficient reserve stocks should be bought and held to cover the assessed shortfall between warning time and lead time (and to allow for destruction). This seems simple enough in principle. It only requires the strategic/operational planner to assess a warning time for each contingency (lead time comes later under 'commercial/industrial'). He need not even be particularly accurate, provided the warning time is clearly longer than the lead time or provided the probability of the contingency is low. Conversely, though, as the war clouds gather the responsibility becomes heavier.

The key stocking component from the commercial/industrial viewpoint is lead time. Finding the right numeric value for lead time is a tricky business. Whatever it is in peace, it will be different in an emergency. Friendly suppliers will shorten their lead times. Antagonistic suppliers may refuse to supply. National industry may or may not switch to defence production and it may be fast or slow. The point at issue is that the defence commercial/industrial adviser has a contribution to procurement decision-making. The liability assessment process decided what would be needed to equip and stock the contingency force initially and how much it would need each month thereafter. The commercial/industrial adviser must say, for each major equipment and for much else besides, what the prevailing lead times will be. Only then can the essential minimum buy quantity be arrived at.

Finally, financial considerations will lead to a re-assessment of all that has gone before. Service levels within each of working stocks, equipment pools and reserve stocks may need to be changed. The merits of each of these three may need to be considered against each other. In particular, there may be a need to find a balance between contingency needs and current operations. The contributors to this balance will be all of the command, strategic, commercial/industrial, financial and, probably, political participants.

**Asset Management**

Every commander is an asset manager. Every commander is responsible for the equipment and stocks he holds. And he will want the most from them. The asset manager must manage with what he has. He appreciates the same stocking components and they have the same purposes. But instead of working upwards from the desirable numeric values of components to a total liability, he works down from a total asset in order to assign actual numeric values to stocking components.

The asset manager will be well advised to keep the liability well in mind. His tools of trade are rationing and pooling. In effect, he alters service levels, probably arbitrarily. For example, whereas the liability assessor sets a repair pool based in part on desirable on-line percentages for unit equipment the asset manager will impose on-line percentages based on the repair pool he happens to have.

An important tool is the training pool. Instead of letting all units have their full entitlement the asset manager probably has to restrict them and then put part of the asset thus saved into a training pool for all to use. But he must use the principles of liability assessment nonetheless for he must define the purpose of the pool in order to measure its equipment liability.

Repair pools must always be set aside first—at their appropriate proportion of the actual fleet-in-use.

The original liability must never be forgotten, else there is the danger that a contingency reserve may waste away. Of course one may deliberately use a contingency reserve for current purposes provided it can be re-called in an emergency. But the best advice is still: upon committing a reserve, immediately constitute another.

**Liability/Procurement/Asset—Summary**

The same stocking components are used for the purposes of liability assessment, procurement decision-making and asset management. But they are used differently for each purpose and, particularly, the numeric value assigned to each component will differ according to the purpose. Liability assessment is definitely the start point because neither of the other purposes can be pursued efficiently without being informed as to the underlying liability.

The stocking components are:

- working stocks, comprising:
  - consumption period
  - supply margin
— lead time
— usage rate.

• equipment pools, comprising:
  — unit equipment
  — force pool of construction equipment
  — other contingency-related pools
  — any other pool with a specifiable purpose
  — repair pools commensurate with the whole fleet in use.

• reserve stocks, comprising a separately identified quantity for each probable contingency or the designated capability.

Although neither equipment pools nor reserve stocks have been defined to include a lead time element, it is there nonetheless. Whereas for liability assessment, the numeric value assigned to lead time can be reasonably standardized, for the other two purposes it becomes important, even desperately important, to know what the actual lead times will be for particular equipments in particular circumstances. In fact, there is justification for the defence commercial/industrial experts taking action to control lead times in advance. Pre-existing contractual arrangements could be justified.

Recognising that there are three separate purposes, the organizational elements involved in each are:

• liability assessment—commanders (and their staffs).

• procurement decision making—commanders, strategists, commercial/industrial specialists, financiers and politicians.

• asset management—commanders (and their staffs).

A PRESCRIPTION FOR SENSIBLE STOCKING

It is not necessary to summarise this article here because there is a summary at the end of each section of the article. Instead this is the place for some evangelism. It was said that there is no such thing as a correct stocking system and that stocking systems are designed to meet two criteria, namely service level and economy. Neither criterion is met particularly well in the present Service stocking systems. In the first place, we have only the vaguest idea what service levels we achieve—let alone what we aim at. In the second place, the present systems are far from being as economical as they could be. The following paragraphs offer a prescription for improved economy.

The point has been made several times that a good (meaning economical) stocking system requires good warehousing and stock control, good communications and adequate, reliable (with some of it being rapid) transport. The price to be paid for shortcomings in these characteristics is increased stocks forward, probably including an increase in the number of echelons. Such increases carry the overhead of greater investment in manpower, accommodation, material (stock) and equipment. If commercial experience and the experiences of military Services overseas are anything to go by, the Australian Services could have the same service levels for less investment or better service levels for the same investment, or both.

We should rationalise our storage accommodation into fewer locations and buildings. Other people's experience is that we could sell some of what we have, build modern efficient (i.e. low operating cost, low manpower) storage accommodation and still make a cash profit on the changeover.

We should introduce modern (well, modern to us) inventory control techniques. By using the Economic Ordering Quantity (EOQ) formula to set most (not all) consumption periods other people have saved staff and a great deal of money. Why should we be different? In the case of supply margins, we presently set them on a fixed and arbitrary basis. Flexible supply margins are easily calculated by computer and a great deal of money can be saved while giving better service. Better communications and more streamlined procedures lead to lower investment in stock and fewer staff. Other people’s experience has been that all of these advantages flow from two factors:

• a thorough review of their stocking system, and

• the use of adequate, preferably dedicated, computer capacity.

The need is for a standard military stocking policy with the features listed at the beginning
STOCKING CAN BE SENSIBLE

of the article. The route to such a policy has to be through:

- the analysis of the stocking components in order to detect their constituent elements and to do so at least as rigorously as this article has done;
- the development of methodologies for allocating numeric values to each stocking component, i.e. different methodologies which will be relevant to each of the different stocking purposes and which will be cost-effective in relation to the value and importance of the different strata of the inventory; and
- the derivation of a set of military stocking principles to guide the re-design and subsequent operation of the military stocking organization.

BOX KITES AND BEYOND

Here are extracts from what E. McL. Holmes, Senior Lecturer in Accounting, Melbourne University, had to say about the book 'BOX KITES AND BEYOND' by WGCDR E. G. Roberts, RAAF (Retd). The Hawthorn Press, published in 1976, $14.95.

Wing Commander Roberts learned to fly on Box Kites, in the days before parachutes had been invented, which had a top speed of forty-five miles per hour and a landing speed of about twenty-five miles per hour.

In 1916, after four and half hours dual and ten hours solo flying in Australia, Roberts was sent to the United Kingdom via Egypt for further training. Having seen five men killed in three aircraft accidents during the first three days at his new United Kingdom aerodrome, he understandably approached with some trepidation his first flight in two months and in a BE2C (a new type of aircraft).

Between the wars Roberts travelled widely, seizing every opportunity to keep in touch as a pilot. In 1939 he once again enlisted, this time in the RAAF, for service which was to take him in 1942 in and out (before the advancing Japanese) of Singapore and the Dutch East Indies and later to London towards the end of the blitz.

'Box Kites and Beyond' is a book for the lover of wartime adventures and of the thrills of flying.

Supermarine Spitfire Mk Ila, P7973, photographed in the United Kingdom on the occasion of its presentation to Australia in 1944. The fighter is shown in the camouflage, colours and markings as detailed in BRITISH AVIATION COLOURS OF WORLD WAR TWO. This Spitfire is one of the major attractions in the Aeroplane Hall of the Australian War Memorial. See pp. 63-64.
IN 1858 a powerful alliance of North Island Maori tribes elected their own King, and in the early 1860s the ‘Kingite’ forces armed with rifles, shotguns, muskets and a few cannon, attempted to resist further land alienation by European settlers.

This article tracks the advance of the Imperial Forces against the ‘rebels’ into the most fertile and best defended of the Kingite strongholds—the Waipa delta.

In January 1864 Lieutenant General Sir Duncan Cameron, once the commander of the Highland Brigade at Balaklava, began his slow and laborious advance from Ngaruawahia up the Waipa River. Cameron had succeeded Major General T. S. Pratt as General Officer Commanding the Imperial Forces in New Zealand in 1861, and after two years spent improving the military roads in Auckland and south Auckland he led his mixed army of British Crimean and Indian veterans, colonial militia, and Forest Rangers and loyalist Maori, southward to attack the Kingite ‘rebels’. On 12 July 1863 Cameron had begun his campaign in the Waikato and by the close of October the Kingite forces had been dislodged from their fortress at Meremere. Rangiriri was the next Kingite bastion to be attacked and once the intricate system of trenches and ramparts, with its great central redoubt, had been taken the door was opened into the Waikato hinterland.

He was laughingly called ‘the lame seagull’ by his Maori foes, who marvelled at the slowness of his advance southwards; a slowness dictated by the difficulties created in supplying thousands of European troops over hundreds of kilometres of broken, bush-clad and swamp-divided terrain. William Fox, at first a critic of Cameron’s caution, noted soon after the Waikato campaign had ended that ‘the lame seagull’ could move only as quickly as “some 1500 horses [that] toiled incessantly at the task of hauling wagonloads of stores from Auckland along the forty miles of road to the river running the gauntlet through the flanking column of marauding natives . . . dragged its slow length along”. Only at the outbreak of war was attention given to the provision of steamers and barges to allow supplies to be sent to the Waikato by sea from Manakau.

Cameron’s caution was encouraged by his shrewd realisation that his conquests were intended to provide landed estates for Auckland speculators, many of whom sat in the Provincial Council and some who were members of the central legislature. A professional soldier, with experience at the Alma and Sebastopol in the Crimea, Cameron did not allow his admiration for the Kingite troops to influence his tactical decisions. He was a brilliant strategist who was unwilling to sacrifice his troops needlessly, who sensibly refused to advance his men beyond the capability of his thinly held supply line, and
who set as his goal the shortening of the war by a careful selection of military targets.

In early 1864 the fighting strength of the Kingite forces had not been fully gauged and the danger of counter-attack against the supply line from Auckland was a distinct possibility. Although by early December the imperial forces had won several victories and had forced the Maori King to evacuate his capital, Ngauru-wahia, the general realised that the most warlike of the Kingite alliance, the Ngati-Maniapoto, Tuhoe, and Ngati Raukawa, had still not thrown their full weight into the campaign. Cameron could not be sure whether ‘rebel’ reinforcements might not suddenly appear to give his enemies a numerical weight and tactical mobility that could divide and threaten his forces.

‘The lame seagull’ sensibly took his time advancing into the Waipa delta. He waited while a sea expedition, led by his second-in-command, Brigadier General G. J. Carey, occupied Tauranga and turned the attention of the Bay of Plenty tribes to their own predicament. The Tauranga expedition depleted their ranks by further weakening their strategic reserve and Cameron was unwilling to face the strong Kingite forces in the Waipa, awaiting him in four massive fortresses guarding each of the four routes from the rivers to the delta, without a full complement of officers and men.

Once the Bay of Plenty Kingites were contained, Cameron ordered his Imperial Regiment, the Waikato Militia, loyalist Maori adventurers and the Forest Rangers led by Captain (later Major) Gustavus Ferdinand von Tempsky, and Captain (later Major) Frederick Jackson to begin their march along the banks of the Waipa River.

Naval and artillery support backed Cameron’s cavalry and infantry as the Imperial Force edged forward. Though narrow in places, the slow-flowing Waipa River, then free from the willows and weeds that today constrict its flow, was navigable to smaller supply craft and to barges. Two armoured gunboats, the Pioneer and the Avon, patrolled the Waikato to guard the seaward approaches, and Cameron’s 3,000 troops were accompanied by an artillery battery of six-pounder Armstrong fieldguns. Comparisons with other colonial wars of the mid-nineteenth century, in Africa and India, suggest that Cameron’s army possessed a seemingly conclusive fire-power advantage over the musket-firing and Taiaha-wielding ‘rebels’.

By mid-February 1864 General Cameron had advanced his field-headquarters to Te Rore, about fifteen kilometres south of the present city of Hamilton. A few kilometres to the east of his river-side base, on a low ridge commanding more open fern-covered valleys, lay the Kingite fortress of Paterangi. Of all the bastions that blocked Cameron’s advance in the Waipa delta —Puketoki (Axehill), Manga-Pukatea, Rangiatea, and Paterangi, the last-named was the strongest and most defensible. Perched on a long, low spur Paterangi pa was a fortress of amazing strength and complexity. Trenches, tunnels, earthworks, bomb-proof shelters and underground accommodation were designed to protect its defenders from prolonged siege. Crimean veterans on Cameron’s staff refused to believe that Paterangi had been built by Kingite warriors and insisted that a European engineer was in the Maori King’s employ. One Crimean veteran argued that the Paterangi fortress was a stronger and more intricate than the Redan at Sebastopol, where the British and French
received over 3,000 casualties in their attempts to storm that fortress. Faced with an apparently impregnable castle Cameron was unwilling to risk heavy losses in an attempt to reduce a fortress obviously stronger than Rangiriri, where he had received 130 casualties.

The Kingite defenders of Paterangi assumed that Cameron could not afford to by-pass their fortress and calculated that once their challenge was accepted the invaders’ advance would be halted. They under-estimated Cameron’s determination to destroy their fighting capacity with as few battles and as few losses as possible. Cameron had learned from the wasteful siege warfare of the Crimea where thousands of lives were spent in needlessly reducing strongposts that could well have been ignored. From the blood-letting of the Crimea he had gained a new strategic perception that led him to aim his blows at lines of communication, political rallying points and, above all, at supply bases. He declined to attack Paterangi pa and by a skilful night march on 20 February Cameron marched his army round the Kingite fortress and moved his forces into position above the vital Kingite supply base of Rangiawhia, about seven kilometres to the east of the present town of Te Awamutu.

Ensign Mair, an interpreter on Cameron’s staff, noted that on the morning of the 21st February, the Imperial Forces looked down upon “the large and unfortified village of Rangiaowhia nestled among the peachgroves and surrounded by extensive fields of wheat and maize, the spire of its churches rising above the trees”. This prosperous village with its flour mill and food stores was indispensable to the success and sustenance of the Kingite troops in the Waipa. Rangiawhia’s villagers cooked their morning meal confident that the fortress of Paterangi would hold back the Imperial army and completely unaware of Cameron’s night march.

In a series of speedy and complex tactical advances Cameron deployed 1,000 troops against the Kingite supply base. A brigade of infantry was marched from Te Rore to Te Awamutu, along the hills above the swamp bordering the Mangaohai stream, and after a two kilometre advance along the Hairini ridge overlooking the village they were ready to attack. A fierce cavalry charge by sabre-wielding Imperial troops and revolver-firing Forest Rangers was followed by an infantry attack from the heights. The invaders rushed from whare to whare thrusting flaming torches into the combustible raupo and flax and wildly shooting at any moving object. A tribal elder emerging from his burning home, with his arms raised in surrender, was cruelly shot down, and a desperate last stand in the Roman Catholic church ended in the massacre of the defenders. After a three-hour attack, Cameron regrouped his troops at Te Awamutu and sent patrols to observe likely Kingite retaliatory measures.

By nineteenth century military standards General Cameron’s attack on Rangiaowhia was a brilliant strategic move against an enemy regarded as savage, ignorant and inferior; a native race rebelling against the blessings of British rule. From the point of view of the Kingite Maori, Cameron had offended against the basic code of honourable warfare. He had refused a challenge to fight warriors and instead he had preferred to do battle with old men, women and children. While the Kingite war chiefs denounced their unchivalrous foe Cameron was content in the knowledge that he had deprived his enemy of a vital food reserve, reduced their chances of sustained resistance and had gained a vital victory at the cost of minimal troop losses—five killed and three wounded. Two leading Kingite chiefs, Hoani Papita (John the Baptist) and Ihaiah (Isaiah) had been killed in the attack, and thirty enemy prisoners had been taken. After the imperial victory at Rangiaowhia Maori inhabitants of the Waipa, driving their horses and cattle before them, began to leave their ancestral villages and move slowly southward toward the Puniu River and the apparent safety of the King Country.

Cameron followed his victory at Rangiaowhia by turning his attention to Kihikihi, a large Ngati-Maniapoto town that stretched from the Puniu River several kilometres northwards and eastwards; a peaceful and idyllic settlement with houses hidden among orchards, wheatfields, maize patches and potato gardens.

For Cameron, Kihikihi was the political target of prime importance, for not only was it the home of the Ngati-Maniapoto ward chief, Rewi Manga Maniapoto, the Maori King’s fiercest field commander, but it was the sym-
Major von Tempsky in action.

The historic centre of southern Waipa resistance. On the Ratatu Hill stood the Kingite Council House, the Whare Runanga known as Hui-Te-Rangiora, where the Maori parliament had met. Rewi’s flagstaff, with the Kingite ‘rebel’ standard at its masthead stood defiantly on the hilltop. Kihikihi was the power centre for the most military and most committed of the Kingite tribal alliance, the Ngati Maniapoto. Its master had hoisted the Maori King’s flag in April 1858 to summon the tribes to resist the pakeha land thefts, and the same Rewi Maniapoto had advised the King to advance his troops to fight the pakeha as close as possible to the town of Auckland.

Cameron’s troops came to Kihikihi suddenly and savagely. The town was looted and burned and the Kingite flagstaff pulled to the ground. Rewi and his villagers fled southwards, across the Punui River, where the King and his bodyguard had already established their headquarters.

Rewi looked north across the Punui at the plumes of smoke rising above his town and realised that the time of reckoning had come. The enemy had reached the northern borders of Ngati Maniapoto tribal territory and there seemed no reason why Cameron’s forces might not continue their advance into the heartland of the King Country. Rewi’s despair was only slightly relieved by the arrival of fierce Tuhoe warriors from the Urewera country, reinforcements from Taupo and Ngati Raukawa from Kawhia. These were the troops he had tramped the countryside in 1863 to recruit and now they arrived too late to turn the tide of battle.

In late February 1864 Cameron believed that the southern sector of the Waipa delta could be pacified with little further military action. He was well aware that his colonial political masters had no plan to confiscate the Ngati Maniapoto lands north of the Punui River, and he was now in a position to consolidate his advance without fear of a dangerous counter-attack. Bishop Selwyn had ridden with him as his troops moved toward the end of their mission and had pleaded that the Maori remnant should be given every opportunity to make a dignified peace. Cameron’s disillusion with the colonial parliamentarians and with Auckland’s Provincial Councillors had grown as the war proceeded, and he saw little glory to be gained from using his sword in the interests of land-hungry businessmen.

Cameron’s hope that the fighting had ended was thwarted by a Kingite decision to make a last stand in the Waipa delta. In the last week of March 1864 Rewi was persuaded by his un-blooded reinforcements, and by sub-chiefs who had seen their villages ravaged by the Redcoats, that honour demanded that yet another challenge be offered to Cameron’s forces. On the 29 March an armed patrol from the 50th Regiment, on a reconnaissance mission from the
Te Awamutu redoubt, discovered a small force of 'rebels' digging rifle pits on a knoll about five kilometres to the west of the present town of Kihikihi. An armed column was at once despatched to attack the Kingite force and the spearhead commander, Colonel Waddy, ordered his advance guard, the Forest Ranger Squadron commanded by von Tempsky, to probe the enemy's defences. Von Tempsky's squadron cautiously approached the weak barricade of manuka sticks and were scarcely surprised when the bracken on the slopes beyond suddenly came alive with enemy marksmen. The Karapōnia (California) slope at Orakau had been chosen as the site for a final battle with the Imperial troops, and the combined Ngati Maniapoto, Waikato, Tuhoe, Ngati Whare, and Ngati Raukawa force had dug themselves into concealed positions, and baited their trap with the building of a weak barricade.

Captain von Tempsky called for reinforcements and Brigadier General Carey set out on the 31 March from Te Awamutu with 600 soldiers, accompanied by an artillery battery and a supply of new friction hand grenades. A mobile detachment of 300 troops—from the Forest Rangers, the 40th Regiment and the 65th (the Royal Bengal Tigers) Regiment had previously moved unobtrusively behind the Kingite position. A detachment of the Waikato militia, volunteers recruited from throughout New Zealand and the Australian colonies on the promise of land grants, joined Cameron as he marched, and a third body of troops, one hundred men strong, moved simultaneously through the bush to the north-east of the Kingite's position, to complete the encirclement and to force the enemy to retreat within their fortification.

How defensible was the Orakau Pa? The site selected for the Kingite challenge was regarded as inferior and disastrous by Rewi Maniapoto. Religious prophecy had a greater say than military judgment in the siting of the Orakau defences. A tohunga of the Tuhoe warriors prophesied that if a fortress was built at Orakau the Imperial Forces would fail in their attempts to take it. Te Paerata, a chief of the local Orakau people, was eager to fight on his own ravaged land, and added his weight to the tohunga, insisting 'Me mate auki kone', 'Let me die here!' Rewi let the reckless newcomers, avengeful local inhabitants, know that their choice could only bring disaster. He sang a lament of despair to them, of war and of one solitary tui left to sing in the dawn, in a land overrun by pakeha. That night Rewi dreamt that he was flying a kite, a Maori kite made of raupo and decorated with feathers. In his dream the kite flew high, outside the church at Orakau, soaring and lifting, and then suddenly it began to dive and crashed to the earth, to smash into a hundred pieces. This was a makite, an omen of defeat, but it failed to dissuade the Kingite defenders who continued to deepen their trenches, sharpen their stakes, and cover bomb-proof shelters—women and children labouring beside the men.

When Carey’s force attacked, 300 Kingites, including twenty women and children, prevented from escaping by the encirclement of the fortress, faced their opponents from positions forming a rectangle, about the size of a tennis court. Orakau had only two advantages for its defenders. The soft clay of the Karapōnia ridge allowed speedy digging but even so the defenders had not completed their preparations when the attack began. The site was bordered to the south by swamplands and a bush-covered escape route to the King Country. These two assets only slightly redeemed this tactician’s blunder, for the low knoll provided no natural protection from artillery bombardment, there was no secure water supply and the hill crest provided neither enough height for useful observation of enemy movements, nor enough cover for sanctuary following aggressive sorties. Higher and more easily defensible hilltops, some within sight of Orakau, many the sites of earlier pas, were within an hour’s march. Orakau was obviously selected as a battleground in order to allow the Kingites an opportunity to redeem their honour. Those who had arrived too late for earlier battles insisted that the pakeha be drawn by a challenge he could not ignore, and the Ngati Maniapoto, who had not played a full role at the Battle of Rangiriri, were anxious to salve their reputation. This uninspiring slope, so close to the Kihikihi and Te Awamutu redoubts, could not fail to draw an attack from the imperialists—and it did.

The first attack on the Orakau trenches was made at 9.30 a.m. on 31 March and in leading it Captain Ring of the 18th (Royal Irish)
Regiment was killed, and his men were forced to retreat under a fusillade of musket and rifle fire. A second infantry charge, reinforced by a company of the 40th (the Somerset) Regiment and a company of the 18th Regiment also failed. Two Armstrong six-pounder guns placed 360 metres from the pa on the most elevated position on the ridge, then bombarded the 'rebels', but their shells did little damage to the deeply entrenched defenders.

By the mid-afternoon of the 31 March, Brigadier General Carey was aware that any further infantry charges against the pa would entail heavy casualties for his troops. Carey decided that as his foes were completely encircled he could best use time to advantage by slowly advancing saps (protected trenches) into their position. The Brigadier instructed that a 'flying sap' (a speedily dug trench protected by baskets of earth) was to be excavated right up to the pallisade, and that artillery and grenade attacks should then be left to do the rest. Soldiers were at once instructed to begin digging, while others were sent into the swamp to make gabions (wicker baskets of cylindrical shape) from flax, to hold packings of earth. The gabions were placed along the top of the trench, facing the enemy, to give protection to the sappers, and cover for riflemen sniping at the defenders.

During the night of the 31 March, the sap was dug closer and closer to the Kingite fortifications with the sappers under constant fire. On Friday morning the digging continued while Kingite reinforcements from the direction of Maungatapu and Rangiaowhia were turned back by the 65th Regiment, the Waikato militia and the Forest Rangers. During the night a Kingite attempt from within the pa to halt the progress of the sap failed and a charge into the sappers was beaten back. Throughout the night the pipes of the Scottish Highlanders encouraged the sappers and the chants of the Kingite sentries kept the besieged to vigilance.

The dawn of the second day, the 2 April, saw the battlefield shrouded in fog. The Kingite defenders were now low in ammunition and were forced to fire peachstones and bullets carved from applewood and manuka at the attackers. When General Cameron and his staff arrived at mid-day the flying sap had reached within 21 metres of the outside defence perimeter and a platoon of troops had been issued with friction grenades, designed to ignite when struck against any hard object and timed to explode before the enemy could have any chance to hurl them back. At this point an artillery piece was moved to the sap-head and charges of grapeshot fired into the Kingite position, while a grenade attack was simultaneously launched. Soon after his arrival, Cameron decided that the defenders must now be low in water and observed the presence of women and children in the fort. The General decided to offer the defenders a chance to surrender and ordered Ensign Mair (later Major Mair, resident magistrate) into the sap with a white flag. Mair bravely climbed over the gabions and made his peace overtures into the muzzles of scores of Kingite weapons. His message was to the point: “Friends, listen! This is the word of the general; great is his admiration for your bravery. Stop! Let the fighting cease. Come out to us that your bodies may be saved.” After a short debate the besieged gave a reply, later and for political reasons ascribed
to Rewi Maniapoto; 'Kaore e mau te rongo, ake, ake!' ('Peace shall never be made, never, never!'). Mair attempted to continue the parley by offering the defenders an opportunity to send out their women and children. Ahumai Te Paerata, a Taupo chief's daughter, refused this offer, insisting: 'Ki te mate nga tane, me mate ano nga whahine nga tamariki.' (If the men die, the women and children must die also!) As Mair dropped to cover a bullet slashed through the shoulder of his tunic to announce that the truce had ended.

The defenders successfully repelled two further attacks and then, almost completely without ammunition, attempted to mass escape from the south-eastern side of the fort, through a little guarded sector of the Imperial line. Rewi's escape attempt was made through an area where sentries had been drawn to give the field guns a clear zone of fire, across a dray road, into the bush beyond and then into the swamp. This mass escape was foiled by the chance observation by a work-party from the 40th Regiment, who were engaged in cutting manuka in the bush. In the hand-to-hand combat that followed the alarm was given and the mounted artillery, with sabres drawn, galloped around the swamp to encircle the escapers, while von Tempsky's Forest Rangers, assisted by 'friendly' Maori troops, forced the Kingites to divide into small groups that were pursued and massacred. After the stockade was finally entered only twenty Kingite bodies were discovered; 101 were shot down or sabred in the swamp. Only a few defenders, including Rewi Maniapoto, made their way across the Puniu River to the sanctuary of the King Country.

With Rewi's escape the battle of Orakau had ended and the General began to count the cost of victory. For the loss of 16 Imperial soldiers killed and 52 wounded, Cameron and Carey had forced the renowned war chief of the Ngati Maniapoto to flee from the field of battle, leaving behind 121 dead warriors, 26 wounded and 7 prisoners for the Kawau Island prison camp. Cameron had won a victory but Rewi had created a legend.

A few days after his victory Cameron had moved his troops to Maungatautari, the last stronghold in the Waipa. The pa on this gaunt 795 metre peak, 16 kilometres to the east of Te Awamutu, appeared the obvious site for a fierce resistance. Cameron's advance patrol found the fortress deserted. The Kingite had abandoned the Waipa and had retreated into the heartland of the King Country.

The Maori King had lost the Waipa delta but the final challenge of his forces at Orakau suggested to both pakeha military and political leaders that it would be costly to pursue the Kingites beyond the aukati (confiscation) line; a line already drawn from Raglan to Tauranga to prize rich lands from the 'rebel' people. The Auckland politicians who mixed business and politics to the advantage of their purses, had already decided that there would be little chance of winning more money from British collers or from New Zealand taxpayers to expand the war into the Kingite heartland. In any case, the Kingites in the Bay of Plenty were restless, and while garrisons were left to build new redounds and patrol the Waipa frontier, Cameron moved with units from the 12th, 14th, 40th, 65th and 75th Regiments to face a challenge at Tauranga that soon led to the Battle of Gate Pa. The Tauranga campaign allowed Waikato passions to cool and an absence of large-scale military operations led both Kingites and Imperial troops to more and more regard the Puniu River as the border between two nations.

The invaders from the north had paid a high price for their conquests of the Waipa. The Waikato campaign had cost New Zealand $6 million, the death of over 100 Imperial troops, 460 wounded, and the anguish of civil war, with the creation of a century of resentment. Within a few months the Waipa had been cleared of its Maori inhabitants and was garrisoned by an invading force that intended to build British farms where Maori villages had once stood. By June 1864 the war had ended and a hostile peace had begun.

NOTES
2. Ibid, p. 75.
THE TIME SAFETY FACTOR

Brigadier P. J. Norton

A SOLDIER must never be late. It is not so important what he does, as long as he does it on time. He is trained to arrive five minutes early for an appointment. This explains the number of soldiers seen cluttering up corridors or loitering outside huts, tents and railway stations. Senior officers also must not be late, but it is even worse for them to be early. If they are, there is liable to be confusion amongst guards, mess supervisors and others concerned with their reception. However, they do arrive early and go into hiding close to their destination, appearing again exactly on time. The casual observer may detect expensive cars in back alleys or senior people on lonely side roads in the country, adjusting their medals.

To achieve this punctuality, a Time Safety Factor (TSF) is added to all estimates of how long it is going to take to get there. The TSF is part of all Army activities, the more complicated the activity, the more TSFs. In some cases they are duplicated; any person with any authority will create one. They are endemic.

A common example of the application of the TSF is a regimental parade. "I want a regimental parade at 0900 hours on Friday", the Colonel tells his Adjutant. By this he means that at 9 o'clock on Friday morning he expects to find on the regimental parade ground, all those of the regiment who cannot find an excuse to be elsewhere; arranged tidily in three ranks and all wearing the same sort of clothes. He will then inspect them, march them around a bit, and if they are very lucky, make them a short speech. A simple exercise, but the problems arise in getting everybody there on time.

The Adjutant breaks the good news to the Second-in-Command who says, "You can hand the parade over to me at five to nine". Before the Adjutant has reached the door he is told, "You had better make it ten to nine". The first TSF has appeared. The phrase, "You/we had better make it . . .", readily identifies most TSFs.

It is interesting to examine the Second-in-Command's motive for a TSF at this stage. He has two simple acts to perform between the time the Adjutant hands over the parade to him and the time the Colonel appears. Firstly, he receives the Adjutant's parade state. The Adjutant reading from ballpoint pen notes on the palm of his left hand, tells him how many soldiers are on parade and where he thinks the others are. The Second-in-Command can accept these figures or he can set about proving to the Adjutant that they do not balance with the unit strength. This sort of mental arithmetic is beyond most Seconds-in-Command, particularly at 9 o'clock in the morning and the figures are usually accepted. He then has to 'post the officers'. This entails all the officers saluting together and marching to their places on the parade. Given the difficulties involved in getting a group of officers to do anything together, it is still a simple process and very little should go wrong, although recently arrived junior officers

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have been known to get temporarily lost at this stage.

These actions take two or three minutes at the most, yet the Second-in-Command has demanded ten. His TSF is not designed to allow for something going wrong during the act, the more common type of TSF. He is apprehensive that if he does not tell people to be early they may be late. This TSF allows for any previously undetected inefficiency in the organization, and is usually only originated by senior officers.

The Adjutant next passes the Colonel's wishes to the Battery Commanders and the Regimental Sergeant Major. From here planning proceeds down two distinct chains of command. Each chain adds its own TSFs and where the chains meet, an extra TSF is liable to appear. The problem is complicated by one chain, the Sergeant Majors, working to precise timings plus their TSFs, and the other chain, the Battery Commanders, working by rough estimates plus their TSFs.

Take for example one battery. The Battery Sergeant Major suggests a time for a battery parade. The Battery Commander, knowing his Sergeant Major to be a most reliable NCO, but with not much idea of how long things take, replies, "We had better make it ......."

If the Battery Commander had watched the movements of his Sergeant Major over the last few hours, he would realise how unnecessary this TSF was. Some people would take it as an insult. It is fortunate that most Sergeant Majors are very hard to insult.

The Sergeant Major has done his sums in great detail with a blue pencil on the back of Gunner Jones' application for weekend leave. He has allowed time for everything which must happen before the battery arrives at the regimental parade ground, and what is more, he has walked the course, accompanied by his good friend the Sergeant Major from the battery next door. Each of them armed with a stopwatch drawn from their battery Q Store. The Regimental Sergeant Major having brought his pace-stick into action.

At the regimental parade ground, there was a brief conference and a time agreed upon. This was the only precise, scientifically arrived at timing in the whole exercise and what happened to it? — a TSF was added. Thus allowing for unforecast cyclones or attacks by wild elephants.

At some stage of the preparations a coordinating conference may be held. Whether it is or not depends on personalities, usually that of the Second-in-Command. It is a meeting of all interested parties where each checks the others have not forgotten anything. The person who detects the most faults in the other's planning is the winner. Timings are all important at this sort of conference and TSFs while never being acknowledged, get a tremendous boost.

If one person questions a time, the person who has suggested it may be furious, but he will always agree to an increase. Imagine how silly he would look if he did not and something went wrong.

The final TSFs appear in administrative arrangements, culminating in an early reveille and breakfast.

On Friday morning the Colonel is staring at his reflection in the shaving mirror, wondering why he decided to have the parade, and Gunner Jones is standing outside his barracks filling in one of the TSFs with speculation as to what could have happened to his application for weekend leave.

The Colonel is interrupted in his reverie by the Adjutant who makes an enigmatic statement, "What about the parade, Sir?"

"What about the parade?" echoes the Colonel.

"It is raining", replies the Adjutant, water dripping from his raincoat and cap. He has already mentally cancelled the parade along with the rest of the regiment; all he needs is confirmation from the Colonel. The Colonel, not believing the Adjutant's sodden appearance, goes to the window where he is confronted with grey landscape and rivulets of water running from the roof. The Adjutant waits for the decision he knows he is not going to get.
The Colonel knows very well that decisions about parades and wet weather are always wrong. If he says it will go on as planned, it will still be raining at 9 o'clock. If he cancels it, the sun will be shining at that time.

As it is much too early in the morning to make decisions, he tells the Adjutant he will give him an answer about the parade at 8 o'clock. In the meantime he had better find out what the weather is going to do. One would imagine that the rain and its interruption to the inexorable process of getting to the regimental parade ground on time, coupled with the delayed decision would pose a threat to the whole exercise. Fortunately it doesn’t, but all the TSFs are used to the last second. This should not be taken as an excuse for wholesale TSFs. Nothing was further from the mind of the TSF originators than a wet and windy morning. They all know that nobody in his right mind holds a parade in the rain.

The Colonel has carefully prepared the ground so as to cover himself if his final decision is wrong. The available sources of weather information at this short notice are likely to be quite useless, and can be interpreted any way you like. But the Adjutant must contact them and get their ideas on the matter. The instant oracle is the number in front of the telephone book labelled ‘Weather’. The information recorded here is best described as a general idea of what may happen. If the recording starts off by wishing you a “Merry Christmas” early in January, the remainder of the message should be ignored. The Weather Bureau is a little better but very cautious about definite answers. No doubt they are worried about possible legal action in the case of a wrong forecast. Questions such as “Will it be raining on our regimental parade ground at 9 o'clock?” are not well received. The Air Force are very good if you are holding the parade at 40,000 feet over Dubbo. The Adjutant once rang the Navy and was struck by the similarity of their forecast to the Merry Christmas version.

By 8 o'clock it has stopped raining and a weak and watery sun is struggling through the clouds. All around the regiment faces are getting longer, with the exception of that of the Regimental Sergeant Major which now carries what passes for a smile. The Adjutant presents himself to the Colonel with his carefully edited weather report. No matter how hard he tried, he could not eradicate the note of optimism in all the reports. The Colonel does not even ask for the report, “Cancel the parade” he says, brushing the first fly of the morning from his forehead. Then noting the look on the Adjutant’s face, goes on “Can’t you see those clouds over there. The bad weather always comes from that direction”.

At 9 o'clock it is a very nice day at the regimental parade ground. The sun is shining and the patches of blue sky are getting bigger. Instead of the regiment in three straight lines, the parade ground is occupied by one person, the Regimental Police Sergeant. He is still very wet from his last visit at 7 o'clock. His thoughts, as he collects the little red and blue flags stuck into upturned flowerpots, vary from insubordinate to outright mutinous.

Back in the barracks there is a state of controlled pandemonium as the regiment reorganises itself for activities other than planned. There are soldiers being late all over the place. At this stage it does not matter, at least not for an hour or so. Gunner Jones is waiting outside the battery office, having been told to see the Battery Sergeant Major in ten minutes.

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Award: Issue No. 10 (May/June 1978)

The Board of Management has awarded the prize of $30 for the best original article in the May/June 1978 issue (No. 10) of the Defence Force Journal to Lieutenant Colonel J. S. Baker for his article “The Requirements of National Strategy”. 
SIMULATION: A Cost Effective Training Aid

Flying Officer R. W. Weight,
Royal Australian Air Force

Chorus

It's only a paper moon
Hanging over a cardboard sea
But it wouldn't be make believe
If you'd believe in me

Introduction

THE hard, dollar-conscious commercial airline world demands that their every project be cost effective. This attitude has now become of paramount importance within the Defence forces. Worldwide cutbacks in defence spending has dictated that Defence planners look closely at each project to determine possible performance versus costs trade-offs. This fact coupled with the extremely high acquisition and operating costs of modern aircraft has resulted in a change, within the airline industry, in the emphasis placed on a major part of any project; that is the training element. The emphasis has shifted in favour of more ground simulator training instead of training in the operational vehicle. This trend is also being followed to a lesser extent by the military. Simulator training is not limited to aircraft flight training but includes: navigation, marine, radar electronic warfare, ATC, nuclear reactors, truck, crane, artillery and tanks. This article will concentrate on aircraft flight simulators, and provide an overview of simulators, their benefits and the rationale for using simulators in a training program.

Background

To many people, pilots included, the thought of a simulator evokes the image of a ‘Link Trainer’: a general purpose cockpit enclosed in a ‘toylike’ fuselage and mounted on a mechanical base which provides limited motion cues. The ‘Link’ designers claimed no more of their machine than that it was sufficiently representative of aircraft in general in making a practical contribution to teaching instrument flying. Modern jet airliners and the new breed of versatile air superiority fighters have led to the development of new breed of simulators. Not simple cockpit and procedures trainers but visual simulators designed to provide realistic mission capabilities throughout the aircraft’s operational roles.

Most current military and civil airline pilots have had some experience with aircraft flight simulators. Flight simulation has been spectacularly successful in the airline industry for pilot transition training and proficiency testing whilst reducing unprofitable flying time. Moreover, the general aviation community is becoming increasingly aware of the substantial cost savings associated with the partial substitution.
of simulators for aircraft. Although the military needs differ, sometimes dramatically, from those of the civilian airline industry, the basic requirement for an effective transfer of training from the training device to the operational task, applies equally to both.

History

Flight trainers as such were used as early as 1910, when the ‘Sanders Teacher’ and the ‘Eardly-Billings Oscillator’ were used for flight training in England. These rather crude trainers were a representation of the aeroplane, based on a pivot arrangement located in the centre of the fuselage. The importance of sensory cues were realized even then, as the French, in 1917, developed a trainer which had a pivoted fuselage; and the device produced variations of response and feel with assumed airspeed. This device also included engine noise, rudder-aileron crossover, and a simple visual approach. Development of flight trainers continued in the United States, Canada and Great Britain after World War I.

Edwin A. Link developed his first flight trainer, called ‘The Pilot Maker’, in 1929. Immediately prior to and during World War II there were rapid technological advances in aircraft design. These advances created problems in training. For example, the introduction of instrument flying resulted in a need for qualified instructors. Because of the inherent danger of ‘blind flying’ in an aircraft, greater emphasis was placed on the Link Trainer to fulfil this role.

During the late 1940s electronic systems began to replace the early mechanical devices. Analogue computer based simulators were developed in the early 1950s, and were used until the development of the digital computer. The feasibility of real time digital simulation for flight training was demonstrated during the early 1960s. Visual systems were also developed about this time, however, their effectiveness was doubtful due to the poor aerodynamic quality of simulation and poor image quality of the visual systems. In 1969, however, the effective use of total simulation in the training program (providing there are sufficient funds), was validated when Apollo II landed successfully on the moon. During the 1970s, the second generation digital simulators were developed with technology permitting full six degree of freedom motion bases (roll, pitch, yaw, heave, sway and surge) and realistic visual systems.

What is Simulation?

Although the terms ‘simulation’ and ‘trainer’ are sometimes used interchangeably, a distinction should be made: a simulator is designed to represent a specific counterpart vehicle or operational situation; a trainer is intended to represent a class of vehicles in various situations. Much of the literature on simulation in pilot training can be subdivided into two areas: degree of simulation and fidelity of simulation. Degree of simulation refers to the inclusion of design features such as motion, extracockpit visual cues and part-task (versus) whole task representation. Fidelity of simulation refers to the accuracy with which design features represent or duplicate their real world counterpart. The usual reason for striving for high fidelity of simulation is to maximise transfer of training to performance in the operational situation.

The essence of simulation is, of course, to produce an environment on the ground in which the trainee pilot is subjected to the sensations of aircraft flight. There are three
main factors affecting the ‘realism’ of a simulator, and although the complete system plus the computer is totally integrated to produce a working simulator, each can be studied as a separate sub-system.

Firstly, the physical environment in which the trainee operates must be, for all intents and purposes, an exact physical replica of the particular aircraft’s flight deck with all controls, switches, instruments lights, etc. installed and working. Modern day simulators tend to simulate this factor with a high degree of realism, even to the effect and ‘feel’ of the controls. Normal aircraft sounds are also provided to the trainee.

The second factor is the motion base. The problems involved here are greater, since it is not physically possible to simulate the actual accelerations and movements of an aircraft in flight. For example, to provide simulation of the sustained forward acceleration felt in an aircraft accelerating along the runway would require a surge jack (see later), several hundred feet long. Moreover, the major military users of flight simulators, although convinced of the need for motion cues, do not agree on just how important motion cues are to training. Some recent studies in the US and Europe have raised doubt about the value of full six degree of freedom motion system in the military environment. Considerably more behavioural and statistical analysis is required to determine the effectiveness of motion cues in ground-based training.

Basically motion is provided by the simulator flight deck being supported, or suspended, from a series of hydraulic actuators (jacks). These jacks are driven in response to commands from the simulation computer. The number of jacks varies from the simplest three degrees of freedom system to the more complex which provides six degrees of movement: roll, pitch, yaw, heave, sway and surge.

The third major factor in creating realism is the visual system. This area of simulation has produced some dramatic technical advances over recent years. The most common visual scene is obtained by a closed-circuit television camera scanning a model of the terrain, airport and surroundings. The scene is projected to the crew on a TV screen through a collimated optical system which produces a picture focused at infinity. The problem with this system is that the model, measuring some 13.5 x 5 m (44 x 16 ft) and representing 260 km² (110 ml²) of country, requires an enormous lighting power. This power consumption can, however, be reduced by the low-light TV system which is some five times more sensitive than earlier cameras.

The ultimate form of visual simulation, in theory at any rate, is fully computer-generated imagery (CGI). The technique of generating visual displays using a digital computer is now well established in the night-view-only role. The major manufacturers of visual attachments currently have R and D programs aimed at developing CGI systems to produce daylight scenes. The daylight CGI systems that have been produced to date are still very two dimensional and ‘Micky Mousish’, consequently, these systems are, at present, of doubtful value in the military training role. (Lufthansa, the West German flag carrier, operates four simulators (B707, B727, B737 and B747) each with a day-night CGI attachment and from all reports Lufthansa is very pleased with the daylight CGI presentation.)

The night-view CGI systems, however, produce an extremely realistic night view of an airport and the surrounding countryside, using light points in a range of colours and intensities to simulate runway lights, landing air lights including VASI, strobe and approach lights, beacons, flashing warning and obstruction lights and all the street and building illuminations found in an airport area. A horizon glow is also generated to provide an attitude reference,
and also runway surface markings and texture are generated in the computer to provide the effect of aircraft landing light illumination.

Systems are now able to provide up to 6,000 light points in the picture which is sufficient for any purpose, probably more than is needed in most cases. The major advantage of CGI is the flexibility of this type of system. Different airport data bases can be loaded into the system from tape or 'floppy disc' within seconds while visibility, cloud and lighting can be varied by the instructor at any time. The 'night-only' CGI system is also the lowest cost visual simulator system, with costs being about half that of a rigid model TV system. Other advantages include, ease of installation and maintenance, no massive lighting installations to build, run and cool, and reduced operating costs (in order of 12% to 25% of those for TV model systems.

Another type of visual presentation, VAMP (Variable Anomorphic Motion Picture) is based on the use of a 70 mm colour film, taken from an aircraft on an ideal approach path to an airport. Responses to aircraft manoeuvres and deviations from the ideal path are achieved by the use of variable anamorphic lenses to produce magnification that is controllable in magnitude and direction across the field of view. Two lenses are used, with a cross-section corresponding to a segment of a cylinder, each mounted at right angles and capable of rotating about its optical axis. This produces a distortion of the projected picture which changes the perspective and position of the display in response to the simulation computer instructions. The maximum excursion from the central line of the approach path in the VAMP system is approximately 2.5 x altitude, and outside the operational envelope a 'haze' signal is inserted by the computer. By the same token, overcast conditions and fog can be introduced electronically. The realism of this system exceeds any other type of visual simulation, within these limits. Up to ten different approaches to one or more airfields can be provided on a single film reel, and selected as required by the training program.

A development of VAMP, SCAMP (Scanned Motion Picture) uses a colour television system as the display medium with the perspective distortion produced electronically. The picture quality and resolution is reduced in this system, by virtue of the use of television, but the cost of a SCAMP equipment is substantially lower than that of VAMP.

**Definition of Simulator Requirements**

The philosophy behind the training and utilization requirements and procurement of
our flight simulators has in the past differed widely. Simulators have been used within the RAAF for a variety of functions including adjuncts to airborne training with little or no attempt to achieve substitution and ground crew training. As rising aircraft operating costs force us to consider increasing simulator substitution for flight time, several problems must be solved. One is to decide how much fidelity or 'realism' the simulator must have to be a satisfactory aircraft substitute. Another is to determine the substitution ratio, that is, how many simulator hours are worth one flight hour. Although airlines' use of simulators provides some of this information, their experiences are of limited value because of the wide differences between military and civil missions. The available research on the subject is also of doubtful value, mainly because the experimenters have concentrated on the simulators performance in the acquisition of certain limited skills such as instrument procedures and landing performance. In fact although motion systems have been available since the early Link Trainer days, the first experiment to investigate transfer of primary flight training from a simulator to an aircraft was completed only two years ago (1976). An important area of simulator performance hereto not considered by research studies as far as is known, is the maintenance, as opposed to the acquisition, of a high level of overall proficiency. Quite a deal of human factor and statistical research is required to answer these problems, and studies in these areas are currently under way in both the US and Europe.
Why Simulation?
There are three major objectives in the development of flight simulators. These are:

- the development of better pilots and aircrew members;
- the maintenance and improvement of combat readiness in experienced aircrews, and
- the reduction of training and operating costs.

The potential results from increased use of simulation are apparent in several areas:

- **Economy.** Each simulator training hour is much cheaper than the equivalent aircraft training hour and releases aircraft for their true operational role. The cost of operating an aircraft vis-a-vis a simulator varies with aircraft type and with the complexity of the simulator. Generally, simulator operators (both military and civilian) experience a direct operating cost differential in excess of 10:1).
- **Safety.** Simulator training, including normal and emergency manoeuvres, can be practised without hazarding crew or aircraft.
- **Ecology.** The reduced training flying hours of military aircraft will contribute to the battle against noise and air pollution.
- **Utilization.** Simulator availability is far greater than an equivalent aircraft availability and is not dependent on weather or actual air traffic facilities.
- **Flexibility.** Simulator exercises and specific manoeuvres can be ‘flown’ and repeated, as necessary, to maximise each training hour. This flexibility may ultimately allow a reduction in the man years dedicated to pilot training.
- **Freeze.** Advanced simulator instructor facilities including performance monitoring, exercise record and replay, situation ‘freeze’ and independent crew training provide more effective training than the aircraft.

Instructional Capabilities
The simulator flight instructor is perhaps the most important asset to a simulator training program. In the past little attention was given to the role of the instructor and consequently the instructors were burdened with such tasks as problem control and simulator operation and thus were too overburdened to apply their instructional talents effectively. To ease this burden, and to allow the simulator instructor to assume his unique role as a manager of training, some advanced training techniques have been devised (the order in which the items are listed is irrelevant).

- **Rapid Initialization.** Generally, initial flight training is extensively aircraft orientated. Simple, basic manoeuvres are practised, followed by manoeuvres of increasing complexity until the entire syllabus has been presented. Since these first-learned basic manoeuvres are required in all flights, a considerable amount of expensive aircraft time is necessarily consumed in repeating these manoeuvres for other than learning requirements. Rapid initialization allows the instructor (or student) to quickly select a preprogrammed position and simulator configuration without flying to that position. This results in greater simulator utilization, more effective simulator training per training period and a significant reduction in costs. Modern computers
allow an almost unlimited number of preprogrammed starting points and configurations.

- **Automated Demonstrations.** Flight instruction usually entails some degree of demonstration where the student is shown a manoeuvre then allowed to practise it. As physical conditions vary these demonstrations vary not only between instructors but from flight to flight. This inconsistency provides a poor model for the student. The automated demonstration facility of the simulator allows the computer to present consistently perfect (or purposely erroneous) model performance over and over again. This technique frees the instructor from the aircraft flying task and allows him to concentrate on insuring that the trainee understands the basic cues and subtleties necessary to perform the manoeuvre.

- **Automated Sequencing of Manoeuvres.** An extension of the automated demonstration facility is the capability to preprogram a sequence of manoeuvres. It is a simple matter for the instructor to call up different sequences depending on student performance.

- **Automatic Malfunction Insertion.** Aircraft tend to be rather expensive class rooms and sometimes dangerous depending on the malfunction and associated emergency. Simulators are invaluable training vehicles for these situations. The use of computer controlled malfunction insertion provides more realistic cueing (progressively worsening if appropriate), and realistic and effective training can then be achieved.

- **Monitoring Procedural Items.** Pilot training involves the learning of basic skills and procedures. These basics are built on as the student progresses to more advanced flight manoeuvres. Since these procedures are well defined and can be defined in terms of system logic, they are readily adaptable to monitoring by the computer. This facility serves to relieve the instructor of a significant portion of this otherwise attention-demanding and time-consuming task.

- **Automated Recording of Student Performance.** Since the computer, which provides the brains for integrating all simulator components, uses basic aircraft performance data and computed derivatives to make the simulator perform, these same data may be output in objective terms to describe student performance. Thus the recording task of the instructor is significantly reduced and therefore he has more time to observe student activities which do not lend themselves to objective recording.

- **Automated Performance Comparison.** Several flight parameters are readily adaptable to recording (as described above). The computer can then easily compare pilot performance in these areas (such as ability to maintain desired altitude, heading, airspeed, ratio of turn, rates of descent and co-ordination with predetermined criteria).

- **Situation ‘Freeze’ and Playback.** Modern computers provide a freeze and slow replay capability, such as currently used in TV sports programs, for the simulator. Normal and fast forward selection mode is available. This facility allows a critical situation to be frozen, discussed between trainee and instructor then replayed. This capability is also very valuable for increasing the effectiveness of debriefings.

- **CRT Instructor Display.** Cathode ray tube (CRT) displays provide colour presentations of automatic performance readouts to trainees; instrument readouts, check lists and repeater visual displays at the instructor stations; and information for training observers and maintenance personnel. CRTs have proven versatile and effective and since the displayed information is stored in computer memory, there is a large space saving at the instructor console.

The features discussed include some which have recently come into general application with advanced simulator complexes, and some that are currently being evaluated and validated in pilot training programs throughout the world.
The Simulator in Service

Regardless of all the financial, safety and technical reasons for the use of simulators, pilots do not like simulators. In fact once a pilot is addicted to flying the 'real thing' his feeling towards simulators can vary between cordial dislike and total rejection. And why not? The obvious reason is that the simulator is not an aircraft and a less than convincing simulator will only generate pilot resentment if that simulator is presented to the pilot as a realistic facsimile of his aircraft and he is expected to fly it as accurately as he can the real thing. The pilots resentment may then be intensified by unsympathetic simulator instructors who have had enough practice to fly the simulator and who are probably quite unconscious of the acquired skills they are using to do so. These instructors then usually grade the pilot on his ability to fly the simulator not on the trainees ability to apply his simulator training in the aircraft.

It is of paramount importance to identify those areas of training which can be undertaken in a simulator so that the transfer of training to the aircraft is optimised. Those areas where transference is minimal or could even produce negative training should be rejected. Technology has always led the way in producing the simulator hardware but the key factor in successful simulator utilization is pilot acceptance. The point is that no matter how good the system might be unless aircrews are willing to use it with conviction, the intended results will not be produced. Certain criteria are essential in creating this attitude. First the system must be good and it must be capable of going beyond being just a fancy procedures trainer. Second, it must reinforce experience not be a substitute for it. Third, the mission must be realistic and challenging—but not expected to replace flying. And fourth, the atmosphere and manner of conducting missions have to provide positive motivation.
Conclusion

Just how big a role visual simulators will eventually play in initial and continuation training is debatable. Military and civil operator interest in simulation is high but for more reasons than saving fuel and reducing operating costs. Simulators can and do contribute to acquiring and enhancing combat skills. The possibilities are staggering—better performance evaluation, better error and error rate analysis, practising and learning maximum performance manoeuvres safely, to name just a few. But all that glitters is not gold and the technological magnificence of these multi-million simulators will never, and indeed are not designed to replace the actual flying and doing. Regardless, there is a place in the training element of the defence forces for more capable simulators. We engineers trust the operators will use them to the maximum extent to add another dimension to their ability to do the job better than their opponents.

Reprise

It’s a Barnum and Bailey World
Just as phoney as it can be
But it wouldn’t be make believe
If you’d believe in me

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At precisely 7.23 p.m. on 6 May 1927 the massive German Airship Hindenburg edged slowly to its mooring mast at the American Naval Airstation, Lakehurst, New Jersey. It was a popular and momentous event heavily covered by the media. The arrival of the great airship was being described by Herbert Morrison an announcer from Station WLS Chicago. It was to be a recording of the year’s first transatlantic landing for a local program called ‘Dinner Bell’.

“Passengers are looking out of the windows waving”, described Morrison, “The ship is standing still now. The vast motors are just holding it, just enough to keep it from . . .” Here Morrison cut short. It was exactly 7.25 and the reason for Morrison’s sudden silence was a flash of fire near the tail of the ship. “It’s broken into flames! It’s flashing-flashing! It’s flashing terrible! It’s bursting into flames and falling on the mooring mast. This is terrible. This is one of the worst catastrophes in the world”, Morrison’s broken hysterical voice rambled into incoherence. This dramatic and distraught commentary was relayed to literally millions of radio listeners. It served to dramatise a terrible accident, one which, though not as dreadful as modern aeroplane crashes in cost of human life (out of a total of 97 crew and passengers, 22 crewmen, 13 passengers and one ground crew member were killed), was to virtually stop airship development and prejudice public opinion against them to such a degree that since 6 May 1937 not a single paying passenger has been carried on an airship.

Ask the average person in the street if he or she would go up in an airship and I guarantee they would decline the offer yet they would climb into a jumbo jet with 300 other people plus thousands of gallons of volatile fuel and fly away without a moment’s hesitation. The fact is the public is prejudiced against airships. Prejudice is described in the devil’s dictionary as — “A vagrant opinion without visible means of support”. An ironic description when used in conjunction with airships! In this article I would like to describe briefly what the old airships did and why the early disasters occurred, then see how the airship concept can develop and improve with the benefit of modern technology and finally discuss possible uses for the airship as a viable alternative mode of transport and in particular see what civil and military potential it has for Australia.

When the Hindenburg exploded it was filled with hydrogen, a highly inflammable gas when mixed with air. It should have been filled with helium but this gas was denied to a Nazi-controlled Germany in 1937. The old airships suffered from faulty design. Very little was known about the aerodynamic forces that affected an airship in flight. Little was known in the early days about weather effects on air-...
The serious crashes of the American airships Shenandoah, Acron and Macon in violent storms were caused by their being subjected to stresses beyond design limits. The materials used in construction of the old airships were inadequate. Some fabric used to cover the ships was found to hold static and give off sparks if ripped. The only answer to this was to use fabric made from animal intestines which was very fragile and awkward to construct. Despite unknown quantities, setbacks and inadequate technology, airships developed considerably from around 1862 up to World War I when they were used by the Germans as 'ships of war'. The greatest success achieved in the military field during World War I was by the German L59 which collected 51 tons of equipment including 311,900 boxes of ammunition, 230 machine-gun belts, 30 machine guns, 61 bags of medical supplies, 2 sewing machines and a case of cognac and flew from Germany to within 400 miles of a colonial garrison in German East Africa then, due to a false report that the garrison had fallen, flew all the way back having jettisoned the cargo. When it finished this mission it had flown 4,225 miles at an average speed of 45 mph and still had enough fuel left in its tanks to fly another 3,750 miles when it returned to its base.

Despite this success, design was still primitive. The engines on the R101 British airship, for example, were 8 cylinder diesels made by welding together two 4 cylinder engines originally designed for railway locomotives. Nevertheless the early airships did great things; they had great potential; in short they were a concept that had outstripped technology and due to public prejudice no-one was willing to invest money in their development. The Americans eventually persevered with airships on a military basis and made several which were used successfully in World War II in a defensive mode. They were particularly successful in anti-submarine warfare and were used to escort convoys at sea. In 1944 they were used to counter German submarines threatening to block the Straits of Gibraltar. Six airships were used for this operation and were maintained and employed effectively throughout the rest of the war in the Mediterranean.

Since the war airship design has been improved and range increased considerably. With radar fitted, airships have been successfully deployed by the USN. However in the early 1960s the American Defense Department withdrew its support for airships and threw its effort into conventional aeroplanes acting in the airborne early warning (AEW) and anti-submarine (ASW) role.

I believe airships still have great potential, but before this can be realised certain problems must be solved. The airship is too slow for passenger carrying to warrant development costs on this aspect alone. The most attractive possibility for the airship lies in the carriage of freight. Studies have shown that a large airship can be designed which has direct operating costs somewhat lower than those of a large subsonic jet aeroplane. However this in itself does not warrant development of the airship as a new mode of transport. What must be achieved and demonstrated is the airship's ability to cross land-water boundaries and operate without large ground installations. Before this can be effectively and economically achieved certain major problems must be overcome. The first involves the carriage of cargo. The traditional cigar-shaped airship is light and generally unsuited to extreme localised loading. This could be overcome by either distributing the forces generated by the load throughout the hull or simply by distributing the load itself, probably in the form of containers. The cigar shape hampers the first option and the second raises further problems. Firstly a container airship is in direct competition with cargo aeroplanes and development costs could be so great as to negate any real economic justification for them. This may not be such a problem. D. Howe's feasibility study suggests a certain size would be capable of direct operating costs some 30% lower than a subsonic transport aeroplane. The second problem is that of loading and unloading cargo. This can be done in a number of ways. The airship can be loaded by helicopter whilst airborne; the loads could be winched up inside the airborne airship by integral materials handling equipment (MHE); or the load could be taken on whilst the airship is on the ground in a hangar or at a mooring mast. Loading by helicopter is expensive and time consuming. Direct lift requires precision hovering and controls which have yet to be achieved by any airship, and the last methods involve large
areas of land and extensive installations which are not readily available in most countries, though this is less of a problem in a country like Australia.

Loading, however it is done, involves buoyancy variation and this is perhaps the most awkward problem area. It is relatively easy to propel the airship through the air but to raise and lower it quickly and efficiently presents real technical problems. The old airships simply let out gas or took on ballast to come down and vice versa to go up. Two gases have been used as buoyancy for airships. Hydrogen and helium. The former as already mentioned is, under certain conditions, very dangerous. The second is not dangerous but is in short supply and far more expensive to produce than the former. It has been estimated that to lift 250 tonnes for example would require the release of nearly 9,000,000 cubic feet of helium from a suitable sized airship at a cost of around $A155,000.

Many suggestions have been muted regarding buoyancy control. Gas liquification or gas compression ballasting combined with air, is one solution that could provide the necessary buoyancy variation for consideration in cargo carrying airships. The trouble with this system is it requires a considerable power source in addition to that required to propel the airship and the only feasible solution would seem to be nuclear power. A more satisfactory solution, at least in the immediate future, is one involving the burning of hydrogen. In simple terms this envisages hydrogen held in cells entirely within the main helium filled buoyancy cells for safety reasons. As buoyancy changes are needed hydrogen is burned off, not wastefully, but usefully as a fuel in special engines. This has the added advantage of being economical, as hydrogen is cheaper than helium.

The power source for an airship is the last major problem I will deal with. The old airships used heavy diesel engines to propel them. Modern technology has developed more options for power sources. The nuclear answer is purported to be feasible and this has tremendous advantages. The main stumbling block is adverse public opinion. This is unlikely to change until the shortage of natural
fuels really takes hold towards the end of the century. If this should happen then airships can readily develop their potential. For initial development nuclear power is, I believe, a non starter. An airship powered by some form of engine deriving energy from a chemical source is far more likely and this will probably be an internal combustion engine. Diesel and petrol powered engines have little to commend them. The former is heavy and the latter can be hazardous in an airship. The gas turbine is a possible power source. It is light enough but not economical over long distances mainly because it operates best at speeds far in excess of that an airship can cope with. The most suitable suggestion for power is an engine whose development was largely eclipsed by the turbojet which proved more efficient in aeroplanes. This is the Napier Nomad compound engine which combines a diesel with a gas turbine second stage. If this engine were resurrected and developed it is claimed it would be ideal for airships.

If the buoyancy and propulsion problems can be satisfactorily overcome, and I believe they can, then the loading problem can be solved and the airship is on the way to being a viable alternative mode of transport. As mentioned earlier, the critical factor in selling the airship concept is to confirm its potential to cross land-water gaps and do away with expensive elaborate ports and terminals. Potentially the airship offers many advantages. It is quiet and clean which should please the conservationists. It offers very large payloads in containerized form at a lower direct operating cost than a subsonic transport aeroplane which should please commerce, and it can, if suitably designed and developed, do away with considerable port and terminal facilities, which should please hard pressed physical distribution managers and freight forwarding firms but which, I concede, may meet with union resistance. Further direct benefits are gained from these advantages. The need for an extensive road system is reduced. It eases road congestion by reducing heavy ground vehicle traffic hence helping reduce road wear, pollution, and road travel hazards. The Australian continent encompasses 7,683,481 square kilometres of land, much of which is arid, almost impassable to conventional ground vehicles and subject to periodic flooding. This is surrounded by 20,029 kilometres of coastline, much of which is hazardous. This huge expanse of land is not well served by road and rail links and understandably so. The cost of providing a comprehensive all weather road system over the continent is incredible and I suggest is unlikely to happen in this century. Maritime costs are so high that coastal water transport has withered away. Department of Transport statistics show that in 1970/71 sea transport around the Australian coast was responsible for only 5.21% of the total tonnes carried compared to 72.93% by road and 21.85% by rail.

Apart from its great commercial potential the airship also has considerable military appeal and indeed it has been the military application that has resulted in most airship development up to date. A group of airship experts made the following point about airship military potential. “Current technology has not revised the WWI verdict that airships make poor combat aircraft . . . [but] it would permit improving their ability to survive if attacked. Damage control would become feasible in a large rigid or structural airship, since repair parties could reach its frame, engine, and gas cells in flight. More important, it could carry self-defence aids, consisting of early-warning and fire-control radars, anti-air and anti-missile missiles, also other counter-measures suitable to the threat. Even so, prudent operations must keep the ship out of situations for which it is not intended. The vulnerability considerations of an airship do not differ from those of any other military vehicle, be it troop transport or aircraft carrier. Each must operate in the tactical environment for which its designers intended it to have an acceptable level of survivability”. This last sentence is particularly pertinent. The misunderstanding of this point probably contributed to the Royal Navy losing their aircraft carriers in the 1960s—now being replaced in the form of ‘through deck’ cruisers—and also hampered the introduction of the helicopter into the land tactical battle.

The Russians and the Americans have both been studying the use of airships for military purposes for many years. The airship offers the Russians a very real improvement in the rapid deployment of troops to the Sino-Soviet border. At present such a deployment by
surface means would depend on the inadequate and vulnerable trans-Siberian railway. This situation facing the Soviets is similar to that faced by military planners in Australia. The military forces in Australia are widely dispersed and, as already mentioned, the road and rail infrastructure is poor. Should rapid troop concentration or deployment be required, delays are inevitable. Even the use of aeroplanes is limited in certain areas due to the lack of airports with adequate runways. An airship could deliver entire units plus their operating stocks direct to a deployment area so avoiding the use of time consuming and costly military terminals and airstrips. This could be a vital asset when building up military forces in times of increasing tension or potential national threat.

Australia is prone to natural disasters. Airships offer considerable advantages to disaster relief operations. The problem of moving relief supplies and personnel directly into areas struck by disaster can be considerable. Extensive flooding or cyclone damage can preclude the use of ground traffic and even aeroplanes in the vital, early stages of disaster relief and a sea route may not be available or possible. Airships could lift whole field hospitals, prefabricated buildings, vehicles, clothing and bridging direct to the points needed. An airship leaving Sydney could reach Darwin in approximately 20 hours cruising at 120 mph carrying several hundred tonnes of relief supplies. The potential relief that could have been afforded to that city after Cyclone Tracy had airships been available is worth thinking about.

The American military concept for airships has largely centred around Naval operations. I have already mentioned airship operations in World War II. In 1954 a Goodyear ZPG-2 crewed by US Naval personnel cruised for 200 hours off the Atlantic Coast without refuelling, so it has proven ability and as times change and necessity demands, airships could be of great military use in coastal surveillance. Consider the RAN’s current commitment to patrolling the Australian coastline. They have a few patrol boats and millions of square miles of sea to cover. Some of the coastline in the region of the Barrier Reef is so hazardous to shipping as to effectively stop patrolling in that area. An airship could cover huge areas of ocean over long periods regardless of such natural navigational hazards as reefs. The 200 mile territorial limit is being enforced along the coasts of Europe and the Americas, not only to safeguard fish stocks but also present and future oil and mineral stocks. Such a limit around the Australian coastline would, I submit, be impossible to enforce without a vast increase in Naval ships and RAAF aircraft at an unacceptably high cost. An airship is quite fast enough to overtake surface ships. It has the endurance to remain guarding them or remain in the vicinity of an oilrig for example, until help comes by other means if the airship could not put its own boarding party down on it. Because of its size an airship could fly phased-array radar sufficiently powerful to mount a watch over large areas of ocean surface. It could also carry other sensors such as infrared and over-the-horizon radar to enable it to become a highly effective ocean patrol craft. There is no reason why the airship could not carry its own air-to-surface weapons or even its own aircraft which could be launched to classify and intercept intruders into Australian waters. The ability to launch its own light planes or helicopters has the added advantages of permitting the airship to close down its integral surveillance system and so avoid detection if needs be.

The airship could be no less effective as an air surveillance craft. It could help deny target intelligence by detecting the approach of hostile surveillance aircraft. It could also greatly improve the chances of countering submarine launched missiles by giving early
warning of their approach and launching counter weapons at a time when the submarine missile is in a vulnerable stage of launch. The airship could detect submarine activity by trolling high powered sonar devices or by dropping large fields of moored sonar buoys which it could then monitor. There is no reason why the airship could not also carry some sort of anti-submarine air-to-sub surface missile or even the conventional depth charge. As well as pure surveillance the airship has the size and ability to act as a most effective central command post and operational control centre for a large area of sea and air. The power and space available in a nuclear powered airship would enable all the necessary computers, communications and display devices to be installed.

An airship firm, Aerospace Developments, is building a 5,000 cubic metre craft for Venezuela who intends to use it for a variety of purposes ranging from border patrol to passenger and freight carrying. This firm has also received enquiries with regard to the possibilities of an anti-submarine warfare airship version. It seems therefore that interest is being rekindled regarding the military airship.

Feasibility studies have shown that airships can be a viable economic mode of transport. Problems exist but they can be overcome with modern technology and already several firms in Europe are developing small airships for commercial and quasi military purposes. I believe it is not a matter of “if” airships will come but “when”. Pressures from diminishing fuel resources (it is estimated that by 1985 Australia may have to import between 60 and 70 per cent of her crude oil). Widening territorial sea limits, mounting costs of expanding conventional transport infrastructure, and the need for a more rapid, efficient, distribution of supplies, will I believe combine to make the cost of developing airships worth while. Whilst I see no problem in selling the freight airship to the public I can see problems in convincing people that a passenger version or a nuclear powered version is acceptable. Passenger travel may not be important enough to pursue initially, though it is worth mentioning that before World War II the Goodyear Airship Fleet, operating from a bus that acted as both mobile mast and repair ship, carried 405,526 passengers 4,183,470 miles without so much as a bump, so it isn’t nearly as risky as generally thought. Nuclear power offers great potential energy to airships but is clearly less acceptable until the world reserves of natural fuels begin to seriously run dry then, as I have said, public opinion may begin to change.

Australia is a country well suited to airships. Her size, her huge coastline and the costs of improving her road and rail system make the introduction of a new mode of transport like the airship more viable than in European countries. There is yet one more advantage the Australian continent offers airship operators. The average elevation of the whole continent is less than 1,000 feet. As it is desirable to operate an airship at as low an altitude as possible in order to generate the greatest buoyancy and hence payload capacity. This large low land mass presents an ideal operating area for airships far better than any other continent on the earth’s surface.

Airships offer a revolutionary new mode of transport. Anything so new and revolutionary as an airship, especially with such a much maligned and misunderstood past history is going to be hard to sell to governments or industry notoriously cagey about investing in expensive conventional transport modes let alone revolutionary ones. It is my belief that the airship will enter the world’s transport systems this century. I hope this article helps dispell the unfounded prejudice that has long retarded development of these marvellous ships of the air. They have such potential for Australia both commercially and militarily and are worthy of serious consideration.

NOTES
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THE ROAD TO PASSCHENDAELE, by
Cooper.
Reviewed by Captain P. A. Pedersen, Army
Office, Canberra.

THE Third Battle of Ypres began on 31 July
1917 and is better known by the title of
Passchendaele. This single word has achieved
notoriety. It represents more than the enact­
ment of the gloomiest drama in British military
history. For the British people themselves, the
indescribable conditions of the battle and the
incompetence that shrouded its conduct have
come to epitomize the whole course of the war
on the Western Front between 1914 and 1918.
Passchendaele is synonymous with military
failure and time has not diminished the bitter­
ness and acrimony evoked by its very mention.
Indeed in 1958 British newspapers contained
heated exchanges on its pros and cons.

John Terraine’s new book, The Road to
Passchendaele, will, if anything, ensure that
the controversy continues unabated. Familiar
to most Australians for his involvement in
such television series as The Great War, Life
and Times of Lord Mountbatten and The
Mighty Continent, Terraine is among the fore­
mest authorities on the First World War. To
the esoteric reader in this field however, his
proclivities are well-known, for Terraine is
intimately concerned with restoring the image
of Douglas Haig, the British Commander-in
Chief in France. This bias is particularly
noticeable in his earlier works, Douglas Haig:
The Educated Soldier and The Western Front
1914-1918.

The Road to Passchendaele is a continuation
of this theme, utilizing a method that is both
selective and misleading. Terraine has ‘allowed’
the protagonists to tell their story in their own
words, reproducing a wealth of contemporary
documents many of which have never before
been published. According to the blurb this
approach ‘ensures that all sides have an equal
hearing and presents a true account of the
background to the epic saga of Passchendaele’.
One is reminded here of E. H. Carr’s analysis
of the publication of Stresemann’s Vermoehtris,
the papers of the Weimar Foreign Minister.
Stresemann devoted constant and anxious
attention to relations with the Soviet Union
but his negotiations with Moscow produced
only meagre results. Hence the Vermoehtris
concentrates instead on the spectacular results
of his western diplomacy.

Terraine’s work is open to criticism on
similar grounds. Haig emerges as a military
paragon, a worthy member of that hallowed
hall of Great Captains. The Passchendaele
offensive was the product of necessity. The
mounting toll of Allied shipping exacted by
the U-boats following the German declaration
of unrestricted submarine warfare, made vital
the capture of their bases at Ostend and Zee
brugge. Moreover, the serious discontent that
erupted in the French Army following the
Nivelle failure in April 1917 transferred the
burden of containing the German armies on
the Western Front to the British. Finally, there
was uncertainty as to Russia’s attitude follow­
ing the overthrow of the Tsar and it was felt
that a major stroke in the West would harden
the Russian resolve to remain in the war.
Haig’s solution to these problems was to
mount an offensive in Flanders, hoping to
clear the Belgian coast, capture the submarine
bases and expose the German northern flank
to an exploitation whose extent might be
sufficient to force an armistice.

Charteris’ criticism of Nivelle, that he ‘cer­
tainly sees big’ is perhaps equally applicable
to Haig’s strategy. Since 1914 the greatest
offensives by both sides—Ypres, Verdun, the
Somme, and Aisne—had resulted in only mini­
mal gains whose importance was completely
disproportionate to the dreadful slaughter in­
vitably incurred. There were few grounds
on which to base hopes that the Flanders
attack would be any different. L. C. F. Turner
says that from the outset it had no chance of
success and it is difficult to disagree with this view. The area had been reclaimed from marshland through the construction of an intricate system of drainage. This was shattered by the terrific opening bombardment and the battlefield was transferred into a slough in which the armies foundered hopelessly. Heavy rain added to the troops' misery. Terraine overlooks this vital point as he does a Tank Corps Memorandum to Haig warning of these inherent dangers. Foch forecast the verdict when he deprecated the British offensive as a 'duck's march'. Furthermore, the U-boat ceased to be a major threat after July 1917, obviating the necessity to capture the Flanders ports. In any case the principal U-boat bases were located on the German coast and not Belgium. In sum then, there is no gainsaying the fact that offensive action by the British armies was essential in the latter half of 1917 but Haig's choice of ground is open to the gravest indictment.

What of Terraine's assertion that a major reason for Haig's choice of Flanders was that the Germans could not retire from this sector as they had done on the Somme but must stand and fight? Already weakened by the intensity of the struggle on the Western Front, the German armies were to be battered into insensibility by Haig's relentless 'step-by-step' pressure until the change of a breakthrough offered itself. As Terraine says, there is no doubt that Passchendaele hit the Germans very hard. However the campaign dealt a crippling blow to the British armies as well. Despite some local successes such as the brilliant feat of the Australians at Broodseinde, when the offensive ended in November 250,000 troops had been sacrificed for the gain of a few square miles of mud. The British Army had been reduced to the verge of exhaustion and its reserves expended. For this reason the outstanding success at Cambrai on 20 November could not be exploited and the Germans recaptured all the ground lost. Moreover the German Army had not been broken. In the East the Russian offensive in Galicia was shattered soon after it began while in September, Austro-German forces scored a crushing success at Caporetto. Finally, the Germans were still strong enough to launch their famous offensive of March-April 1918 and come perilously close to winning the war.

Lloyd George fares badly at Terraine's hands and the Prime Minister's claim that Cabinet was not informed of the proposals for the offensive until June 1917 is shown to be patently false. He was infatuated by the charm and panache of Nivelle and at the Calais conference of 26 February 1917, Haig was subordinated to the French Commander-in-Chief for the duration of the Aisne offensive. Any prospects of future mutual confidence between military and civilian leaders were now illusory, especially after Nivelle's failure. Thus began a battle between Haig and Robertson on the one side and Lloyd George on the other, as to the strategy to be pursued. The military leaders were justified in their contention that the Prime Minister was an amateur strategist. His advocacy of a shift in the military effort to support the Italians was unsound. While British forces were being diverted to this front the Germans could have fallen upon the ailing French Army with catastrophic results.

Terraine places the blame for the antipathy between civilian and military leaders squarely at the feet of Lloyd George. This will not do. Lloyd George's attitude stemmed from his belief that the Somme offensive of 1916 was a failure and his determination that such an experience should not be repeated. Addressing the Cabinet Committee on War Policy on 21 June 1917 the Prime Minister commented that: "... during nearly three years of war I had never known an offensive to be undertaken without sure predictions of success. Similar reasons to those given now had always been adduced as to why we should do better than the last time and I had always been told that by applying the lessons of the past we should succeed."

In view of the consistently meagre results gained, it is little wonder that Lloyd George was sceptical and resorted to various indirect measures to restrain Haig.

Herein lies another characteristic of Third Ypres for Haig's stubborn optimism ensured an unnecessary prolongation of the campaign. His reports to the War Cabinet, his diary entries and his general correspondence are characterized by this attitude: the situation is always favourable; the enemy is always demoralized; one more attack might always lead to breakthrough. Yet Haig scarcely mentions
the state of his own troops. Optimism is a virtue only when it is tempered by an awareness of reality.

Haig’s Head of Intelligence, Charteris, may well have contributed to the Commander-in-Chief’s erroneous conclusions. Terraine does well to point out that Charteris’ private feelings were in marked contrast to the sanguine reports he preferred to Haig. And in face of the latter’s obstinacy the Army Commanders did not press contrary views with the strength that the situation demanded. Thus on 26 October Gough informed Haig that the ground on his front was so bad that the attack scheduled for next day should be postponed. When that attack became hopelessly bogged in the mire Gough claimed that it was not the mud but an inadequate bombardment that caused the failure.

These deceitful practices were not confined to the leadership of the British Army in France. Petain continually misled Haig as to the true state of the French Army which led to the latter placing great reliance on promised offensives that did not materialize. Wilson’s warnings to this effect were ignored because Haig distrusted him as a devious schemer. Then there were serious differences between Haig and Robertson. The CIGS began to question the veracity of Haig’s information but continued to support him because any hint of disagreement would be seized upon by Lloyd George. This is indeed a lamentable commentary on British politico-military leadership after three years of war. Hence Terraine’s description of the Flanders campaign as ‘haunted from beginning to end by misunderstandings’ is somewhat euphemistic. Liddell Hart’s analysis is perhaps more appropriate. Passchendaele, he says, “exemplified the need of allowing more latitude in the military system for intellectual honesty and moral courage”. There is a lesson here for those who wish to find one.

In conclusion then, John Terraine has produced a provocative and, at times, disturbing work. Those without some knowledge of the Western Front will find it difficult reading and may gain false impressions. The maps are poor—there is no map of the Aisne front even though Nivelle’s offensive is treated at length. Maps must be drawn as a book is written, not added as an afterthought.


Reviewed by Lieutenant Colonel Adrian Black, Regular Officer Development Committee, Army Office, Canberra.

LOOKING back over the past fifteen months, a period of reading and researching a large volume of literature for the Army’s Regular Officer Development Committee, two books stand out in my memory for the excellence of their analysis of the military profession. Norman Dixon’s exploration of the military mind in On the Psychology of Military Incompetence I found to be a disturbing and incisive challenge to the shibboleths of ‘military’ behaviour. For the global view it provided of where the profession of arms stands and where it might be headed, Downey’s Management in the Armed Forces is, however, paramount in my recollection. On reflection I believe it is not so much the global view which impressed me, but the conviction provided by an ‘insider’s’ perspective and feeling for the topic which I have not often been able to share while reading the more dispassionate works of a host of academic analysts or the more readable but often inaccurate pieces proffered by defence journalists. Of course the problem with such a statement is that there has been little choice; military men, as Downey points out, have concentrated on ‘memoirs, campaign studies and accounts of unusual exploits’. Our contribution to the analysis of our own profession—and in Australia we have been more guilty than most—has been lamentable.

For this alone, Downey’s work is a milestone. An Air Vice Marshal only recently retired from the Royal Air Force, John Downey’s career and those of his three contributors (two serving and one recently retired senior British officers, one from each of the Armed Services) all show the stamp of the ‘military intellectual’. This book does a great deal to dispel the doubt that the two terms may be mutually exclusive. The title of the book I found misleading; though management in the Armed Forces does form a central core, this is a much broader analysis of the profession than of its organization or management alone. I think it important that prospective readers
be directed to the sub-title “An Anatomy of the Military Profession” which gets closer to describing what the book is all about.

The work is in three parts, each of which contributes in different measure to its overall impact. Part 1 ‘The Heritage’ deals with the past and the present, tracing the military from its historically recent evolution as a profession certain of its role and place in society, to its present position as a complex, technologically oriented organism of society far less certain of its place in an increasingly interconnected web of governmental activity. With the exception of a brief section on the principles of war, which seems awkwardly placed, Part 1 provides a clever and thoughtful analysis of a profession searching to redefine its place in a reordered society.

Part 2 ‘The System’ is a definitive analysis of both the peculiarities and commonalities of military management as a distinct element of the body of knowledge identifiable within the catch-all of management. This part of the book concludes with a chapter on leadership which warns that the military, ‘despite their prowess in combat leadership . . . have not made equal advance in other forms of leadership . . . on conducting, guiding and persuading. Most important of all, they have not made the same progress in elucidating the ends towards which leadership is merely a means’.

The final part of the work looks briefly at the future in a single chapter entitled ‘From craft to science’. Downey examines possible future roles, highlighting the dilemma facing the military professional: ‘A high state of technical readiness and enthusiasm will have to be prolonged indefinitely with no prospect of action or any feedback of real experience . . .’. The author pleads for an increased intellectual contribution by military professionals, for ‘Upon intellectual vigour rests the quality of innovation itself, the key to continuing effectiveness’. Downey questions the intellectual capacity of a system designed for a mode of existence long gone and pleads for ‘corporate balance’ in which the military’s role as a public institution, its structure and the solutions to its operational problems all receive adequate emphasis. He cautions against an exclusive concentration on day-to-day operational problems which leads towards the ‘inbreeding’ of ideas and the stifling of essential innovation.

To repeat my earlier accolade, I believe the book to be a milestone both in the quality of the analysis and in the fact that it is a broad study of the profession of arms by a member of the profession. It should quickly take a place at the head of reading lists in our various military colleges and institutions and I hope that it will be widely read outside the Services. The book is fluently and forcefully written and conveys a message vital to both the military and to the nation.


Reviewed by Capt W. W. Houston, Directorate of Army Training

THIS is a book written by an enthusiast with the aim of encouraging the reader to try the hobby for himself. The author addresses the full spectrum of board wargaming from the ‘individual games’ to the massive recreations of complete naval, military or air campaigns.

The book is presented in five parts. The first three deal with the history, development and rules of various types of games. The fourth is a series of thumbnail reviews of 289 games that were available at the time of publication. These range from ‘Sniper’ in which individual riflemen stalk each other in a village to ‘Drang Nach Osten’, which covers the Russian front at Divisional level with five maps and 1,700 counters. (Successful commanders can purchase ‘Unentscheiden’ which extends ‘Drang Nach Osten’ by four half maps and 1,900 counters.)

The fifth section is an illustrative move by move account of an actual wargame.

For those who know nothing about board wargames this book offers a solid introduction. It explains in great detail, with illustrations from popular games, the playing board, the counters, movement and engagement rules. As an added incentive to take up the hobby, a small introductory wargame is included in a pocket inside the back cover. For those already familiar with the board gaming the section of reviews is perhaps the most interesting, offering a series of glimpses of an amazing range of simulations.

Wargames can be based on any event which strikes the designer’s fancy but generally games may be regarded in five categories:
BOOK REVIEWS

• Historical — games based on actual battles, campaigns or wars from the dawn of history to Korea. A game on Vietnam was produced but it proved to be so unpopular that it was withdrawn from production. These games allow the recreation of historical events and many have 'what if' scenarios, for example allowing players to explore the effects of an earlier and more effective allied rearmament on the campaign in France in 1940. Some games are in themselves a terse comment on history. Palmer notes that ‘American Revolution’ has ‘idiocy rules’ which hamper the British commander to provide a balanced game.

• Future/Hypothetical — games based on conflict in the foreseeable future. Many involve a NATO/Warsaw pact clash although others involve a Sino-Soviet war, the Middle East, and even an invasion of the United States. Some go even further and explore ‘after the holocaust’ situations.

• Science Fiction — games based on a distant future, often on novels such as Heinlein’s ‘Starship Trooper’ or the TV series ‘Star Trek’. After the recent success of the film ‘Star Wars’ it will undoubtedly become the basis for at least one game.

• Fantasy — conflict involving knights, dragons and damsels -in- distress -type scenarios. Many games are based on Tolkien’s ‘Lord of the Rings’ trilogy.

• Diplomacy — it and the games based on it are in a category of their own, not quite a wargame but plenty of conflict behind the bonhommie. An excellent way to find who your true friends are, an exercise which in ‘Diplomacy’ rarely requires much counting ability.

Having started as a military training aid, with the Prussian ‘Kreigspeil’ and developed into a recreational pursuit board wargames are now being readopted by the Army. The United States Army has had a series of games developed as a tactical training medium. The games range from company-team (combat team) to divisional level. Some, such as ‘Firefight’ a tank/mechanized infantry company team game set in Europe, are now available commercially. SPI, the manufacturers, were in fact involved in the development of the games for the US Army. Games in this series can be fought with present day weapons or with the next generation: XM1, MICV, T72, cannon launched guided projectiles, etc.

Against this background, ‘The Comprehensive Guide to Wargaming’ seems for the price to be the sort of book one borrows from the library rather than buys. The beginner will soon outgrow the ‘how to do it’ chapters and the enthusiast will be mainly interested in the reviews of games. Both categories of readers should, however, find it a most interesting reference.


Reviewed by Dr Neil Primrose, Department of Defence

L ESTER BROWN’S thesis is that, whereas ‘national security’ has traditionally been thought of in military terms, threats, far more disturbing than military conflict are even now bearing upon the world system. The term ‘national security’ should be redefined as a first step toward mobilizing the resources of the state (he is writing to a US audience) to meet these new and extraordinarily complex threats. Brown is arguing for a wholesale reorienting of bureaucratic assumptions, including those of military strategists and intelligence agencies, regarding threat to the state.

He poses five threats: viz, lagging energy transition, deterioration of biological systems, the threat of climate modification, global food insecurity and economic threats to the status quo.

The energy transition from oil to alternative fuels, Brown argues, is lagging behind the depletion of petroleum deposits while projected energy demand is rising faster than previously predicted. Government authorities and industry have been unduly complacent of the need for urgent transition because of the existence of nuclear power. However, the envisaged expansion of nuclear power generation has been slowed by political and environmental opposition in the face of growing awareness of the side-effects of the technology. The other en-
visaged alternative is increased usage of coal. However, increased use of coal gives increased possibility of climatic change by altering the carbon dioxide balance in the upper atmosphere. Global transition to more exotic energy sources, solar, wind and water generated, must therefore be made with a war-time sense of urgency.

Deterioration of the biological systems—principally forest lands, grasslands, crop lands and ocean fisheries—is caused by increasing population and declining allowance for recovery in harvesting. Ocean fisheries are overfished. Forests are shrinking before the timber fellers and land-hungry farmers. Grasslands are being overtaxed to provide for wild and domestic animals. Croplands are under pressure from rising population and fallow cycles are shortening. These elements are not new, but combined pressures are forcing the natural systems beyond their limits of recovery.

Climate modification from the heat and pollutants of energy generation and from the dust caused by human alteration of the biosystem will affect not only regional climate but also existing agricultural systems and settlement patterns which have evolved in a particular existing climate. Whether the world would be “better” if areas were warmer or cooler is a moot point which is admitted but not followed through.

The global food economy has undergone a basic transformation in the 1970s with previous reserves used up and hunger still widespread. Economic mismanagement is rife in underdeveloped countries and since World War II every continent except North America has become food deficient (the author has ignored Australasia). Brown’s argument is that increasing food insecurity will lead to increasing violence.

Economic threats to security, primarily through inflation of the price of resources, can aggravate social divisions, turning political cracks into fissures. The outlook of a generation of youth reaching adulthood with sparse chance of employment exacerbates the already divisive issues of this generation.

Brown concludes that the present outlook of governments is not likely to ensure change in sufficient time. A mobilizing of national will and resources such as occurs at the outbreak of war is needed to meet the impending threats.

The argument is elegant and persuasive in generality. It is a worst case argument and has sufficient short-comings to gratify its opponents. Nevertheless it is not a doomsday book. It isolates real problems which must be accepted and overcome. Brown’s own viewpoint is essentially optimistic; that the problems are surmountable given sufficient energy in the very near future.


Reviewed by Wing Commander D. J. Gordon, RAAF Staff College, Fairbairn

THOSE who are familiar with the earlier work by George Odgers, The Royal Australian Air Force—An Illustrated History, published in 1965, might well feel that the new edition offers only some small increment of history to the original publication. Indeed, in comparing the two works, one feels some regret that so many excellent and unique photographs did not find a place in the new edition. However, this is more than compensated for by the highly readable account of the RAAF’s more recent involvement in South-East Asia, and by the superb contributions by Defence photographer Bruce Adams.

A pictorial history, by definition, might suggest a fairly cursory treatment of 63 years of Australian military aviation, but the author has succeeded in portraying, in considerable detail, a fascinating chronology, ranging across the years from the beginnings at Point Cook in 1914 to the organization, roles and functions of today’s Air Force. He has traced the ebb and flow of our nation’s concern with defence, and particularly with the role of air power. Famous names, regrettably no longer familiar to the young men of the modern RAAF, are vividly brought to life—in the great air battles of World War I, the carnage of Bomber Command in World War II, the struggle in the South-West Pacific in 1944-45 and in Korea. Of particular interest are the young flyers who were fledged as sergeant pilots in Korea, and who are today in the top echelon of the Service.
Going back to the earliest days, it is a measure of the brevity of our aviation history that one of the original four graduates of the first flying training course at Point Cook, and our first Chief of the Air Staff, Air Marshal Sir Richard Williams, is not only still with us, but has himself recently published a fascinating history of his times.*

Sir Richard, the ‘Father’ of the RAAF, was in the thick of it in the Middle East in the First World War, but like his counterpart in the Royal Air Force, Lord Trenchard, he had to fight a long and hard battle in the peace that followed, to ensure the survival of an independent Air Force against the pressures of more powerful men, the apathy of ‘peace in our time’ and, for us more familiarly, the tight purse strings of the national treasury. Notwithstanding these difficulties, we see Australia in 1939 rapidly mobilizing her resources and, in the course of the next five years, apart from the development of the Army and Navy, producing an Air Force that enlisted 189,000 men and 27,000 women—and, even more surprisingly when one considers the size of the population in those years, some 44,000 men and women produced 3,500 aircraft of nine different types, and nearly 3,000 engines. For the technology of the times, this was a prodigious effort; but then, 10-year lead times had not yet been invented.

The overall impressions of this excellent history of the RAAF are the detail in which the story is told, the constant involvement (surpassing in scope that of either the UK or USA) in the great events of military aviation—World War I, World War II, Berlin Airlift, Korea, confrontation with Indonesia, the air defence of Malta in the 1950s, Thailand, Vietnam, the United Nations, and at home in emergencies and natural disasters. One wonders how it was all achieved, and is still being achieved, on the minimum resources provided by a national purse which can never be considered profligate.

George Odgers’ history should be prominent on the shelf of every man and woman in today’s RAAF, if not of everyone in our country who has at least passing interest in our future as a free country.

* See review in this issue.


Reviewed by Group Captain Keith Isaacs, Royal Australian Air Force (Retired)

WHEN the Royal Flying Corps came into being on 13 April 1912, its training publications were conspicuous by their absence. A pocket-sized Training Manual, Royal Flying Corps, Part I, was eventually produced and its 170 pages contained all that an aspiring airman needed to know to become an efficient member of the new arm of defence. To those who are familiar with the massive aircraft maintenance manuals of today it is, perhaps, inconceivable to learn that a single chapter only was devoted to ‘Assembling, erecting and trueing up of aeroplanes’, all of which was contained in a mere 25 pages. This, then, was the basis of technical information upon which the infant RFC flew off to engage the mighty German Juggernaut in 1914.

As the 1914-18 War progressed, and many new types of aircraft came into service, various forms of rigging notes were introduced as interim measures to meet urgent technical requirements. Then, in 1917, printed notes with illustrations and line diagrams were issued in the form of booklets by the RFC and Royal Naval Air Service. Many riggers and fitters kept this series in a loose-leaf folder for use as a master maintenance manual.

It is this manual then that is now published for the first time as a complete bound volume under the title of British Military Aircraft of World War One which, as the subtitle explicitly states, is ‘The Official Technical and Rigging Notes for RFC and RNAS Fighting and Training Aeroplanes 1914-1918’.

The aircraft included in the volume are the Avro 504, Armstrong Whitworth FK3 and FK8, Bristol Fighter F2b, Curtiss JN4a, de Havilland DH4, DH5, and DH9, Martinsyde Scout, Maurice Farman Longhorn and Shorthorn, Nieuport Scout, Royal Aircraft Factory BE12, BE12a, BE2c, BE2d, BE2e, FE2b, RE7, RE8, and SE5a, Sopwith 1½ Strutter, 5F1 Dolphin, Pup, 2F1 Camel, F1 Camel, and Triplane, SPAD SVII, and Vickers FB9. Each
The Royal Flying Corps technical notes as republished in BRITISH MILITARY AIRCRAFT OF WORLD WAR ONE were also used by the Australian Flying Corps. These photographs show Sopwith Fl Camels, E1509 single-seat scout, and F1946 two-seat trainer conversion, undergoing maintenance and rigging. The two machines were attached to No 5 (Training) Squadron, AFC, Minchinhampton, England, in 1918.

(Australian War Memorial Negative No. D499)

The type is illustrated with sketches, photographs, and fine drawings—the drawings, incidentally, were not issued as accurate scale drawings but as diagrams for the notes. There are more than 360 illustrations, including 286 detailed line drawings.

This uniquely authoritative collection of historic technical notes will appeal greatly to those who are interested in WWI aviation. In addition, many others will find them fascinating, for as the doyen of WWI aircraft historians, J. M. Bruce, declares in his foreword—"to the intelligent student of aircraft of any period they cannot fail to be of interest".

I might add that one particular group of aviation enthusiasts regard the book as an absolute Godsend. This is the Australian Society of Aero-historical Preservation Incorporated which is currently restoring the Australian War Memorial's de Havilland DH9 at the Royal Military College, Duntroon. ASAP members continually thumb through pages 129 to 139 as they painstakingly carry out the book's instructions pertaining to the overhauling, erecting and trueing-up of the DH9 in which Parer and McIntosh made the first single-engined aircraft flight from England to Australia in 1920.

Admittedly, everyone may not be fortunate enough to have their own DH9—there are only about three left in the world—but I am sure that many readers will be intrigued by the nostalgic contents of this book.

Available in Australia through Thomas C. Lothian Pty. Ltd., 4-12 Tattersalls Lane, Melbourne, Victoria 3000.


Reviewed by Wing Commander J. D. F. Philip, RAAF Staff College

It has long been my contention that a good way to study history is to evaluate the experiences of important men, and women, of an era. Of course, there is a need to decide when the contemporary scene has receded sufficiently into the background to be considered history.

In the case of Air Marshal Williams there are very few men still serving in the RAAF who were in that Service when the Air Marshal left it in 1946, after 34 years in Australia's Armed Services. Therefore, perhaps the majority of Australians will accept that much of Air Marshal Williams' autobiography—These Are Facts—is a venture of some historical significance.

In writing of his many memorable experiences the Air Marshal reveals: an outstanding memory, proof of an ability to research detail, and a wry sense of humour. The book comprises 28 chapters (each covering a specific period between 1890 and 1973), and a number
of appendixes containing a wealth of interesting minutiae.

Born at Moonta, South Australia in 1890, the young Richard Williams exhibited at an early age the dogged determination (some might say obstinacy) which was to be a lifelong characteristic. Starting work as a telegram messenger, the ambitious Williams switched to the Union Bank at age 16 and enlisted in the volunteer Citizen Force Organization at the earliest opportunity.

Commissioned into that organization in 1911, he undertook the examinations for entry into the Permanent Forces in 1912 and passed fifth on the list 'subject to a further test in riding'. Fourth on the examination list was John Northcott, later Chief of the General Staff and Governor of New South Wales.

Subsequently, Lieutenant R. Williams was one of four Army officers selected for pilot training; the first pilots' course started at Point Cook in August 1914. The escapades of Williams and Co. in earning their 'wings' and their exploits in the Australian Flying Corps during World War I occupy a significant portion of the book and serve to introduce a number of characters who frequently reappear in later chapters.

The RAAF came into being on 31 March 1921, and much of the effort which went into its formation was produced by Richard Williams. That there was opposition to the RAAF from the more senior Services, and also public servants, is evident from much of what the Air Marshal has to say. In fact, throughout the book there are signs of bitterness as the author recounts episode after episode of interference and incompetence at all levels in the bureaucratic system. But it is bitterness without rancour, probably born of the frustration of the forward thinking mind being opposed by the intransigence of Permanent Heads who had the 'ear' of their Minister.

However, it must not be thought that Air Marshal Williams restricts his writing to the trials and tribulations of nurturing the infant RAAF into the efficient Service it is today. Throughout the book there are accounts of aims achieved and milestones reached, including detail of Australia's participation in the Empire Air Training Scheme during World War II.

Many readers will be intrigued by the machinations surrounding the appointment of, first Burnett, and then Jones as Chief of the Air Staff. These matters and other aspects relating to RAAF 'personalities' are presented from the point of view of a man who was privy to Australian Defence politics for over 30 years.

Richard Williams is frequently referred to as the 'Father of the RAAF'—and this appears to be a deserved title. However, it may surprise many people to learn that, notwithstanding his long service to the RAAF, Williams was virtually compulsorily retired in 1946 in circumstances which caused him to write: 'The Air Force treatment of its officers was the meanest piece of Service administration in my experience'.

Following retirement from the RAAF, Air Marshal Williams assumed the appointment of Director-General of Civil Aviation. To that post he took his vast organizational ability and experience and before his final leaving of public service employment, at age 65 in 1955, Richard Williams had guided the Department of Civil Aviation well along the road towards its present, excellent standing. Ironically it was in 1954, whilst serving in the civil aviation sphere, that the author received his knighthood.

Air Marshal Williams has lived an extremely interesting and frequently controversial life. In *These Are Facts* he has produced an easily read book which should have wide appeal. The well edited text is complemented by a number of David Hammond's first class drawings of early aircraft and many historic photographs, some of which I believe were made available by Keith Isaacs, who also made available many of the interesting annexes. Overall, the result is a book which is highly recommended.


Reviewed by Group Captain Keith Isaacs, Royal Australian Air Force (Retired)

The subtitle of this small, but important, volume defines that it contains 'The Official Camouflage, Colours and Markings of
RAF Aircraft, 1939-1945’, and it is the word ‘official’ that denotes the true significance of the book.

Camouflage, and colours, of World War II aircraft have been contentious topics for many years, and non-official publications devoted to these subjects have tended to confuse the issues rather than to clarify them. The Royal Australian Air Force, Australian War Memorial, and other similar Australian institutions, are continually besieged with requests for camouflage patterns and colours of specific wartime aircraft. No doubt the Royal Air Force, Imperial War Museum, and the like in the United Kingdom, are inundated with similar queries, and the need for an official publication on the subject has long been overdue. The RAF Museum is to be congratulated, therefore, on producing this extremely useful reference volume based entirely on contemporary official publications.

The book consists of facsimile reproductions of 14 Air Ministry Orders, and two chapters from Air Publication 2656A. The AMOs are printed exactly as originally published, together with subsequent amendment lists. Thus, the civilian reader might find the book difficult to use as a reference work in the first instance. Even those experienced in military jargon could find it perplexing to track down the precise colours and markings of a particular aircraft type at a specific time. This is because the orders range from 1939 to 1945 and are amended, further amended, and/or superseded.

An exception to the rule, however, pertains to the first AMO in the book, A.154/39. This order contains an appendix with a list of RAF squadron code letters, and was promulgated on 27 April 1939. The book does not mention that these codes were changed on the outbreak of WWII and, thus, the published lists apply in general to prewar aircraft only.

The two AP chapters are devoted to camouflage schemes, and identification markings. In each case the information is applicable as from October 1944, the date of issue.

Notwithstanding the ultimate authority of the orders, they were disregarded at times for various reasons. For instance, the right paint at the right time was not always available in operational areas, and camouflage patterns and markings were occasionally the outcome of individual idiosyncrasies. Thus the book is the bible for what was the order of the day, although it must be remembered that the order of the day was not always implemented. As J. M. Bruce, Keeper of Aircraft and Research Studies, RAF Museum, warns in his foreword —‘The user of this fascinating document is advised to treat it with a certain amount of caution, however, and to use it intelligently and with care . . . not all the schemes herein delineated were used, nor were the instructions necessarily followed to the letter in practice, despite the fact that this was intended to be the official word on these matters’.

Whether by design, or not, the statement made by J. M. Bruce is substantiated by the picture on the dust jacket. In fact it is the book’s only photograph, and features a plan view of a Hawker Tempest. The clearly defined camouflage pattern on the fighter bears little resemblance to the camouflage design for ‘single-engined monoplanes’ as contained at page 43.

A similar situation came to light during the recent renovation of the Australian War Memorial’s Avro Lancaster, W4783, ‘G for George’. Initial inspection revealed that the bomber’s camouflage pattern was a mirror representation of that for ‘four-engined monoplanes’ at page 46. A study of WWII photographs of W4783, and acquisition of the A. V. Roe and Company plans for the aircraft, verified that ‘G for George’ had operated with a camouflage configuration, and colours, that were at variance to official instructions.

An outstanding feature of the book is the inclusion of a folding plate containing 29 — the dust jacket inexplicably states 32, not once but twice —exact paint chip facsimiles of official Air Ministry colours. This folding plate is worth the price of the book alone, for the paint chips are most authentic, and have been reproduced as accurately as is humanly possible.

For those who demand exactitude when it comes to British Aviation Colours of World War Two this is the basic reference book — providing historians, artists, and modellers adhere to the warning emphasized by Jack Bruce in the foreword.

*Available in Australia through Thomas C. Lothian Pty. Ltd., 4-12 Tattersalls Lane, Melbourne, Victoria 3000.