Mine Warfare in Australia’s First Line of Defence

ALAN HINGE
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MINE WARFARE IN AUSTRALIA'S FIRST LINE OF DEFENCE

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ABSTRACT

The sea mine is important because it is used. One and one half million sea mines have been used during this century by a wide range of users for a multitude of political-military purposes. The sea mine is used because it is inherently flexible and can give a first, and least escalatory, option in situations requiring a precisely measured graduated response. Minefields can be used to control the actions of an adversary by adjustment of their areas, intensities, timings, targets and durations of effect.

This monograph presents an imaginative plan for the use of the sea mine in Australia’s defence. It explores uses of the sea mine as a peacekeeper, capable of eliminating escalatory ‘eye-ball-to-eye-ball’ confrontation between forces. A role for the sea mine as a ‘robot policeman’ of Australia’s EEZ is also considered, together with the sea mine’s traditional role as a proxy warfighter, one which issues no communiques and never surrenders.
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### ACRONYMS AND ABBREVIATIONS

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<tr>
<td>AA</td>
<td>Anti-Aircraft</td>
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<tr>
<td>AAT</td>
<td>Australian Antarctic Territory</td>
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<tr>
<td>ADCM</td>
<td>Air-Deployed Combat Mine</td>
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<td>ADF</td>
<td>Australian Defence Force</td>
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<td>ALIS</td>
<td>Australian Lightering System</td>
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<tr>
<td>A-M-P</td>
<td>Acoustic-Magnetic-Pressure</td>
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<td>AMS</td>
<td>Australian Minesweeper</td>
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<td>AMUM</td>
<td>Australian Mine-Use Model</td>
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<tr>
<td>ASS</td>
<td>Acoustic Signature Spectrum</td>
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<td>ASW</td>
<td>Anti-Submarine Warfare</td>
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<tr>
<td>BCK</td>
<td>Bomb Conversion Kit</td>
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<tr>
<td>BMM</td>
<td>Bottom-Mounted Mine</td>
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<tr>
<td>CAML</td>
<td>Cargo Aircraft Minelaying (Project)</td>
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<tr>
<td>CAPTOR</td>
<td>Escapsulated Torpedo</td>
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<tr>
<td>CCMC</td>
<td>Command Controlled Mine Charge</td>
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<tr>
<td>cif</td>
<td>cost insurance freight</td>
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<tr>
<td>CJCS</td>
<td>Chairman, Joints Chief of Staff (US)</td>
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<tr>
<td>CMOS</td>
<td>Complementary Symmetry Metal Oxide Semiconductor</td>
</tr>
<tr>
<td>CNO</td>
<td>Chief of Naval Operations (US)</td>
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<tr>
<td>COOP</td>
<td>Craft of Opportunity</td>
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<tr>
<td>CRZ</td>
<td>Critical Response Zone</td>
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<tr>
<td>DST</td>
<td>Destructor</td>
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<tr>
<td>ECM</td>
<td>Electronic Countermeasures</td>
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<td>EEZ</td>
<td>Exclusive Economic Zone</td>
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<tr>
<td>ELPFI</td>
<td>Electric Potential Field</td>
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<tr>
<td>EOD</td>
<td>Explosive Ordnance Disposal</td>
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<tr>
<td>ERMISS</td>
<td>Explosion-Resistant Multi-Influence Sweep System</td>
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<tr>
<td>F/A-18</td>
<td>Australian Fighter Aircraft</td>
</tr>
<tr>
<td>FFG</td>
<td>Fast Frigate/Guided</td>
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<tr>
<td>fob</td>
<td>free on board</td>
</tr>
<tr>
<td>GNR</td>
<td>German Naval Reserve (WWII)</td>
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<tr>
<td>GPLD</td>
<td>General-Purpose Low-Drag</td>
</tr>
<tr>
<td>GRP</td>
<td>Glass Reinforced Plastic</td>
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<tr>
<td>H6</td>
<td>A high explosive</td>
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<tr>
<td>HDR</td>
<td>Harbour Defence Ring</td>
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<tr>
<td>IJN</td>
<td>Imperial Japanese Navy (WWII)</td>
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<td>LRZ</td>
<td>Limited Response Zone</td>
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There may never be a nuclear war. Nuclear weapons have not been used in anger for almost half a century and may not be used for another half century. Such devastating weapons and methodologies for their use are clouded in great uncertainty. However, it is certain that so-called 'limited wars' - fought under a number of political constraints for limited objectives - will continue to be the military reality for some time to come. The sea mine is a relatively unsophisticated weapon which, if used in a clever manner, can be of unique value to Australian decision-makers during the management of limited conflict in our region.

The sea mine is important because it is used. It has played an important role in twentieth-century conflict and is deployed in a wide variety of situations. In the 1970s approximately 15,000 sea mines were deployed during the India-Pakistan (1971), Vietnam (1972) and Yom Kippur (1973) wars as well as in the blockade of Phnom Penh in 1974-75. Sea mines were deployed in the Falklands War of 1982 and in 1984 they were used by armed revolutionaries in Nicaragua. Later, in July 1984, sea mine deployment in the Red Sea become a new tactic of international terrorism. The successes of 1984 were followed by the very effective use of simple contact mines against shipping in the Persian Gulf during 1987 and 1988.

Sea mines are used because they are flexible. They can be used as a first and least escalatory option in situations requiring a graduated political-military response. They also facilitate and multiply the effectiveness of other military operations undertaken in the national interest. A nation developing expertise in the manufacture and use of sea mines has a valuable advantage in the waging of war at sea and in response to many types of crises. This is particularly so in the case of an island continent such as Australia.

The major aim of this work is to systematise the use of the sea mine and its countermeasures in the Australian defence context. The central purpose is to provide a practical framework for the use of the sea mine as a unique tool of graduated response which can yield options not provided by any other weapon system. The Australian Mine-Use Model (AMUM), which is described in Chapter 9 of this work, offers just such a framework.
CHAPTER ONE
THE MINE AS A TOOL OF CONFLICT MANAGEMENT

Political Aspects of International Conflict Management

Conflict between nations is a continuing aspect of human experience. During the time leading up to overt military conflict a state of tension is said to exist. In this crucial period leaders must aim at convincing their rivals that the costs of further antagonistic actions significantly outweigh the benefits which can be reaped by these same actions. But military options selected for use during this tense period must not be unduly provocative because provocation, as opposed to stabilising the situation, could accelerate escalation.

The fundamental political problem of unambiguously signalling perspective, intent and resolve to a rival or an adversary is indeed a challenge. Ultimately, a government's aim during a crisis is the development of a minimum-risk strategy involving appropriate use of diplomacy. In some circumstances the government in question may determine that diplomacy has to be supported by appropriate military force in the defence of legitimate national interests. It should be emphasised that, for most governments, the decision to use any level of military force is a major choice in itself. Specifying the force to be used is also a difficult and no less significant choice, since a judgement has to be made to ensure that 'expenditure' is commensurate with the value of the political objective.

The saliency of the political process and firm political control of operational objectives has increased markedly since World War Two.¹

¹ Government is ultimately responsible for the higher conduct of war which, among other things, involves the formulation and stipulation of war policy. Increased government intervention during the post-World War Two era has grown in proportion to the increasing destructiveness of nuclear and conventional weapons. A classic case involving increasing government control of operational objectives occurred when General MacArthur was involuntarily relieved of his Command during the Korean War. MacArthur was seen as escalating military objectives beyond those needed to harmonise with much more limited political aims (see R. Osgood, Limited War: The Challenge to American Strategy (University of Chicago Press, Chicago, 1957) for a classic treatise on the concept of limited war as it developed in the 1950s). For an account of the tight political control of the Vietnam War and its effect upon US military command structure see M. Van Creveld, Command in War (Harvard University Press, Cambridge Mass., 1985), pp. 232-260.
In the post-war period strategic commentators have developed a theory of limited war, or war of risk, waged for limited objectives. Thomas Schelling suggests that:

... This new species [of war] is the competition in risk taking, a military-diplomatic manoeuvre with or without military engagement but with the outcome determined more by the manipulation of risk than by the actual contest of force.2

The ultimate suitability of a military option is measured by how far its accomplishment achieves the desired political effect. Feasibility deals with the question of whether the option can be accomplished with available means and acceptability involves a final judgement as to whether the desired effect is worth the risk and cost. Military planners must always be aware of the suitability/acceptability/feasibility criteria when presenting options to civilian leaders who may be contemplating military action.3 If the military can successfully address these three issues relative to a particular option, they will clarify their own objectives and fully specify their problem. Also, if this is done, the government will feel more confident in defending its stand before the electorate, allies and the international community.

The political leadership of any nation expects to be presented with a range of options during crises. These options, which are developed by the bureaucracy and the military, must be aimed at making diplomatic and perhaps military moves that will give the government the chance to develop a solution capable of engendering favourable terms of crisis settlement. Consequently, with specific reference to the use of military force, the military leadership must ensure the availability of options for graduated response.

The development of a system of graduated response provides the political leadership with more flexibility than might otherwise be the case. Without a means of graduated response — that provides a capability to deliver a proportional response to a threat — governments might over-react or under-react militarily. At either of these extremes the price paid in terms of escalation could be prohibitive. Under-

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3 H. Eccles, 'Strategy: The Theory and Application', *Naval War College Review*, May-June 1979, p. 15. The author cites the US Naval War College 'Green Book' entitled *Sound Military Decision Making*, which directs that any proposed course of action be examined for suitability, feasibility and acceptability.
reaction contributes to making the adversary feel more confident in a war of risk, while over-reaction can force the adversary to escalate and so initiate a vicious circle of increasing violence.

The sea mine is a valuable asset in a national system of graduated response. It has unique characteristics that provide graduated response in terms of area, intensity, time and duration of action. In many instances the minimum response required to achieve a political/military objective can be selected using the naval minefield.

The Mine as a Suitable, Acceptable and Feasible Option for Graduated Response

The greatest hurdle facing Australian decision-makers in many potential crises could be that of deciding on the precise point at which to take unilateral military action against an opponent. As mentioned earlier, the risks of escalation and its consequences will be a prime consideration for the decision-makers. At the same time, a point may be reached where the national leadership feels that there is a compelling requirement to do something tangible and decisive. The use of directed weapons — such as bombs and missiles — greatly increases the potential for escalation and a high threshold against early use of these weapons will exist.

Directed weapons are active weapons launched with the intent of destroying a target shortly after release from human control. They are also highly visible weapons and are carried by highly visible platforms, such as combat aircraft and warships, and lack flexibility in the crucial lower echelons of escalation, where too much ‘gunboat diplomacy’ could accelerate escalation rather than stabilise it. This is because, if a show of force by an active platform such as an FFG or an F-18 fails to deter, the platform’s human director must either ‘pull the trigger or back down’. Pulling the trigger involves an inherently high potential for escalation and backing down may be interpreted by the opponent, the world and the Australian electorate as a sign of weakness and effective surrender of interests or even sovereignty. In short, directed or active weapons systems provide for rapid realisation of the

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5 The problem of determining the magnitude and nature of an appropriate military presence is formidable. A certain degree of military threat or ‘show of force’ can diffuse a situation. See J. Cable, Gunboat Diplomacy 1919-1979: Political Applications of Limited Naval Force (St Martin’s Press, New York, 1981) for a comprehensive account of the political applications of naval force since World War One.
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major ingredient of 'hot' wars — this ingredient being overt armed conflict between large regular military forces. Overt conflict, at least initially, must be avoided.

The Australian government is therefore likely to show considerable reservation in authorising the unilateral deployment and use of active or directed weapons systems. But lack of prompt, proportional, yet firm action in the early stages of crisis development may draw severe penalties in terms of contributing to the opponent’s confidence and ability to retain the initiative. The Australian government must be able to do something that will not immediately sow the seeds of a hot war. Military options that initially avoid committing active platforms and their directed weapons to ‘all-or-nothing’ engagements must therefore be sought out and systematised.

Minefields provide political leaders with a valuable option not provided by any other weapons system that may obviate the necessity to escalate to the ‘hot’ war or overt conflict level. The following minefield characteristics are of critical importance in terms of their implications in modern crisis management and conflict limitation:

(1) Mines are passive, undirected devices which are the only form of weapon that can actually be used without killing or injuring people or damaging property. They can perform their denial task without ever firing. In these terms the mine is a relatively ‘humane’ weapon, since the onus is on the opponent to make a decision to challenge or withdraw from the field. If he elects to challenge the declared field he has decided to risk sinking or damage and the consequences are borne by him. The initiative and the aggression must come from the opponent. Mines essentially limit violence to those who make a conscious decision to challenge them and civilian populations are attacked with shortages rather than bullets, bombs and other forms of missile weapon.

(2) Mines are impersonal weapons which completely eliminate escalatory ‘eyeball-to-eyeball’ confrontation between rival combat forces. Their invisible and automatic nature imply that

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6 Mines are actually launched from their deployment platforms to fulfil a sea denial mission. They are ‘mindless’ and permanent weapons capable of infinite patience and instantaneous attack. They can therefore be used as threatening and not necessarily destructive weapons.
there is little shame in refusing to challenge them. National governments would not lose the same amount of ‘face’ when refusing to challenge a minefield as they would in refusing to challenge an opponent’s active, highly visible, human-directed weapons systems such as combat aircraft and warships. The mine can therefore provide the basis of a politically invaluable ‘golden bridge’, by allowing the opponent a legitimate excuse to tone down his efforts, and supply a foundation for truce and negotiation.

(3) Mines are unambiguous. Only one decision to deploy is made in order to pose a persistent threat to a rival. Mines are automatic and will detonate if a suitable target is detected within damage range irrespective of the nationality of that vessel. Unlike other forms of maritime control or blockade, major political decisions need not be continually made regarding the stopping, searching or visiting of a vessel depending on its flag. The mine can be depended on to reliably ‘follow orders’ since rules of engagement are programmed into its memory prior to deployment. Though this apparently inflexible aspect may at first seem a disadvantage, it allows the government time to get on with the job and avoid the repeated confrontations of a blockade enforced by interception and seizure of surface shipping.

(4) Mines are versatile. They are much more selective than bombs and only a very small fraction of the cost of missiles. Modern mines can select specific classes and sizes of target and are flexible in terms of period of activity. Direct casualties can be inflicted on military and support vessels or the mine can simply be used as a tool of economic warfare by disrupting sea traffic, diverting supply lines and saturating ports with idle shipping. They could even be used as ‘robot policemen’ in the role of protecting areas of Australia’s Exclusive Economic Zone (EEZ) against possible resource challenges in the years to come. In effect, mines can be used to cover the spectrum of military use from the constabulary role to a full warfighting role. (See Chapter 9 for a full description of mine-use in a wide range of Australian defence contingencies.)

(5) Mines are readily available. Many types of mines are effectively ‘ready rounds’ in terms of preparation time and ease of deployment. Mine preparation often only involves a small
number of pre-operational circuit tests and the setting of appropriate safety, sensitivity and arming mechanisms. Initial costs are relatively small. Storage and maintenance costs are not significant. Mine shelf life used to be limited by the life of the explosive charge (20-30 years), but this is no longer the case as removable charge cases are a common feature in modern mines. Also, mines can be deployed by almost any aircraft or ship and there is no requirement for a purpose-built platform to act as a minelayer. In short, if mines have actually been produced before a crisis it takes little time to prepare them for action or obtain suitable deployment craft from military or even civil platforms at hand. These factors can enhance a government’s ability to seize the initiative in a situation involving extremely short warning time; they can also allow the government to gain valuable time by not permitting full freedom to the opponent to set the pace of action.

Mines are acceptable. They are ‘low-profile’ weapons, the use of which can be accepted by the Australian public and the international community. During the US mining campaign against North Vietnam, the US administration finally took up its option to use mines while it was constrained by an American public which had generally developed a high degree of revulsion toward any warlike activity, even though the decision was only six months before the elections. The following comment concerning the political utility of the mine was made by a senior US military officer and well illustrates the unique political advantages of mine-use:

It is no exaggeration to suggest that the mining of Haiphong and other North Vietnamese harbors was a naval victory matching or exceeding the earlier land force’s thrust into Cambodia to clean out North Vietnamese sanctuaries in May 1970. Both operations had similar objectives — prevent the enemy from getting supplies to his forces fighting in South Vietnam. While each operation accomplished its tactical mission the mining of Haiphong by US Naval forces provided an extra strategic bonus of bringing tremendous political pressure to bear upon the enemy. Ironically,
The Cambodia excursion led by the Army’s First Air Calvary Division and spearheaded by the 11th Armored Cavalry Regiment had the opposite effect. Americans took to the streets to protest what they perceived to be a widening of the war into Cambodia with what they mistakenly believed to be unacceptable risks to US forces. Even though American casualties in Cambodia were kept to a minimum while US ground troops confiscated 70 percent of equipment and supplies held in enemy caches the war opposition abroad and at home forced President Nixon to place time constraints on the operation. Consequently on June 28, two months after the Cambodian blitz began, US troops were withdrawn back to South Vietnam, short of completing all objectives.

The naval scenario was entirely different. America’s allies applauded the President’s action when he ordered the Navy to mine the North Vietnam harbors, and at home hardly a whimper was heard because most Americans seemed to realize that mines do not have to sink a ship or cost a single life to act as a deterrent.7

Mines are anonymous. The mines laid in the Red Sea (1984) and Persian Gulf (1987-88) clearly demonstrated this advantage. It is difficult to link mines to their deployers when undeclared fields are discovered. Evidence can often be no more than circumstantial, as was the case with the Red Sea mines, and no direct punitive action can be taken. Most importantly, the advantage of anonymity isolates the deployer from the threat for enough time to enable the situation to ‘cool down’ and the deployer can avoid the immediate wrath of sovereign states. For example, in 1988 the US Frigate Samuel B. Roberts was very seriously damaged by a mine in the Persian Gulf but US forces could not retaliate against the Iranians. The mining did not invite the magnitude of US retaliation that far less harmful

events, such as attempted ‘armed’ Iranian speedboat attacks, did. US responses to the ‘eyeball-to-eyeball’, but impotent, speedboat attacks were severe because the enemy was close in terms of time and distance. The mine attacks removed a provocative enemy in time and distance and US response was attenuated once the initial shock was over and no enemy was found in the vicinity.

In view of the mine-use characteristics specified above, and the many constraints of modern limited warfare, the value of the sea mine is evident. Mine-use lies at the critical interface between military and political action. Indeed, in many circumstances mine-use provides the minimum military response by which to achieve a major political objective during a crisis. A mine-use capability can provide decision-makers with an instrument of firm, yet non-escalatory, response. This capability can yield precisely measured military force aimed at minimising violence.
CHAPTER TWO
THE SEA MINE

The Mission

Mine warfare involves all aspects of the strategic and tactical use of sea mines and their countermeasures. The sea mine is an underwater explosive device that waits to sink or damage targets or deter them from entering an area. It should always be remembered that the sea mine has completely succeeded in its mission if the opponent refuses to challenge it: he has failed to bring hostile forces to bear at the time and place of his own choosing and so a measure of control over his actions and ability to seize the initiative has been achieved. Control over the actions and deployments of an adversary at sea is the essential mission of the sea mine.

Origins

A number of nations have laid claim to the invention and first use of the sea mine. However, in terms of its fundamental quality as a weapon that waits, first use was by the Russians in the Crimean War (1854-56). The Russians commenced development of a truly independent sea mine in the 1840s. This weapon was not simply a charge detonated electrically using cables from shore, or set adrift in the vicinity of a target in the hope of hitting and sinking it. The Russian mine was the first operational moored contact mine and was anchored to the seabed by a weight and cable with the spherical mine case buoyed very near the surface. The case contained 12 kilograms of gunpowder as its main charge, ignited by a then-revolutionary mechanism called the Jacobi fuse. This fuse was the first of a series of chemical horns which project from the mine casing so as to rupture when contacted by a ship's hull. The lead horn contained a glass phial of concentrated sulphuric acid surrounded by sugar and potassium chlorate. When the phial was ruptured on impact with a ship, ignition occurred.

In 1854 the Russians laid fields of sea mines at Sevastopol, Kronstadt and Sveaborg. At the Baltic port of Kronstadt two Royal

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2 ibid., p. 17.
Navy warships on patrol were damaged in a minefield but the size of the charge was insufficient to penetrate the hulls. As a result of these incidents the Royal Navy had to deploy patrols further out to sea. The Russian reaction to this moderate success was one of optimism, marking the beginning of what has been described as a Russian ‘love affair’ with the sea mine.3

The next use of sea mines was by another government faced with an enemy deploying vastly superior seapower. During the American Civil War the Confederate States of America (CSA) used sea mines and spar-torpedoes against the much more powerful Federal (Union) navy. More ships were sunk by sea mines than by naval or shore-battery gunfire, with the Federals losing 23 ships to the mine while the Confederates only lost 2 ships to mines.4

Significant improvements were made in the reliability of sea mine firing mechanisms and depth-setting devices in Europe during the latter half of the nineteenth century. These made the sea mine more suitable to use as an offensive weapon in hostile waters. In 1904 the sea mine was used offensively for the first time in the Russo-Japanese War, with great success. The main Russian naval contingent was at Port Arthur. To support Japanese forces fighting on the Korean Peninsula the Japanese Navy initiated blockades of Port Arthur and the other enemy naval base at Vladivostok. After observing Russian entries and exits from Port Arthur, Admiral Togo, the Japanese commander, ordered a small field of 48 mines to be laid across the main entry route while the Japanese fleet remained out of sight over the horizon. The next morning saw a small Japanese decoy force lure the Russian fleet out of harbour. The Russians then hastily returned to port when the main Japanese force made a well-timed appearance. The Russian flagship and Commander-in-Chief, together with 600 crewmen, were destroyed by mines on return to harbour. Another battleship was severely damaged.

More ships were sunk by mines in the Russo-Japanese War than by naval or shore-based gunfire. The success of the sea mine was remarkable in that it sank a total of 3 battleships, 5 cruisers, 5 destroyers,


2 gunboats and a minelayer. Many of these were Japanese ships sunk in Russian defensive minefields. The sea mine had emerged as an important and flexible weapon of naval warfare.

How the Sea Mine Works

The modern sea mine is designed to detect a target entering its damage radius and explode so as to sink or damage that target. The mine is a metal or fibreglass casing packed with explosive, batteries, safety and arming devices together with some form of Target Detection Device (TDD). The TDD determines just how 'smart' the mine is in terms of its ability to resist countermeasures, select the right target and localise this target so as to inflict the desired amount of damage. The TDD can range in complexity from simple chemical and mechanical contact horns to sophisticated microprocessor-based electronics units with ship-detecting sensors attached. If the mine is of the moored or buoyant type it will have a mooring cable and some sort of depth-setting sinker unit (see Figure 2:1). Most modern mines are not of the moored variety and are deployed so as to rest on the ocean floor. These mines are called bottom mines and are generally of cylindrical shape, usually ranging in length from two to four metres depending on the explosive charge contained within.

Besides being classed as either moored or bottom mines these devices are also specified according to their methods of deployment and target detection. Mines are deployed by submarines, aircraft and surface craft. Some moored mines are still of the contact variety, requiring direct contact with the target's hull, although many moored mines today are of the influence variety, in which physical irradiations from targets are detected, amplified and used to trigger the charge. All bottom mines are of the influence type. Certain types of mines combine some features of both moored and bottom mines. For example, Short-Tethered Rising Mines (STRMs), designed to increase the difficulty of minesweeping. These may be highly buoyant mines tethered very close to the seabed, often within a few metres of the bottom. Normal wire (mechanical) sweeps streamed behind minesweepers cannot sweep so close to the bottom without risking serious damage from bottom-scraping. When the STRM detects a suitable target influence its tether is

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5 ibid., p. 37.
FIGURE 2:1
MOORED MINE PLANTING SEQUENCE

released and the mine quickly rises to the vicinity of the target under its own positive buoyancy, after which it explodes. More advanced STRMs are rocket-propelled to the target area. Similarly, the US Mk 60 encapsulated torpedo mine (Captor) is short-tethered to the seabed and consists of an encapsulated Mk 46 homing torpedo which is deployed once a hostile submarine is detected at a suitable range.6

The traditional, and still extremely useful, ship influences used in triggering mines are the magnetic, acoustic and pressure irradiations of a vessel. A ship's magnetic signature derives from the magnetic field surrounding the hull of a steel ship, and a common method of detection is to use some form of magnetometer to recognise the increase in magnetic field intensity caused by the presence of the ferrous material. Even wooden vessels possess some form of magnetic signature, by virtue of the ferrous materials included in engines, generators and fittings within their hulls. The magnetic signature of a ship or submarine can be attenuated by processes called degaussing and deperming, but the signature cannot be entirely eliminated (see Figure 2:2). The acoustic signature derives from shipboard sources such as generators, pumps, hull vibrations and propeller motions, from which emanate distinctive and detectable noises. Items of shipboard equipment have their own, often unique and stable, frequencies of operation which constitute discrete spectral lines in the overall Acoustic Signature Spectrum (ASS) of vessels (see Figure 2:2). Such acoustic 'fingerprints' can be surreptitiously collected for various ship and submarine classes in peacetime. By planting special recording devices on the ocean floor, recovering them and filing the signature into the microprocessor-based target signature library of a combat mine's memory, a valuable store of data can be accumulated.7

A ship's pressure signature exists as a measurable pressure drop, or suction, experienced on the seabed as a ship passes over a point in shallow water (up to 60 to 80 metre depth). The amount of suction depends on the speed, draught and size of the ship, together with water depth. However, in practice a depth of 60 metres represents the greatest

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FIGURE 2.2
TYPICAL MAGNETIC/ACOUSTIC/PRESSURE SIGNATURES

Source: Hartmann, *Weapons That Wait*, pp. 90, 93, 95.
depth in which pressure sensors can be used reliably in modern mines. Like the magnetic and acoustic radiations, the pressure signature, if used alone as a mine-triggering parameter, can lead to premature actuation of the mine. This is because large ocean swells and waves can produce suctions of sufficient intensity and duration on the seafloor to satisfy the pre-set detonation pressure level. Similarly, magnetic disturbances to the ambient or prevailing background magnetic field, due to solar and atmospheric disturbances, can prematurely detonate a mine which is dependent only on the magnetic influence. The acoustic influence is even more difficult to rely on in that shipboard noises travel a long way and localisation is made difficult. The process is further complicated by a host of other factors affecting sound propagation in such a diverse medium as the sea.

In addition to the risk of premature detonations, such single-signature mines are easily countered. Strictly magnetic or acoustic mines can be disposed of by influence minesweeping, in which strong magnetic fields and acoustic signals are generated so as to ensure that such mines detonate at harmless ranges. Mines relying simply upon pressure change can be countered by slow speeds. During World War Two, allied vessels countered the German pressure or 'oyster' mine by simply reducing speed to 4 knots in shallow water where the presence of mines was suspected.8

To overcome the inherent limitations of relying on individual signatures, bottom influence mines are now almost invariably of the combination type. Combination detonation involves any two or all three of the traditional influences. Such mines come in Magnetic-Acoustic (M-A), Pressure-Magnetic (P-M), Pressure-Acoustic (P-A) and increasingly common Acoustic-Magnetic-Pressure (A-M-P) versions. Only when the joint pre-set levels of each signature are simultaneously present will the mine detonate. Such mines are almost impossible to influence sweep as most combinations require the presence of an actual vessel, since only with a sufficiently large vessel can the necessary pressure signature be produced.

A modern, highly capable bottom influence mine is depicted in Figure 2:3. This weapon is capable of responding to acoustic, magnetic or pressure signatures as well as any combination thereof. Like most mines, it is equipped with a ship-count device which allows the mine to

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explode only after a predetermined number of possible targets has passed over the mine. This facility is used to foil influence sweeps and maximise chances of striking the right target. For example, if an opponent is known to undertake three consecutive sweeps of an area as standard operating procedure, the ship-count device may be set to actuate only after the fourth or fifth pass of a vessel. The ship count or ‘clicker’ will remain one of the simplest and most effective of a mine’s anti-sweeping features. Delayed arming and sterilisation devices are also incorporated in modern mines. Delayed arming allows the mine to be activated at a predetermined period after placement while the sterilization device causes the mine to switch off after a set period. This makes for enhanced operational flexibility and is of value in situations where negotiated peace settlements may call for the mine user to sweep the mines which have been deployed. The user can thus ensured the means by which the mine can be eventually neutralised prior to actual deployment.

Many bottom mines are twenty-one inches in diameter (533mm) so as to be deployable from standard submarine torpedo tubes. Various farings and parachute fittings can be attached to such mines for aircraft deployment. Bottom mines are capable of housing very large explosive charges since, unlike moored mines, they need no air pockets to maintain positive buoyancy. Explosive charge requirements depend on water depth, nature of the seabed and target construction characteristics together with the damage to be inflicted. The mine depicted in Figure 2:3 ranges in length from 1.4 metres to 3.6 metres, depending on which of the 250, 500 or 750 kilogram warhead options it is provided with.

The present mainstay of Australia’s protective and offensive mining capability is the conversion of Mk 80 series general-purpose low-drag bombs to bottom influence mines. These ‘bomb-mines’ are called Destructors (DST) and were widely used during the Vietnam War. The Mark 80 bomb series consists of the Mk 81 (250 lb), Mk 82 (500 lb), Mk 83 (1000 lb) and Mk 84 (2000 lb) bombs. The Mk 82 and Mk 84 are produced in Australia at the Munitions Filling Factory, St Marys, NSW, and can be converted to mines using the US Mk 75 Destructor Adaptation Kit — which is also known as the BCK (Bomb Conversion Kit) — as depicted in Figure 2:4.

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FIGURE 2:3
A MODERN COMBINATION BOTTOM MINE

FIGURE 2:4
THE DST-36
This kit consists of a battery, booster charge, arming device and firing mechanism. The Mk 42 firing mechanism detects a target using a thin film magnetometer. This very small, cheap and effective component was invented in 1966 and greatly reduces the size of magnetic detectors and increases shock resistance of the mine. The magnetometer is essentially a high-frequency oscillator that appreciably changes frequency when the ambient magnetic field is disturbed by the presence of a metal target. The firing mechanism has a limited anti-sweeping device in the form of a Probability Actuator Circuit (PAC), which isolates the reception of firing actuations at regular intervals.

Later models of the Mk 42 firing mechanism have magnetic/seismic (similar to acoustic) detection properties which also serve to enhance efficiency and resistance to countermeasures. The extraordinarily high shock resistance of the DST mine led to its widespread use as an aerially deployed riverine and ‘land control’ mine during the Vietnam War. Hundreds of thousands of DSTs were deployed near river crossings and roads in Vietnam. The DST has an underground trajectory on impact with the ground and it remains buried until activated by the magnetic and acoustic/seismic irradiations of passing trucks and armoured vehicles.10

The DST is a very handy mine and conversion from bomb to mine is relatively quick and easy. Selection of sensitivity, arming delay and sterilisation time is achieved by simply breaking tabs in the circuits. However, as a ‘bomb-mine’ it has a relatively small charge fraction, which makes it fairly ineffective in deeper waters. For example, the Mk 36 Destructor (DST-36), which is made by marrying the 500-lb Mk 82 bomb to the Mk 75 conversion kit, has a charge weight of only about 87 kilograms or 190 lbs of H6 explosive. This small charge fraction is due to the weight of a thick wall casing surrounding the explosive charge. The casing is designed to give the bomb high shock strength and fragmentation potential. The Mk 84 bomb, for instance, has an external thermal coating, a steel case 1.5 cm thick and an internal asphaltic liner of 0.5 cm thickness. All in all, the Mk 84 bomb casing is one inch thick and the casing represents more than half of the bomb-mine weight, since

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only 950 lbs of the 2000-lb bomb weight consists of explosive material. Thus the DST family are all shallow-water mines, with the Mk 82 and Mk 84 charges effective at maximum depths of only 20 and 45 metres respectively.

Another major problem with the DSTs is that their essential principles of operation because well known during the Vietnam War, and this enhances the ease with which they could be swept if deployed by Australia. During the minesweeping of Vietnamese harbours in 1973, as part of a US-Vietnamese ceasefire agreement, the United States conducted a three-week Mk 36 DST course for 40 North Vietnamese at a school the Americans set up near Haiphong harbour. DST sweeping equipment was also provided for North Vietnamese use.

In discussing how the modern bottom mine works it may be instructive to consider its use against a particular target. Assume that one of the acceptable targets in an opponent’s force is a well-degaussed destroyer of approximately 4000 tonnes displacement, length 100 metres and draught of 6.5 metres. It is known to regularly transit an offshore area of average depth 40 metres at a speed of around 16 knots. Assume the minelayer has done his homework and enters the acoustic spectrum of the target for speeds between 12 and 20 knots into the mine’s microprocessor target signature library bank, so that early target identification can be made at long ranges once the mine is deployed. Particular acoustic spectral lines, characteristic of equipments operating on this particular class of ship, will be used for positive identification. Because the vessel is expected to be well degaussed and thus have quite a low magnetic signature, a minimum magnetic disturbance above the ambient level will also be programmed in as an added prerequisite for detonation. The pressure setting, based upon a speed of 16 knots, would be set to finally trigger the mine if a negative pressure change of at least one inch of water suction is experienced for 10 seconds or longer. Even though a suction of about 5 inches of water could be expected for 12

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11 E. Kilmer, The MK80 Series Bombs: Demolition Potential, NSWC/WOL/TR76-5 (Naval Surface Weapons Center, Virginia, 23 January 1976), p. 12. Successful research has been conducted in Australia to produce Mk 80 series General-Purpose Low-Drag (GPLD) bombs with plastic casings. Substantial cost savings arise from this development but effectiveness of DST conversions may be seriously compromised.

seconds in the ideal case of the ship passing overhead, this is seldom achieved in practice.\textsuperscript{13}

Once an A-M-P combination mine is deployed it can detect and attack the target in a number of different ways. One hypothetical example could involve the mine settling to the bottom and automatically arming one hour after deployment. It could then turn on its low-power passive acoustic sensor (hydrophone) while the other sensors were switched off to conserve battery power. Frequency spectrums of passing vessels would be matched against the target ‘fingerprint’ held in the target signature library. A certain identification can be made while the target is still several miles away. At this point an electronic ‘time window’ may be opened during which a suitable magnetic reading must be received and acoustic signals are monitored so as to ensure that legitimate rates of rise of signal amplitudes are received. This is to help localise the target and also to foil the opponent’s possible influence sweeps, since minesweepers often vary magnetic and acoustic sweep intensities so as to deceive mines and trigger premature detonations. If a small but gradual increase in the mine’s local magnetic field is registered then the mine will be fully ‘cocked’ and finally it will be up to the pressure detector to register if the ship is sufficiently close for the mine to profitably detonate. A charge weight of perhaps 350-450 kilograms at the 40-metre operating depth should be sufficient to seriously degrade the vessel’s operational capability, if not sink it outright.\textsuperscript{14}

The actual degree of damage inflicted by a mine depends on a number of factors. First, the political aspects. If heavy loss of life and injury is to be avoided (for instance, to prevent escalation) then mine sensitivity and charge weight for depth must be selected accordingly. High-sensitivity settings ensure that the mine is detonated at a non-optimum position not very near the target. Low-sensitivity or ‘course’ settings are reserved for optimum damage and deliberate sinkings. These lower settings ensure that the target is well localised and within a damage radius in which detonation could cause immediate sinking or serious hull rupture leading to eventual sinking. The nature of the

\textsuperscript{13} See Hartmann, \textit{Weapons That Wait}, Appendix C, pp. 280-281 for a quantitative analysis describing the pressure drop on the seabed resulting from the passage of a vessel.

\textsuperscript{14} A major factor determining the actual amount of damage to a vessel is the sturdiness of ship construction. See Hartmann, \textit{Weapons That Wait}, pp. 98-103 for a discussion of ship vulnerability.
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seabed is another important factor when considering damage effects. Even if water depth, charge weight and vessel draught are equal, detonations on hard, rocky seabeds are much more severe than those occurring on muddy, silty or sandy bottoms. The reason is that hard bottoms have a reflective effect in terms of non-absorption of explosive force. Another factor in determining actual damage effects is the strength of a ship's hull; this varies from vessel to vessel even if they are of the same class, somewhat like with motor cars. Most warships should have a sufficient level of equipment redundancy to enable them to remain operational even after a few localised projectile 'hits' in non-critical areas. However, sudden and whipping mine shock effects certainly test the strength of any hull.

In the above example, it is almost certain that the destroyer attacked by a mine containing a 350-450 kilogram high-explosive charge in 40 metres of water would suffer major machinery and systems damage, sufficient to cripple its operational effectiveness for a long time. This would not only deprive the opposition of an extremely valuable major combatant but would also require enormous costs and effort in terms of shipyard repairs. Outright sinking may occur at this charge level if vital equipments are not shock-mounted and damage control is not of sufficiently high order to counter contingencies which could arise from hull ruptures, cracked hatches and relatively small leaks which can get out of control if many pumps are inoperative. In the early days of World War Two a large number of ships were sunk because equipment used for dealing with minor leaks was made unserviceable by the shock effect of the mines.15

Damage Effects

Contact mines (which are still used today, by themselves or in 'mixed bag' minefields) simply destroy part of a ship's side, with much of the explosive force being expended in the ocean or in the air in the ship's interior. For example, these mines were used widely against Persian Gulf shipping during June 1987-July 1988 and caused a highly disproportionate response from US naval forces. If the local damage caused cannot be dealt with, the ship often sinks. Similar results occur with bottom mines used in very shallow water, up to a depth of about

ten metres. With bottom mines used in deeper water there are less obvious damage effects.

The common, solid, high explosives contained in modern, large, bottom influence mines include tritolit, minol, and various members of the HBX and RDX family. On average, the explosive efficiency per unit weight of these substances is about one and a half times that of TNT and modern combination bottom-influence mines generally carry from 250 to 850 kilograms of explosive. This is equivalent in explosive effect to 375-1275 kilograms of TNT (that is, up to approximately 1.3 tonnes of TNT). Underwater ignition of such large explosive charges immediately produces gas under enormous pressure that rapidly and violently expands against the intervening, incompressible mass of water. A shock wave is produced that initially travels toward the target at supersonic speed, but this is only the beginning of the effect. At this point a huge gas bubble has commenced expansion and migration towards the surface. The subsequent pulse action of the huge bubble, in the incompressible water medium, gives rise to a series of overpressures and underpressures which follow up the initial heavy shock wave and are soon experienced by the target. A whipping effect upon the target ensues, which results in the 'lifting of a ship in the middle and causing it to flex violently as a free beam'.

The extent of damage that occurs depends on water depth, target strength, composition and topography of the seabed, together with the amount of charge detonated. The effects of the gas bubble can, and have, lifted vessels out of the water causing their keels to snap, literally breaking them in two. At greater depths the hull of the vessel may retain its apparent integrity but havoc might be wrought within. In World War Two numerous ships were written off or held up with lengthy and costly repairs due to whipping effects. Distortion damage, such as the breaking of frames, braces, lines, and loading hatches, together with main engines 'jumping' off their beds and all manner of pump, valve and system fittings breakages, occurred — to the understandable dismay of ships' crews.

Modern commercial and military vessels are usually of significantly less sturdy construction than World War Two vessels. They are laden with sophisticated electrical and electronic systems,

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17 Ruge, Seawarfare, 1939-1945, p. 90.
which make them extremely vulnerable to the violent shock damage inflicted by the detonation of large bottom mines in depths up to a maximum of perhaps 80 metres. In fact, given the number and complexity of electronic systems on board modern vessels, a bottom mine containing 850 kilograms of high explosive at this depth could create sufficient on-board damage to significantly reduce the capability of a warship. (This assumes that very expensive and often impractical shock-mounting of all major equipments has not occurred.) It should be noted that visible, structural damage need not be done to make a modern warship ineffective. Serious damage to a small number of critical target-acquisition and power-generation equipments alone can compromise a combat vessel's entire capability.

Mine Cost

In 1972 the United States mined three major North Vietnamese harbours and many miles of coastline, using 11,000 mines. Except for a few dozen larger MK 52 air-laid bottom influence mines, all mines deployed were of the DST family (mainly DST-36). The cost of these mines and their delivery was $US 6.5 million. This puts the average cost of production and delivery of the mines used at just under $US600 each in 1972. Given that, prior to mine deployment, the North Vietnamese were getting 85% of their 2.5 million tons of war materiel by sea, it appears that the mines proved exceptionally good value for money. North Vietnam was not to receive war materiel by sea for ten months after mine deployment.¹⁸ More sophisticated mines obviously involve more expense. Expense depends on capability requirements and whether the weapon is produced domestically or imported. Cost is also governed by the level of production, since mass production of mines in batches of thousands brings commensurate economies of scale in terms of unit cost.

In relation to Australian production of good bottom-influence combination mines, it may be possible to keep costs around $70,000 per unit with moderate economy of scale.¹⁹ This cost is extremely cheap at


¹⁹ This is the author's cost assessment of a surface/submarine-laid A-M-P mine manufactured to an acceptable operational standard. An air-deployed version would, however, be more expensive due to more stringent shock-proofing standards of construction. The major cost would be incurred in the purchase of the TDD assembly that determines just how 'smart' the mine is. It should be remembered that if the mine is made to be too 'smart', it may never detonate!
today's weapons prices. The term 'good' is used purposefully, since the best is always an enemy of the good. This is particularly so when discussing weapons. Many advantages of the mine stem from its lack of expense and its traditional cost-effectiveness must be maintained. A good mine should be able to satisfactorily detect and classify a target. It should have reliable actuation devices and be quite robust, using printed circuits and other products of mass producible, modern, solid state electronics. The weapon should incorporate some form of anti-sweeping function in its program, which could also facilitate delayed arming and sterilisation features.

For the cost of one Harpoon missile, which is about 1.5 million dollars, the Australian Defence Force (ADF) can have a devastatingly effective minefield of twenty or so capable bottom mines. And, of course, each of these mines is capable of attacking a ship, drawing a disproportionate enemy response, providing political leverage and offering a persistent threat which constrains enemy action.

The Way Ahead in Mine Design

Improved target detection and selectivity are mine design objectives that will continue to be pursued with vigour. In particular, the use of acoustic 'fingerprinting' techniques, in which the target's acoustic signature is compared with a microprocessor-stored pattern, may find widespread use. This offers the potential for extremely accurate target selectivity.20

Investigations are sometimes carried out to determine new means of detecting a ship's presence, many of which are of limited value due to their small magnitude and mine sensor detection limitations. Such means include distortions in the local gravitational field, the change in cosmic ray and white light transmission to the seabed due to the opacity of a ship's hull, redistribution of sea mass per unit volume and variation of fluid velocity flow around a ship. A currently more feasible alternative may relate to the ELPFI (Electric Potential Field) effect associated with a ship. Certain changes in this field can be detected and used to activate mines in close proximity to targets. ELPFI changes derive from a number of causes, a major one being the simple battery circuit formed between the steel hull and bronze propellers of a

vessel. These dissimilar metals are linked by the seawater electrolyte, of high and stable conductivity, and the propeller shaft bearings, which complete the circuit. The contact resistance of the shaft bearings varies, due to a number of factors including shaft revolutions (ship’s speed) and bearing lubrication state. Varying resistance causes an alternating current flow in the circuit. This current has a correspondingly alternating or modulated magnetic field associated with it. The modulated magnetic field can be detected, and in certain instances usefully employed as a signature.\(^{21}\)

Resistance to countermeasures, especially minehunting, is also an area of major continuing interest to mine designers. Minehunters, which use sonar to locate mines, have low acoustic and magnetic signatures. Having a small draught and operating at low speed also make their pressure signatures small. The minehunter’s strength and weakness lies in its sonar. Mine designers are also interested in methods of enhancing the mine’s resistance to detection with anechoic coatings that absorb ultrasonic radiation. Constructing the mine in an unusual shape is another means of camouflage (see Chapter 4).

A distinctly less subtle, but potentially very effective, means of counter-countermeasure involves making use of the hunter’s sonar as a signature in its own right. Specialised acoustic sensors could be incorporated in a bottom mine that, instead of having a simple explosive charge, could be equipped with a bottom-mounted homing rocket or torpedo as its lethal component. The rocket or torpedo would home in on the hunter’s sonar transducer, together with its hull in general. Given the heavy emphasis on minehunting as opposed to minesweeping these days, especially in Western Europe, such a quick-kill device could prove extremely cost effective and would greatly hamper the clearance of minefields. It is evident that a few of these devices deployed in a minefield consisting of various more standard mine types would pose an extremely formidable problem to mine countermeasure forces.

Widening the radius of action of modern mines remains a subject of great interest to mine designers. The US Captor (Mk 50) mine, for example, has a radius of action variously defined as between one and three thousand metres.\(^{22}\) Rocket-propelled mine charges have a similar

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22 Pretty (ed.), *Jane’s Weapon Systems 1983-84*, (p. 180) states that the range of the Mk 60 mine is approximately 1000 yards. This remains the authoritative estimate.
effective radius of action and would, of course, give the target less time for evasive action or countermeasures.

The increasing efficiency and abundance of modern air and surface surveillance systems has led to a heightened requirement for covert mine deployment. The Submarine-Launched Mobile Mine (SLMM), which is deployed from torpedo tubes, is receiving much developmental attention. The SLMM may be a purpose-built mobile mine, or a reconditioned torpedo equipped with a target detection and actuation system. This mine is used in shallow waters where it is dangerous for submarines to simply enter and eject mines out of their tubes. Using SLMMs, a submarine can launch the mine from deeper and safer water, after which the mine travels to a predetermined resting place on the seabed in a choke-point or port approach, if not in a harbour itself. In addition to the development of the SLMM, the submarine's mine-carrying capability can be increased by the temporary fitment of externally attached mine carrying cradles and chutes, which can practically double the number of mines available for deployment from a submarine during a mission.

The mine is also being increasingly adapted to satisfy political requirements for improved flexibility of use. Increasing levels of post-deployment human control, employing remote methods of turning the weapon on and off, are receiving much attention. Remote activation can be achieved using a number of radiation types, including coded sonar signals transmitted by submarine or ship. Aircraft can exercise control over mines on the seabed using radio signals sent through a temporary transducer buoy, which can automatically scuttle soon after its relay job is completed. Since the provisions of international law imply that the minelayer is required to remove the danger posed by his weapons on completion of hostilities, remote on/off control is of considerable political utility. Mines can even be pre-programmed to regularly switch off during certain days or hours of days. This increases the level of safety of friendly vessels and adds a new dimension to operational flexibility. Such time-control functions as sterilisation, self-destruction, delayed arming, ship counts and switch on/off can be controlled by a

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23 The US commenced production of the Mk 67 SLMM in 1979. Initial stocks will consist of converted Mk 37 heavy torpedoes. The Soviets are also said to have developed an effective SLMM (see Vego, 'Soviet Mine Warfare', p. 1419).

24 An example of this technique of remote mine control is given in S. Geisenheyner, 'Naval Warfare and the Seamine', Asian Defence Journal, August 1984, pp. 21-23.
tiny CMOS (Complementary Symmetry Metal Oxide Semi-Conductor) — a chip-based internal clock.25

Further advances are being made to make the mine a true ‘ready round’, requiring minimal preparation time prior to deployment. The cover plate of the mine can be easily removed and rail-supported electronics and battery racks can be withdrawn, after which self-test programs may be run. The explosive charge case can be inserted after safety mechanisms have been checked. The mine is then ready for deployment and action.26

The way ahead in mine design has its problems. A danger is the tendency of the ‘technical tail to wag the operational dog’.27 The pursuit of developing the best possible mines can have adverse effects on the operational use of what is and must remain a very cost-effective weapon. For example, mine-use by Iran in the Persian Gulf during 1987-88 clearly demonstrated that mines of early twentieth century design could be used to harass and extensively damage the most sophisticated units of the world’s most powerful navy (see Chapter 3). A simple moored contact minefield liberally sprinkled with sweep obstruction devices is still one of the ‘black beasts’. Technological excellence costs money and reduces the number of mines available for operations. This, in turn, influences tactics and strategy. A ‘good enough’ mine offering 80% of best performance at 20% of cost, for instance, should be preferred. Of course, small numbers of anti-MCM vessel mines and other specialty devices should also be produced. Modern mines should also not be made too selective since, unless ideal actuation conditions exist, they may fail to detonate at all. Rather than aim for the development of a perfect mine, the mine designer and his military counterpart must concentrate their efforts on the challenge to accurately deliver a sufficient quantity of ‘good enough’ mines.

25 ibid., p. 18.
26 See ibid., pp. 17-18 for a description of the Italian MR-80 mine, which incorporates many features leading to enhanced reliability and ease of preparation.
27 This phrase is derived from a comment made by the World War Two Director of British Minelaying, Admiralty (Captain J. Cowie, RN). In the 1960s he wrote that ‘... the technical tail must be prevented from wagging the operational dog’, when suggesting that the USN must adhere to sound operational principles in mine warfare and not be led astray by pursuing technical excellence in design. See J. Cowie, ‘The Role of the US Navy in Mine Warfare’, US Naval Institute Proceedings, May 1965, p. 52.
Conclusion

Control over the actions of an adversary is the ultimate aim in war. The mine contributes to realising this goal by providing a cheap and potent means of sea denial by which to stop or channel enemy deployments. This denies the enemy the initiative by which to set the pace of maritime conflict.

Modern technology has consistently been applied to enhance the performance of the mine. Advances in the detection capabilities of sensors, signal processing, microprocessor capabilities and miniaturisation have made the modern mine an even more operationally flexible weapon. It can be very target-selective, have a wide radius of action and is highly resistant to countermeasures. However, 'the technological tail must not be allowed to wag the operational dog', since the mine's traditional cost-effectiveness must not be sacrificed for the pursuit of elaborate technical excellence of design.

The mine is used, and will continue to be used, because it remains a very affordable and easily deployable sea denial weapon. Maritime nations neglect this potent and versatile weapon at their own risk.
CHAPTER THREE
THE MINE THREAT

German Offensive Minelaying in Australasian Waters

Pinguin’s Visit

During both world wars armed German merchant ships, or auxiliary cruisers (raiders), operated for short periods in Australian and New Zealand waters. These vessels inflicted extremely large amounts of damage when compared with the resources invested in their operation and drew a vastly disproportionate response from the Australian Commonwealth. The raiders were adept in the use of deception and the essentials of what was effectively sea-going guerilla warfare. The use of the mine was an integral part of their operations and each raider was equipped with several hundred mines, with resupply being made as circumstances permitted.1

An example is the World War Two offensive minelay of the raider Pinguin (Ship 33), under the command of Captain Felix Kruder. Pinguin’s principal hunting ground was the Indian Ocean and adjacent Antarctic waters. The Germans were fully aware of the utility of the mine and the vulnerability of Australia to mines. Consequently, in the words of Vice Admiral Friedrich Ruge — Germany’s senior mine warfare officer — ‘[Kruder] ... made a long reach to South and South-East Australia for the sole purpose of laying mines off Sydney, Adelaide and the southern part of Tasmania’.2 While operating in the Indian Ocean during September 1940, Kruder planned his Australian minelays and decided that two minelayers would make the operation much easier. He intended to use his next ‘prize’ as an auxiliary minelayer. Two vessels would enhance the security and spread of the operation in view of the large distance between the planned fields, which were to be deployed between Newcastle and the Spencer Gulf. Realising that once his mining effort was detected an effort would be made to sweep all significant ports on the coast, Kruder decided to place a two-day

activation delay on his moored contact mines so that they would not be detected until all fields were laid.  

In early October Kruder captured the Norwegian tanker Storstad (8,998 tons), which was heading from the Sunda Strait towards Australia. Storstad was renamed Passat and was promptly converted to an auxiliary minelayer east of Christmas Island. Passat was to mine Banks Strait and the east and west ends of Bass Strait between Tasmania and the Australian mainland. Under Lieutenant Warning, GNR, Passat proceeded south from Christmas Island, around Cape Leeuwin and deployed 120 mines in accordance with this plan.

Passat was to mine areas around Sydney, Newcastle and Hobart, since these areas were considered natural focal points for shipping — as indeed they still are today. The raider kept well out to sea until ready for its lay. At midday on 28 October she slowly steamed on a south-west course towards the east Australian coast and had arrived off Port Stephens by 7.33 p.m. that evening. Conditions for the lay were ideal. The night was cloudy and very dark, with coastal lights conveniently operating in accordance with peacetime regulations. This made accurate navigation — so essential to deploying the minefield correctly — possible. Kruder’s War Diary, or log, contains the following entries which describe the details of this offensive minelaying operation against Australia. Entries are reproduced here in full to emphasise the ease with which covert minelaying operations have been and indeed still can be prosecuted in Australian waters:

28.10.40
7.33 p.m. Beam from Port Stephens coming in sight 65° to starboard.
7.40 p.m. Sweeping searchlight beam coming in sight over the horizon from direction of Sydney.
7.52 p.m. Three searchlight beams can be made out in the direction of Newcastle, in between them the beam from Newcastle lighthouse. Cross bearings of Newcastle and Port Stephens cannot be taken as the lights still lie below

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the horizon. Lights are shining in accordance with peacetime regulations.

8.13 p.m. First part of Operation begun, with first mine in 188 m of water.
8.27 p.m. Two lights 30° to starboard.
8.30 p.m. Confirmed as lights on shore (Catherine Hill).
8.53 p.m. End of first part of mine laying operations. Last mine laid in 153 m of water.
9.19 p.m. Began second part of Operations. First mine in 140 m of water. The enemy searchlights in Sydney and Newcastle can now be clearly defined. They are located on hills, possibly outside the towns. They sweep for ten minutes every half hour in Sydney, and ceaselessly in Newcastle. They impede a direct approach to the harbour entrances, and render sights possible in spite of entering craft.
9.33 p.m. End of second part of operation. Last mine laid in 140 m of water.
9.53 p.m. Norah Head Lighthouse beam appears.
10 p.m. Norah Head dead ahead.
10.22 p.m. Began third part of operation. First mine laid in 130 m of water. The position is easily determined. Norah Head Lights on a hill ashore, dead ahead. Catherine Hill, 30° to starboard; Beam from Barrenjoey Head Light (Broken Bay) 30° to port; Sydney searchlights 60° to port.
10.38 p.m. Last mine laid in 96 m of water.
11.30 p.m. Proceeding at 14 knots to last barrage position.
11.40 p.m. Began fourth part of operation (Sydney approaches) by laying one mine in 140 m of water.

29.10.40

12.1 a.m. Finished fourth part of Operation. Last mine laid in 164 m of water. Course 110°, speed 10 knots.
12.40 a.m. Withdrew at 10 knots, course 110°. Newcastle beams out of sight. Proceeded south at 15 knots to carry out mining operation Two, off Hobart. As up till midnight (29.10.40), nothing has been heard of Passat, I presume that she has been able to complete, according to plan,
The Mine Threat

Exercise I, scheduled for today; the fouling of mines of Banks Straits.

30.10.40

12 p.m. 40°20' S., 151° 58' E. Visibility good. Nothing (Noon) to report. Nor has anything been heard of Passat today. Consequently Operation Two, the mining of Eastern Entrance to Banks Strait has presumably been carried out.

31.10.40

[At noon, en route for Hobart, Pinguis reached position 44° 19' S., 147° 59' E. The weather had deteriorated, with misty rain and poor visibility. At 3.44 p.m. the look-out sighted Eddystone Rock on the starboard bow. The raider approached to a position 15 sea miles from the entrance to D'Entrecasteaux Channel.]

5.5 p.m. Sky suddenly clears, rain ceases, and the snow capped coastal range of Tasmania, 1000 m high, comes in sight on the starboard bow. Turned away and withdrew. Turned again to course 335° before darkness falls and steered towards both cliffs. Approach slowly.

7 p.m. Action Stations. Cape Bruny Lighthouse in sight 40° to starboard.

7.37 p.m. Piedra Blanca 2.5 sea miles off the starboard beam. It has completely cleared up and the night becomes starlit, the western horizon can be clearly seen.

8 p.m. Cape Bruny dead ahead.

8.7 p.m. Searchlight beam in sight 09° over the horizon, sweeping to and fro.

8.21 p.m. Glow from searchlight sighted on 24° apparently searchlights on both sides of D'Entrecasteaux Channel, situated on a narrows behind Bruny Island.

8.47 p.m. Clouding over. Increased speed to 13 knots and then to 15 knots.

9 p.m. The ship has now approached the D'Entrecasteaux Channel entrance sufficiently to sum up the position. Six sea miles off the port beam, the coastal range, 300 m high, curves around into the distance far ahead. Dead
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ahead lies the Entrance and on the starboard bow Bruny Island.

9.18 p.m. Patrol vessel D/F4, true bearing, 030°, apparently in Storm Bay.

9.20 p.m. First part of Operation begun. First mine laid in 100 m of water.

9.33 p.m. End of first part of mining Operation. Proceeded into Storm Bay at 16 knots.

9.53 p.m. Tasman Head 5 sea miles off the port beam.

10.29 p.m. Turned to minelaying course 046° for the second barrage. Two searchlights can now be seen on 360° apparently right in Hobart entrance.

10.35 p.m. Lights on shore come in sight.

1 p.m. First mine of second operation laid in 113 m of water.

1.11.40

12 a.m. Last mine laid in 137 m of water.

Position End of operation. The coastline of Tasmania lies six 14° 40'S. miles off the port quarter. 16° 42'E. Raining. No message from Passat consequently she must have completed Operation Three in the Western Entrance to Bass Strait.

The German operation was conducted without a problem for the raider and its auxiliary. One week after this rather casual, three-day minelaying operation had been completed, the British freighter Cambridge (10,846 tons) was mined and sunk six miles east of Wilson's Promontory, Victoria. Two days after this, on 9 November, the US merchant ship City of Rayville (6,000 tons) was mined six miles south of Cape Otway in southern Victoria, earning the dubious distinction of being the first US ship sunk in World War Two.6

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6 No record exists of any US vessel being sunk before 1941.
FIGURE 3:1
THE (a) CAPE OTWAY AND (b) WILSON'S PROMONTORY FIELDS, WWII

Source: Journal of the Australian Naval Institute, May 1987, p. 33.
In early December the British merchantman Nimbin (1,050 tons) was sunk and the British freighter Hertford (10,923 tons) was severely damaged, off Norah Head, NSW and Liguanea Island, SA respectively. Even with the intensive effort of the Australian 20th Minesweeping Flotilla, coastal shipping was disrupted until the end of the year. The threat persisted into 1941 with the trawler Millimumul being sunk off Barrenjoey Head, NSW in late March of that year.

The death-toll as a result of this German offensive minelay was sixteen, together with a large number of injured allied personnel. Besides the direct destruction of over 18,000 tons of shipping and serious damage to a large freighter at the cost of only 230 simple, moored contact mines, the indirect results in terms of disproportionate response were huge. Coastal shipping was thrown into confusion, ports were completely closed and shipping did not return to normal for many weeks after each sinking. Vigorous minesweeping efforts were instituted, which were to last not for weeks or months but years. The disproportionate response made by Australia as a result of the German operations will be discussed in more detail below.

In mid-November 1940, the crews of the raider and its auxiliary were commended by the German Naval High Command for the '... planning, preparation and execution of an exemplary operation' in Australian waters. Shortly after Pinguin rendezvoused with Passat (15 November 1940), Grand Admiral Raeder, Commander-in-Chief of the German Navy, awarded five Iron Crosses (First class) and fifty Iron Crosses (Second class) to crew members.

Other German Operations in Australasian Waters, World War Two

Pinguin's and Passat's Australian minelay was certainly the most rewarding (from a German point of view!) minelay in Australasian waters, but it was by no means an isolated effort. German naval authorities were resolved that materials destined for Britain from Australia and other Commonwealth nations should be intercepted. Mines were seen as an ideal means of doing this, when co-ordinated with direct raider interdiction operations.

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9 ibid.
In September 1940 the raider Orion (Auxiliary Cruiser 36) was active off the coast of Western Australia and was drawing a disproportionate response from minesweeping units and Commonwealth authorities. Earlier that year, in June, Orion had been in the Gulf of Hauraki mining the approaches to Auckland. At that time, Orion laid all of the 228 combat mines in its hold and, one week after deployment, success was forthcoming. The large mail steamer Niagara (13,450 tons), containing two million pounds worth of gold bullion and over one half of New Zealand's stock of wartime small arms ammunition, was mined and sunk. Soon after this costly loss occurred the freighter Port Bowen was also sunk in the minefield, and efforts to sweep the field resulted in the loss of the RNZN minesweeper Puriri. The commanding officer of Orion (Commander Kurt Weyher) was so pleased with his New Zealand success that he ordered the manufacture of a small number of dummy mines while at sea and deployed them off Albany, WA, to capitalise on the confusion and fear spread by the New Zealand sinkings.

New Zealand waters were also mined by the German auxiliary minelayer Adjutant, off Port Lyttleton and Wellington. The magnetic mines employed were either faulty or laid in water which was too deep. Had they been deployed properly, in the right number and at the right depth, New Zealanders would have been confronted with a far more demanding Mine Countermeasure (MCM) problem than the sweeping of simple, moored contact mines.

Australians, too, were fortunate to escape the offensive use of magnetic mines. In 1941 the raider Kormoran (Ship 41) was directed to mine Australian waters using magnetic mines. Captain Theodor Detmers, the youngest of the raider captains, was planning to mine the approaches to Geraldton and Carnarvon but had decided against it on the grounds that traffic in and out of these ports was insufficient to warrant a minelay. The division of the German Naval High Command that oversaw raider operations (the SKL) 'deplored this decision'. Finally Detmers chose to initiate his offensive minelay off Perth and was on his way to this objective when Kormoran met, sank and was sunk by the Australian cruiser HMAS Sydney on the evening of 19 November.

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1941. Sydney's entire ship's company, numbering 645 men, was lost as a result of this action. Most of the raider's crew survived.12

Offensive Minelaying in Australasian Waters, World War One

The use of the mine against Australia in World War Two should not have come as a surprise to Australian authorities. After all, the mine was used as a 'first strike' weapon against Australia in World War One also.

The raider Wolf introduced the mine to Australian and New Zealand waters. In June 1917 Wolf, during its piratic circumnavigation of the world, laid a small field of moored contact mines off Cape Farewell, New Zealand. In August the large cargo vessel Port Kembla (5,000 tons) was sunk. New Zealand naval authorities initially thought that a bomb had been placed on board by a disgruntled Australian dockworker and believed mines were not responsible for the sinking. However, mines were ultimately shown to be responsible when they claimed another victim. The passenger steamer Wimmera (3,500 tons) was mined and sunk between North Cape and the Three Kings, NZ, in July 1918, with the loss of twenty-six lives. New Zealand authorities were now pressed into decisive action and requested assistance from Britain and the US. These requests were dismissed out of hand as war materials and assets were said to be needed more in other theatres. At this point, being thrown on their own resources, the New Zealanders mustered an ad hoc sweeping squadron consisting of two fishing trawlers and a whaler. These succeeded in sweeping Wolf's remaining simple moored mines.13

Unfortunately Australia was not to escape the attention of Wolf, since the raider lost no time in making for the Australian coast once its New Zealand fields were laid. A small field of 25 mines was laid 10 miles off Gabo Island lighthouse on 3 July 1917. Mr Roy Alexander, an Australian prisoner of war who was on board Wolf at the time, stated in his memoirs:

That afternoon off Gabo seems unreal, somewhat incredible even to one who was present. The good folk

12 Woodward, The Secret Raiders, pp. 177-181, gives an outline of the encounter based on German correspondence.

13 An eye-witness account of Wolf's voyage is given in R. Alexander, The Raider 'WOLF' (Angus and Robertson, Melbourne, 1968, originally published as The Cruise of the Raider 'WOLF', 1939). The New Zealand minelay is described at pp. 17-33.
of Sydney and Melbourne would certainly have been startled had they known that a raider was steaming off the coast with her afterdeck black with mines, and waiting only for darkness to set in before mining Australia's most important sea track.\textsuperscript{14}

Three days later the new steamer \textit{Cumberland} (15,000 tons) encountered the Gabo field just before midnight and the master signalled that he was mined and sinking. However, he did manage to beach his ship on the island and on the following morning the vessel was examined by naval and government experts. The 'experts' concluded that — despite the obvious sight of the ship's plates torn inwards — \textit{Cumberland} had been the victim of an internal explosion!\textsuperscript{15}

Government proclamations offered a substantial reward for information leading to the conviction of persons who had '... feloniously and maliciously destroyed the \textit{Cumberland}'.\textsuperscript{16} According to Alexander such ridiculous proclamations '... caused much amusement when they were reprinted in German newspapers months later'.\textsuperscript{17} No efforts were made by the Australian government to declare hazardous areas or divert shipping. But evidence was mounting that minefields were laid. The modern collier \textit{Undola} disappeared with all hands. Several smaller vessels disappeared without trace. Finally, mines were washed ashore at Bega and Newcastle and 'floaters' were sighted around Gabo Island.\textsuperscript{18}

Alexander does not disguise his contempt for the crassness and incompetence of the Australian government's MCM efforts at the time. He comments:

\begin{quote}
According to the British War History, mines in Australasian waters were 'dealt with by the Australian and New Zealand naval forces'. This phrase 'dealt with' is tactful and correct, for there is little record of any minesweeping on those coasts. Most of Wolf's mines appear to have been 'dealt with' by their cables rusting through and the mines exploding harmlessly on the beaches; others were destroyed by gunfire when they
\end{quote}

\textsuperscript{14} ibid., p. 32.
\textsuperscript{15} ibid., p. 36.
\textsuperscript{16} ibid.
\textsuperscript{17} ibid.
\textsuperscript{18} ibid., p. 37.
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were reported ... Seen from all angles, the Tasman Sea activities of the Wolf revealed hopeless incapacity on the part of the Australian administrators — an incapacity so hopeless it remains almost incredible.19

It was not until mid-October 1917, four months after the sinking of Cumberland, that the Australian government acted to form a minesweeping section and commence sweeping operations off Gabo Island.

Why was the Mine Chosen for Use Against Australia?

Under the direction of Field Marshal Count von Moltke in the mid-nineteenth century, Prussian military thinking underwent a revolution which led to the development of the mission-oriented foundations for future German military practice.20 In the early 1840s, von Moltke began to realise the implications of new technologies, such as railroads and advances in weaponry. On becoming Chief of the Prussian Great General Staff in 1857, von Moltke set about tailoring strategic and tactical doctrine so as to make use of the new weapons, new transport, and other aspects of technology that could assist his military efforts. Within thirteen years, and after three victorious wars, von Moltke’s concepts were vindicated with the unification of Germany. His attitude to staff work and new weapons so dominated the German military for a further eighty years that even in the German Army Field Manual (Truppenfuhrung) of 1936, in paragraph 5 of the Introduction, we find ‘... The art of war is in a state of constant development. New weapons cause it to assume ever-changing forms. The advent of these weapons must be seen in good time, and their effect correctly assessed. Thereupon they must be quickly taken into service’.21

After the Russo-Japanese War of 1904-05, the German Naval High Command made a careful study of this conflict and were impressed with the potential which the mine offered as an instrument of sea power. Doctrines for the extensive use of mines were soon developed and a research and production programme was well

19 ibid., p. 38.
21 Van Creveld, Fighting Power, p. 29.
underway shortly after the end of the Russo-Japanese War. The mine was intended for operational use against the British Grand Fleet and England’s sea lines of communications in general. By 1907 the Germans were so confident in their mines and mine warfare doctrine that they opposed all but the most limited restraints on mine-use at the Hague Convention on Mine Warfare in that year. Allied commentators, describing the state of German and Russian mine warfare preparedness and intent, suggested that ‘... Germany had studied the strategical employment of mines, intended to use them without regard to the dictates of humanity and had accumulated adequate stocks of well designed material. To a lesser extent Russia was in the same position both with regards to policy and preparations’. The pre-war effort and preparation invested in developing a sound mining capability paid off handsomely for the Germans in World War One, since:

The Germans laid over 43,000 mines, the great majority in innumerable small fields round the coasts of Great Britain, France, Italy and Greece, along the eastern shores of the Adriatic, off the Tunisian coast, in the Baltic and Black Sea, in the approaches to the White Sea, and in the Pacific and Eastern waters. These mines inflicted on the British Empire alone the loss of 40 war vessels, 225 Auxiliaries, 63 fishing craft and 260 merchant ships. The total allied loss in the latter category due to enemy mines was 586 ships, representing 1,000,000 tons.

During the early 1930s, research by the Germans into magnetic mines, improved moored mines and devices for destroying enemy sweep gear (obstructors) was rejuvenated. The lessons of World War

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22 The German delegation to the Convention even resisted the suggestion that a one hour time limit should be put on the life of unanchored or drifting mines. The delegation argued that such a short period would be operationally useless (Cowie, Mines, Minelayers and Minelaying, p. 170). It was understood by the British that the Germans intended to use drifting mines with ‘... the idea of dropping them in the path of an advancing fleet in order to blow them up’ (R. Bacon, The Jutland Scandal, Hutchinson and Co., London, 1917, pp. 35, 36).


24 ibid., p. 86.
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One had been carefully studied and the mine once again took an important place in German naval plans. Prior to the start of World War Two, Britain was seen by the Germans as their most dangerous enemy.25 The Germans considered that the ‘object of a Naval War was to deny the enemy use of the sea as a means of transport, while using the sea extensively for one’s own purpose’. They recognised that ‘... England’s weakness, her absolute dependence on supplies from overseas was to be fully exploited’.26 As part of Hitler’s Z Plan, which dealt with the force development and doctrine of the Kriegsmarine (Navy), ‘German operations would involve attack on shipping by various means ... mines would be laid by destroyers, U-boats and aircraft ...’.27 No opportunity was to be neglected for attacking British sea communications and detailed plans were made prior to the war for penetrative sea-going guerilla warfare, involving the use of raiders to destroy supplies bound for Britain, generally harass sea communications and draw a large proportion of the British fleet away from the critical North Atlantic theatre. This investment proved profitable as almost 1,000,000 tons of shipping (the equivalent of one year’s wartime production by British shipyards) was sunk or sent back to Germany as prizes by a few raiders.28

The German Naval Staff chose the Indian Ocean, Australasian and South Atlantic waters for Raider operations for several reasons. Firstly, Britain was drawing large quantities of material from Commonwealth countries and colonies such as India, Australia, New Zealand and South Africa. The huge sea areas surrounding these lands were poorly patrolled. Long coastlines were open and very suitable for infiltration for the purposes of interdicting coastal shipping and international shipping before such traffic got too far out to sea and thus more difficult to locate. The high volume of maritime traffic in easily mineable areas was taken into account and raider captains were given mining objectives prior to their cruise. Pinguin’s 360 mines were to be laid off the east Australian coast and the west coast of India between Karachi and Dondra Head. Kormoran’s operational area was the Indian Ocean. This raider had several hundred magnetic and moored mines on board which were destined to be laid off Fremantle, Adelaide, Hobart,

26 ibid., p. 5.
28 ibid., p. 141.
Sydney, Brisbane, Wellington and Auckland. After resupply of mines she was also to lay mines off three Indian and four African ports. *Orion* and *Adjutant*, as noted, were to concentrate on New Zealand port approaches.29

Germany had scant resources to invest in Indian/Pacific ocean and South Atlantic raiding operations, and employment of high-level force multipliers such as deception, surprise and mines had to be highly effective and indeed was. The mine multiplied each raider's threat and was ideally suited for deployment against the poorly patrolled, geographically exposed and ill-prepared nations in the region.

That the Germans had correctly and consistently assessed the operational effectiveness of the mine and made determined efforts to quickly take it into service is evidenced by the records of both world wars. Though they made a number of serious strategic mistakes in the use of the mine during World War Two, their operational doctrines were extremely effective and use of the mine was very skilful. Most importantly for Australia, the German operations demonstrated the extreme vulnerability of shipping to even the simplest mines deployed in small quantities by very cheap, unspecialised, hostile deployment platforms. The German operations in Australian and New Zealand waters were extremely limited, unsustained and basically tactical in nature, but they wrought a disproportionate amount of havoc.

The most revealing testimony to Australia's vulnerability to offensive minelays rests in the assessments of the specially selected German naval officers who were given raider commands in World War Two. These men made war 'a matter of unremitting study of the enemies' habits and reactions'.30 They were trained to identify decisive vulnerabilities and the most efficient methods of attack. Vice-Admiral Ruge, in his book *Seawarfare 1939-1945: A German Viewpoint*, described Kruder as 'The most enterprising and successful of all the Raider captains'.31 Kruder, like all German officers during the 1930s, was taught that '... decisive action remains the first prerequisite of success in war. Everybody, from the highest commander to the youngest soldier, must be conscious of the fact that inactivity and lost opportunity weigh

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29 Woodward, *The Secret Raiders*, outlines the missions of each raider at the beginning of relevant chapters.
31 ibid., p. 138.
heavier than errors in the choice of means'.32 Kruder concluded that Australia’s vulnerability to mine attack was so clear that it would be a worthwhile and decisive act to make the ‘long reach to South and South East Australia for the sole purpose of laying mines off Sydney, Adelaide and the Southern part of Tasmania’.33 This conclusion, followed up by the act and extremely successful results, is potent and disturbing testimony to the continued vulnerability of Australia to the mine menace.

The Disproportionate Response to Minelaying

The British Case

The mine is notorious for the extremely disproportionate response it draws in terms of countermeasures, which are extraordinarily expensive and must be continually sustained against the automated persistence and natural invisibility of the mine. During World War Two, for example, the British devoted extraordinary energies to the MCM effort. The number of commissioned British minesweeping vessels in September 1939 was 76. After one year, in response to the German minelaying campaign, the number of vessels had increased to 655. By September 1944, the total number of British sweepers in commission had risen to a phenomenal 1496, requiring over fifty thousand officers and crewmen directly involved in sweeping operations alone. A total of 745 trawlers, drifters and whalers were taken up from the civil sector and converted to a minesweeping role.34 The cost of operations and loss of the use of these vessels to the British fishing industry was so huge that Churchill commented:

It is well to ponder this side of Naval war. In the event a significant proportion of our whole war effort had to be devoted to combating the mine. A vast output of materials and money was diverted from other tasks,

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34 See Elliot, Allied Minesweeping in World War 2, Appendix 2 (Increase in Minesweepers in Commission in Six Years of War) p. 185 and Appendix 6 (Minesweepers in Service 1939-45) pp. 188-189. H. Hardy, The Minesweepers’ Victory (Keydex Publishers, Weybridge, 1979), p. 333, states that 52,850 ratings and 4,205 officers were still involved in minesweeping activities in June 1945.
and many thousands of men risked their lives night and
day in the minesweepers alone.35

By the end of the war one quarter of these sweepers (377) had been lost
to mines and various other forms of enemy action.

The Australian Case, World War Two

As a result of the German minelaying offensive in Australian waters
during World War Two, Australians were called upon to make a
disproportionate response of a very high level.

The AMS (Australian minesweeper) was still on the drawing
boards prior to the outbreak of hostilities, and by December 1939 four of
these vessels were laid down with a modest number of follow-on vessels
planned. The AMS, with a displacement of 650 tons and length of 186
feet, was later known as the Bathurst Class Fleet minesweeper or
Corvette. However, the Naval Board was faced with a minesweeping
gap which would exist until sufficient AMS were operational, so in
erly September 1939 the Board set about acquiring the core of an
auxiliary minesweeping flotilla, to provide some initial defence to the
east coast ports of Brisbane and Sydney. On 3 September 1939 the
merchant ship Doomba was taken up from trade for conversion to a
minesweeping role for the protection of Brisbane. At the same time the
merchant ships Goolgwai and Tongkol were taken up for conversion and
given the task of protecting Sydney. By the end of the month a further
five ships (the Orara, Beryl II, Goorangai, Olive Cam and Korowa) were
undergoing conversion. The sloops Swan and Yarra were next to be
converted to a minesweeping role. In mid-November 1939 the
formation of Australia’s first minesweeping flotilla (the 20th) occurred,
with a core force consisting of Swan, Yarra, Orara and Doomba. The
Bathurst Class ships Burnie and Goulburn and the modified Grimsby
Class sloop Warrego (flotilla leader) joined the flotilla in 1940.36

By mid-1940, at the time of the mining of Niagara off Auckland,
swept channels were being maintained in the approaches to Sydney
harbour by twelve minesweepers in five groups.37 These sweepers had
also to support any minesweeping requirements of other east coast

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35 Cited in Hardy, The Minesweepers’ Victory, p. 31.
36 G. Hermon-Gill, Royal Australian Navy 1939-42 (Australian War Memorial, Canberra,
37 Elliot, Allied Minesweeping in World War 2, p. 36.
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ports, which were only very lightly defended against mines by the odd converted sloop or merchantman. Sydney was at that time the only Australian port with an effective means of protection from mine attack, and even then only from conventional moored mines.

After the sinking of Cambridge off Wilson's Promontory on 7 November, the 20th Flotilla was alerted and arrived in the area on 9 November, only to receive the news that City of Rayville had sunk some 150 miles to the west. After two days' intensive sweeping by the whole flotilla only five mines had been recovered from the two then-known fields.38

Bass Strait was at this stage closed to all shipping and all traffic to and from Port Phillip Bay was suspended. It was a full week before vessels were allowed to leave port. A few hours after the sinking of City of Rayville the Prime Minister, Mr. Menzies, stated that:

... for 12 months many Australians have regarded the war as somewhat remote. These disasters on our shores have brought the war very near.39

The Melbourne Herald noted that:

Shortly after the sinking the Government was widely criticized for doing nothing to reduce the apparent ease of enemy minelaying operations and providing '... totally inadequate protection of coastal shipping against enemy attack'.40

The situation did not get easier for the government in early December, when the Minister for the Navy (Mr Hughes) stated that all vessels plying the coast were to be provided with paravanes — bow floats used to divert mines from ships — for mine protection because '... it appeared that the coast of Australia was widely mined'.41 The port of Newcastle was closed for almost a week and partial restrictions were placed on Sydney shipping traffic. St Vincents Gulf, Spencer Gulf, the Backstairs Passage and sections of Bass Strait were closed to traffic. It was at this point that Menzies considered holding a secret session of

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39 Cited in the Melbourne Herald, 11 November 1940, p. 3.
40 Melbourne Herald, 11 November 1940, p. 3.
41 Cited in the Melbourne Herald, 7 December 1940, p. 3.
Parliament to discuss the mining of Australian ships and Australian coasts.42

By the end of December, after sustained operations, only 20 mines had been swept of a (then unknown) total of some 200 mines, which constituted the two Bass Strait fields and the other German-deployed offensive minefields ‘discovered’ by Nimbin on 5 December and Hertford in the Spencer Gulf two days later.43 The Banks Strait field was not discovered by any passing ship and its existence was only uncovered by searching German records after the war.

Bass Strait proved to be a particularly bad place to sweep for mines, extremely rough conditions making accurate navigation, and the marking of swept channels, very difficult. Also, due to strong currents, the mooring anchors of the mines often ‘crept’ along the seabed causing dislocation of most of the field after a few weeks. An added complication was that in such strong currents mines tend to break from their moorings after a few months or even weeks. It was believed that by February 1941, barely four months after deployment, the majority of German mines had become ‘floaters’. Such mines were observed in the Bass Strait area in mid-November, only a few weeks after deployment.44

The Australian sweepers ‘were under great strain hurrying from one trouble spot to another over great distances’.45 They had no indication of exactly how many fields had been laid and by March 1941 five mining incidents, involving four sinkings, had taken place in five different locations along a 1,300 nautical mile front. The German plan of widespread seeding over a long stretch of coast seemed to have paid off well. The Australian sweepers were engaged in continual sweeping operations between Newcastle and the Spencer Gulf for 14 months after the voyage of the Pinguin and the 20th Minesweeping Flotilla did not conclude regular operations against the German fields until the end of 1941. Years after the initial lay the areas of the old minefields were still being occasionally swept for mines which had crept, and it was the auxiliary sweeper Orara which cut the last mine in the vicinity of the

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42 *Melbourne Herald*, 9 December 1940, p. 3.
44 ibid.
45 Elliot, *Allied Minesweeping in World War 2*, p. 36.
Cape Otway field on 22 July 1942. Of course, it was not known at the
time that this was the last mine to be cut and operations continued.46

Largely as a result of the damage done by the offensive
minclays of *Pinguin*, *Passat* and *Orion* the Commonwealth manufactured
far more Corvettes than it had originally intended for its own use.
Australia produced four flotillas (36) of Bathurst Class sweepers for
her own use and 24 units for use by her British and Indian allies.47 A
further 26 civilian vessels were requisitioned from merchant use for
conversion to the minesweeping role. Twelve sweepers formed the core
of the Australian mine defence in Sydney in June 1940. The
disproportionate response to enemy mining was such that this number
was ‘rapidly increased to 70 ships operating from six ports around
Australia’.48 For a thinly populated country the size of Australia this
represented a significant concentration of effort and resources, which is
all the more surprising if it is realised that the cost of the 230 German
moored mines used in the minelay was less than one half the cost of a
single Bathurst Class sweeper. The disproportionate response made by
the Australian government in terms of capital, crew and administrative
costs throughout the war was thus clearly in the order of hundreds of
times the cost of the minelaying operation, even if the costs of the
cargoes of sunken vessels and the mined vessels themselves are
neglected.

The Situation Today

If anything, the mine countermeasures equation, in terms of
disproportionate response, has further benefited the mine during the
post-war years. The costs of effective mine countermeasures vessels has
risen astronomically over the years and will no doubt continue to do so.
In mid-1984 mines were laid in the Red Sea approaches to the Suez canal
and a very costly international effort was instituted to counter the
threat.49 Eighteen mine countermeasure vessels and eight large

46 Department of Navy Letter 175/201/44 dated 25 July 1966, ‘German Minelaying in
47 Elliot, *Allied Minesweeping in World War 2*, p. 37. The 20 sweepers produced for the
RN never saw RN service. They were commissioned into the RAN.
48 ibid., p. 36.
mine countermeasures during the incident.
helicopters with support craft from six different nations were on station for many weeks to sweep and minehunt in the area. The US alone deployed three MCM vessels, eight helicopters and over 1,500 personnel. Numerous mine-like objects were detected and had to be investigated while only one recently laid mine was recovered. The Italian MCM contingent logged over 480 mine-like objects, all of which turned out to be innocent. The Dutch MCM vessel crews were staggered at the 'tremendous amount of junk' that was scattered on the seabed. Debris included refrigerators, parts of old shipwrecks, oil drums, aircraft parts, wire, toilets and numerous other human artifacts. An average of over 20 mine-like contacts per day needed classification, which involved time-consuming identification procedures by divers and Remotely Operated Vehicles (ROVs). It was said that the British minehunters had to classify, on average, 15 mine-like objects per four square miles of seabed. The total cost of the clearing operation is unknown, but in view of the difficulties involved, the time taken and the strength of the countermeasure force, the cost of the countermeasures operation would clearly be many times that of the actual mining operation.

Mine countermeasures, even under ideal conditions against a well specified field, are difficult. During the Vietnam War, the mining of three major North Vietnamese harbours and many miles of coastline took place in enemy waters defended by sophisticated anti-air defences, resulting in the loss of a three million dollar aircraft. Consequently, mine cost (6.5 million) and aircraft loss amounted to 9.5 million dollars as the total cost of this very effective operation. A comparison can be made with the mine countermeasures cost which, neglecting the normal running cost over six months of the 16-ship MCM task force, cost 20 million dollars. At first glance this may not seem to be a vastly disproportionate response. However, certain conditions made the MCM task quite unique and relatively easy. First, practically all the mines had been preset to self-destruct or sterilise after a period ranging from three to six months. Also, the Americans were countering their own mines in known minefield locations in temporarily non-hostile waters. They

50 ibid., p. 104.
51 ibid., p. 106.
were effectively engaged in exploratory sweeping which involved little risk. The North Vietnamese provided the Americans with substantial help, as the Northerners had made quite accurate maps of many US minefields. Rear Admiral Brian McCauley, USN, who was Commander Task Force 78 (CTF 78) during the sweeping of North Vietnamese coasts and ports (Operation Endsweep) said:

... End Sweep was a unique solution to a unique problem and did not present a challenge of nearly the magnitude that can be expected in the future. The location, type and settings of all mines was known ... Additionally Operation End Sweep was the highest priority in the Pacific Fleet. It commenced with the ceasefire and, as a result, people, ships and aircraft, which in a wartime scenario would have been otherwise occupied, were made available. The objective of the sweeping was largely accomplished prior to laying mines when the self-destruct time was set into the fuse ... Even with the 'co-operation' of the DRV (Democratic Republic of Vietnam) and knowledge of types, location, settings and expiration dates of mines we were compelled to devote a large force and exercise great caution to ensure that the seas and ports were clear. Without this information the task would have been infinitely more difficult.54

The disproportionate response drawn by the mine is clearly evident if, even under absolutely ideal MCM conditions and highest priority status, a major US Task Force took six months to clear its own mines from fairly accurately known locations.

Given the much higher levels of effectiveness of modern mines, as opposed to the relatively simple types used in World War Two and Vietnam, the MCM problem becomes increasingly difficult and expensive to solve. Many new mines are all but impossible to sweep, which has led to the development and proliferation of minehunters as solutions to the 'smart' mine. The value and higher damage sensitivity of target vessels has also greatly increased in relation to the cost of modern mines (see Chapter 8). All in all the disproportionate response drawn by the mine remains extremely large and, given the trends in

54  McCauley, 'Operation Endsweep', p. 25.
mine design discussed in the previous chapter, this state of affairs seems bound to continue.

Present Vulnerabilities

Economic Vulnerability

The standard of living of Australians is largely dependent on a national ability to export and import large quantities of materials. Over two-thirds of Australian imports are from the US, Japan and the EEC, with 60% of these goods being critical requirements of Australia’s industrial base. These items include machinery, petroleum products, transport equipment and chemicals not manufactured in Australia. In fact, Australia is particularly affected by a ‘great dependency on increasingly more complex, manufactured equipment from overseas’. Continued access to world markets is a vital national interest, given that ‘the Australian economy is closely integrated with the rest of the world — an integration which has been fostered and intensified in recent years by the emphasis in Australian policies on letting the world market forces direct the economy’. Authoritative commentators have even gone so far as to suggest that ‘there is now no autonomous national economy in any comprehensive sense, but an economy composed predominantly of aspects of world economy located in Australia’.

Trade provides scope for specialisation, economies of scale and enough competition to force firms to cut costs, improve quality and seek new ways of producing and selling their goods. In 1986-87, exports by sea amounted to 240.8 million gross tonnes, worth $31.1 billion free on board (fob). This amounts to 99.9% of all exports by volume, and 85.9% by value. The remainder is carried by air. Major exports by sea include coal, wool, wheat, iron ore, beef, alumina and aluminium.

Imports by sea totalled 23.5 million gross tonnes valued at $28.4 billion in 1986-87. By volume, 99.6% of imports were by sea and by value, 77.9%. Major imports by sea, as discussed, are machinery, motor vehicles, textiles and petroleum products.

56 ibid.
57 ibid.
58 ibid.
While almost all coastal trade is carried by Australian shipping, 96% of our overseas trade is carried by foreign flag ships. In a low-level conflict an adversary may wish to avoid the international condemnation that could result from attacking foreign vessels. However, a sustained mining campaign would inevitably impact on foreign shipping. Because of the greater quantity of commodities traded and the lack of alternative transport modes (other than air), disruption of international shipping would be potentially more damaging than disruption of coastal shipping.

Australia’s economy is critically dependent on access to world markets, and international trade is increasing vulnerable to disruption. If such trade is threatened, stopped or constricted, Australians will suffer not only in the short term but also in the long term, since competitiveness and participation in world trade could be substantially damaged. The detrimental effects on economic growth, which can only be sustained by competitive participation in world trade, would have serious repercussions on all levels of Australian society.

Thirty-eight Australian ports are normally involved in the import and export of goods, with about one dozen of these figuring prominently as relatively high-volume commercial ports. These harbours are scattered over Australia’s 12,500-mile coastline, with harbour approach seaboats being ‘very suitable for the conduct of mining operations’. Approaches are often quite narrow and shallow. The west coast has huge areas of muddy bottom into which ground mines can sink, making the minehunting task much more complicated while the mines themselves remain fully operational. As discussed earlier, shallow waters between Newcastle, Sydney and Melbourne are suitable for mining and have been successful hunting grounds in the past for interception of the large amounts of shipping skirting the coast and passing focal areas near major ports. Also, the northern coastal regions have large stretches of relatively shallow, mineable seas through which much shipping passes.

Taking as an example Port Hedland, we first note its importance to Newcastle and Wollongong smelters as the major supplier of iron ore — an economically and strategically very valuable resource. Access to

60 M. O’Connor, ‘Mining: Money or Your Life?’, *Strategem*, December 1981, p. 11.
Port Hedland is gained through the Hedland tidal races via a shallow, narrow channel some 10 miles long. The sinking of an ore-carrying ship could completely block this port for many months. Such an incident would practically halve Australian steel-making capacity at one stroke, using the simplest of mines requiring only command (remote) detonation from shore.62 A similar wound could be inflicted upon the aluminium industry with equal ease. Bauxite is conveyed from Weipa to Gladstone around Cape York by four 100,000-tonne ore carriers. These vessels are particularly vulnerable through the shallow channel into Gladstone, and the loss of any of these vessels would seriously hamstring national aluminium and alumina production.63

Hundreds of vessels plying the several thousands of miles of Australian coastal shipping routes every year, and international shipping at areas around major ports, are quite clearly vulnerable to interdiction by relatively small numbers of mines. The small number of mines used in the Cape Otway and Wilsons Promontory fields during World War Two are cases in point (see Figure 3:1).

Coastal shipping is an important component of the Australian economy. In 1986-87 some 45 million tonnes of cargo was carried with an estimated value of $15 billion cost insurance freight (cif). In terms of tonne-kilometres, coastal shipping performs 37 per cent of the domestic transport task, larger than any other transport mode.

The relatively low cost per unit transported of coastal shipping makes it the dominant mode for the long-distance transport of bulk materials. Forty-two million tonnes of our coastal trade is bulk cargo, carried over an average distance of 2200 kilometres. On average rail is 3.5 times and road 8.2 times more expensive per unit transported.

For non-bulk cargo, where the convenience of faster service and door-to-door delivery is more highly valued, coastal shipping plays a smaller role. Nevertheless, the value of non-bulk coastal freight amounts to $7.8 billion (cif) compared to $9.8 billion (1990) for bulk coastal freight.

62 See J. Stackhouse, 'New Realities of National Planning', Bulletin, 25 October 1983. A high-ranking BHP shipping executive (Mr J. Prescott) was quoted as saying '... the distance from Port Hedland to Port Kembla NSW, was about 4,800 km around a largely exposed coast. Five 140,000 tonne bulk carriers ply the Hedland-Kembla trade. If two or three of these were sunk or bottled up, Australia's steel making potential would be halved'. The sinking of one ore carrier in the Hedland tidal races while another vessel was berthed would satisfy the conditions described.
63 ibid.
The bulk coastal trade consists mostly of crude oil, petroleum products, iron and steel, alumina, iron ore, zinc ore, bauxite, raw sugar, cement, coal, manganese ore, gypsum, dolomite and limestone. While the greatest concentration of this trade is found in south-eastern waters, much passes through the north, where it could be exposed to hostile interference in any conflict. The most significant of these latter trades are the shipments of iron ore from the Pilbara to Port Kembla and Newcastle; crude oil from Barrow Island to Fremantle, Port Stanvac and Sydney; and bauxite from Weipa to Gladstone.

The coastal shipping trade in non-bulk cargo is largely driven by the absence of road and rail links servicing the relevant areas. The trade between Tasmania and the mainland is of particular significance. The non-bulk trade between other centres is relatively small. In northern Australia, where small and isolated settlements are the norm and alternative transport modes are often non-existent, coastal shipping gains greater importance.

Many of the straits and seas through which Australian trade transits, especially to and from our major trading partner Japan, are quite suitable for minelaying operations prosecuted by parties aiming to harass the Australian government or inflict damage using a strategy of economic coercion. The problem is further complicated by the fact that more than one half of Australia's trade is carried in ships' bottoms not under either the Australian flag or the Japanese flag. The economic interests of these other nations would not be vitally affected if they were to suspend trade with Australia because of a mine threat. Minelays in the Red Sea, other Middle Eastern waters and Central America have destroyed the widely held belief that neutral shipping will not be subject to mine or missile attack, and those vessels and crews prepared to risk dealing with an Australia under serious mine threat would expect to be paid for the added risk. If a sustained mining campaign were launched against Australia, very few neutral ships would take the risk unless some sort of demonstrable countermeasures protection were forthcoming.

Australians are not only vulnerable to the mine threat because of their coastline's sheer geographic exposure or the highly dependent nature of their economy. Lack of MCM capability, relative to the area to be defended, is another consideration. Rear Admiral McCauley noted, while flying over Haiphong at the beginning of Endsweep clearance operations, that:
It was an impressive sight on flying over Haiphong in the early days of End Sweep to see all 26 ships at anchor behind the minefield. None had moved since May when the first mines were dropped ... The effectiveness of the campaign demonstrates once again the vulnerability of a country which has little or no mine sweeping capability to mining. The North Vietnamese ocean shipping was paralysed until we arrived with the technical knowledge to clear their main channels.64

With only one barely operational MCM vessel in the Australian fleet between 1983 and 1990, Australian defence against the mine threat was at a post-war low. The almost forty-year-old Ton class minehunter-sweeper HMAS Curlew had been kept in service until April 1990 to fill the countermeasures gap until the Australian Minehunter Catamaran Inshore (MHI) completed its trials, evaluation and acceptance programme. The MHI is not yet operational and is only produced in small numbers. It may provide a limited capability to counter the most dangerous mine threat, which is that posed by the large bottom mine deployed in shallow water. As its name implies, the MHI operates in sheltered inshore waters and can only operate effectively in very mild sea-states. It may evolve into a capable vessel for doing its designated job but, at best, can only counter threats in a limited band of the mine threat spectrum. Vessels are required which can operate in deeper water under harsher sea-state conditions and a mine-sweeping capability is also necessary (see Chapter 4).

It is clear that, until the mid-1990s at least, Australians will remain uncomfortably vulnerable to the mine menace because of the basic lack of MCM platforms in relation to the geographic susceptibility of coastal shipping lanes, port approaches and various other focal points.

Military Vulnerability

Australian vulnerability to mines can be illustrated from precedent. Mining operations perpetrated by very small elements of hostile forces using the simplest of mines in strictly limited quantities have, as we have seen, met with inordinate success. It would be a serious and irresponsible oversight for the military planners of any hostile nation,

64 McCauley, 'Operation Endsweep', p. 25.
desirous of bringing an Australian government to heel, not to consider the use of the mine in attaining political objectives. As noted, Australia is especially vulnerable to a strategy of harassment employed by those who may wish to inflict economic damage, challenge sovereignty or generally restrict the freedom of the Australian government to implement an independent policy.

The ability to use its armed forces to maintain sovereignty, support friends, patrol areas of interest and generally signal firm government resolve is an essential ingredient of national power. Not being able to expeditiously deploy a force capable of visibly upholding Australian sovereignty and resolve would be a serious blow to national prestige, credibility and confidence. A covert offensive minelaying effort against the major Australian port and Fleet Base at Sydney, for instance, could seriously affect the capacity of the Australian fleet to regain the initiative and deploy to a trouble-spot where its timely presence could be decisive. At any given time, in a situation involving an element of surprise, perhaps half of the Australian Fleet’s major units, including surface combatants and submarines, could be in harbour undergoing refit, repairs or routine maintenance periods. During the Christmas/New Year period an even higher proportion could be in harbour. If Sydney were bottled up for only a few days, the ability of the fleet to promptly and effectively respond to hostile actions would be seriously compromised.

The seabed in and around Sydney Heads is quite suitable for the deployment of a large variety of mines, which can be deployed by covert submarine and surface means. Most conventional submarines are capable of deploying 30 to 40 bottom mines. Mines can also be covertly laid by almost any surface vessel coming in and out of port. Many mines can be constructed to look like 44 gallon drums and simply thrown overboard at night on entry to a harbour or in harbour approaches by ships legitimately entering port. These mines become part of the enormous amount of debris in harbour approaches and become practically undetectable. A one-week arming delay could ensure that the layer had time to berth, do his business and sail out of

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65 J. Spanier, *World Politics in an Age of Revolution* (Pall Mall Press, London, 1967), p. 4, defines power as ‘the ability to influence others in accordance with one’s ends’ or as ‘the ability to make one’s will prevail’. National power may be defined as the ability of a nation to influence the behaviour of other nations.
port in time to escape danger. Bottom mines have even been laid by civilian speedboats in port approaches in recent years.66

As previously discussed, warships contain numerous sophisticated electrical and electronic systems that are highly susceptible to vibration and shock damage from underwater explosions. An explosion causing only minimal injury to personnel and negligible structural damage to a vessel could quite easily degrade sophisticated command and control electronics systems to the point where the vessel was not operational and required expensive and time-consuming repairs. Modern mines can be set to be very selective of targets and hostile intent could simply be to deter Australian warships from leaving port so that limited operations could be carried out elsewhere on the mainland, in the EEZ or in other areas of Australian interest. If this objective were achieved, the security of hostile operations would be enhanced by the lack of forward deployment of Australian units and the Australian government would be embarrassed in not being able to respond to a situation with all appropriate resources.

Regional Offensive Minelaying Capabilities

Mines have the image of being a 'poor man's weapon', and they have been consistently and successfully used by weaker maritime powers against much stronger ones. The Russian use of mines in defensive fields against the might of the Royal Navy during the 1850s has been described earlier. Similarly, in the 1860s the Confederates also used the mine against the much superior Federal navy in defence of their extensive coastlines and river systems. During the twentieth century nations suffering naval inferiority used offensive minefields as a very effective form of sea denial, and the number of seamines deployed this century has risen to about 1.5 million (see Chapter 5).

The lesson of not needing a multi-billion dollar navy to effectively deploy mines was relearned during the Korean War, almost a century after the American Civil War, when simple mines laid from sampans and junks stopped the proposed massive UN amphibious landing at Wonsan harbour (see Chapter 5). A disturbed and irate US Task Force commander summed the situation up at the time by saying '... We have lost control of the seas to a nation without a navy, using

66 Civilian speedboats and small launches were used to deploy mines during the mining of Nicaraguan ports in 1984.
pre-World War One weapons, laid by vessels that were utilised at the time of the birth of Christ'.

It has already been emphasised that single hostile platforms are capable of exerting a persistent threat, drawing expensive responses and inflicting damage out of all proportion to their minelaying efforts. Even if we consider only dedicated military platforms, the submarine stands out as an ideal candidate for surreptitious and safe laying of offensive mines. Three nations in Australia’s region of interest (India, Indonesia and Vietnam) host submarines capable of deploying minefields. The mines themselves, if they are not on inventory in these countries, are readily available from the Soviet Union and Western arms dealers in Europe.

Both India and Indonesia are equipped with highly capable German-built U209 diesel-electric submarines, each equipped with eight 21-inch (533mm) torpedo tubes which can be used for mine deployment. Each torpedo tube is capable of carrying two large (1000-kilogram) mines or one Submarine-Launched Mobile Mine (SLMM). The capacity of a single U209 would therefore be to lay 32 to 36 of these mines. However, this capacity can be doubled using mine-carrying cradles that may be temporarily attached to the outside of the submarine. These cradles do not significantly reduce performance. Indonesia has two U209 vessels in service and may have a squadron of four submarines in service by the late 1990s. In 1990 India had two U209s in addition to fifteen Soviet-made submarines in service. Four more Foxtrots may be on order, and each of these vessels has a capacity for 44 large, 1000-kilogram mines. The Indians have proved to be keen minelayers in the past, and during their 1971 war with Pakistan they used mines widely to constrict seaborne resupply of East Pakistan from West Pakistan. Mines deployed in the Pursur River sank three ships and a Pakistani...

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68 Mines are fairly easily acquired from terrorist-supporting governments whose armed forces are supplied with Soviet weapons. Mines can also be fairly easily acquired from France and Italy.

69 The Military Balance 1989-1990. India’s submarine fleet comprises one SSGN (Charlie l), eight Foxtrot SS, six Kilo SS and the two modified 209s.

The submarine was also sunk, possibly by its own mines. The Indian mines succeeded in their main objective of blockading the port of Chalna.  

The damage that could be inflicted on Australia by a single submarine load of mines (30 to 40) should not be underestimated. In World War Two a German U-boat laid 30 mines off the Delaware River and Chesapeake Bay. This field succeeded in destroying three merchant ships, seriously damaging a destroyer and completely disrupting normal shipping. Over a three-year period a few individual U-boats deployed only eleven loads of mines (338 units) along the east coast of the United States and wrought an enormous amount of damage. Seven large ships were sunk and five were damaged, causing considerable disruption to ocean traffic. At different times major ports such as New York, Norfolk, Charleston, Jacksonville, Savannah and Wilmington were closed for various periods, altogether totalling five weeks. Charleston was closed for over two weeks, Norfolk for 3 days and, at the cost of only 10 mines, New York itself was closed for two days (see Chapter 9 for a description of the considerable economic effects of even limited port closures). No German submarines were sunk. It is also worth noting that the German submarine of World War Two was relatively primitive in comparison with today’s diesel-electric submarines. The indirect results of these sporadic, unsustained submarine minelays against a huge coastline were enormous. Over 100 newly built US minesweepers, urgently needed in the Pacific, were committed to east coast mine defence for years. The US also planted extensive defensive minefields along parts of the east coast. However this led to the sinking of 12 US ships in their own defensive fields, the first being a US destroyer.  

A modern diesel-electric submarine such as a U209 has much more endurance, efficiency, accuracy of navigation and resistance to detection than the World War Two U-boat. Even more significantly, modern mines are much more dangerous than their wartime forefathers. A single submarine minelaying sortie against Australian ports could block them for considerable periods of time after the discovery of a field by a vessel. Forty submarine-deployed bottom or moored influence mines deployed just off Sydney Heads could cause much consternation.

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72 Hartmann, *Weapons That Wait*, from Table 1, p. 70.
73 ibid., p. 69.
and damage. Ten mines accurately deployed at the entrance to four ports on the eastern seaboard could do even more damage if activation delays were such that they became operational at all ports at the same time. Two submarines, operating one on each side of the continent, would certainly cause a major upset, and if eight ports were affected the sparse MCM resources at the nation’s disposal would be hard-pressed, to say the very least.

Besides the potential threat capabilities of some nations in the Indian/Pacific ocean region, Australia must also consider the Soviet power projection capacity remaining in the region. The Soviet Pacific Fleet (SOVPACFLT) maintains approximately one hundred and twenty submarines, with about one-third this number being conventionally propelled. About half of the SOVPACFLT submarine fleet have hulls which are classified as ‘old’ by the International Institute of Strategic Studies, and it is likely that many of these platforms would be dedicated to covert minelaying tasks in time of conflict.74

Soviet Offensive Mining Capability

Soviet doctrine firmly indicates that ‘... the experience of warfare showed that the mass deployment of mines can do serious damage to [merchant] shipping and make the mission of interdicting shipping easier’.75 Mines also make it ‘... easier to blockade operations for one side while increasing the strain on the forces on the other side’.76 The Soviet High Command recognises that ‘mine ordnance has been widely used to limit the operational area of [the opponent’s] naval forces’ and that they ‘retain a prominent place among contemporary means of naval warfare’.77 Consequently, Soviet mines are to be employed in the following missions during wartime:

1. To blockade enemy merchant shipping in ports and naval forces at their home bases and anchorages.

74 See P. Dibb, 'The Soviet Union as a Pacific Superpower', Pacific Defence Reporter, November 1984, p. 23. Most of these submarines are of the Zulu, Whiskey and Foxtrot classes. Each has a substantial minelaying capability and a limited front line combat capability. Involvement in relatively safe minelaying tasks would seem a logical choice for many of these units.


76 ibid., p. 1415.

77 ibid., p. 1416. (Translated from Morskoy Sbornik, 2 February 1981, p. 64.)
To hinder the deployment of enemy ships and submarines for combat action.

To inflict losses upon enemy forces at sea.

To disorganise and paralyse ship traffic along enemy SLOCs and inland waterways.

To protect own amphibious forces during their sea transit.

To serve as an integral part of the anti-amphibious defence system.

To protect the Army’s maritime flank.\textsuperscript{78}

The offensive use of mines is still given a high priority by the Soviets and such missions are clearly reminiscent of those practised by the Germans in World War Two (see Chapter 3). Submarines or aircraft are viewed as the best means of mine deployment. Surface vessels, most of which are equipped with minelaying rails, are usually involved in the laying of Soviet defensive fields. However, unlike in Western navies, most Soviet surface combatant crews are well practised in the tactical use of surface-laid mines and, as the opportunity presents itself, will be prepared to use them.

Table 3:1 contains information relating to the Soviet Fleet’s capacity to deploy submarine and surface-laid mines. This represents a formidable capability, particularly when considering the small MCM forces maintained by the nations of the Pacific.

With the advent of perestroika, the Soviets have made it clear that they have a growing interest in the Asia-Pacific region. In 1986 Mikhail Gorbachev, General Secretary of the Communist Party of the USSR, took what is known in the West as the Vladivostok Initiative. During a visit to Vladivostok in that year he made a comprehensive statement of Soviet interests in the region, based on the premise that the Soviet Union was a legitimate Pacific power which was entitled to have an interest in the stability of the region. Not only did the Soviet Union have important sea lanes of communication passing through the region, he argued, but the region involved potentially serious military threats, especially from a US-Japan-ROK ‘militarised triangle’.\textsuperscript{79} Despite the existence of a much more ‘subdued’ Soviet Union, it would be naive to consider Soviet interests in the Asia-Pacific region as always being

\textsuperscript{78} ibid., p. 1415.

In 1990 the Soviets had 69 strategic submarines and 280 tactical submarines in their Order of Battle (ORBAT). Fifty-five submarines of the F, Z and W classes are in store and many may be assigned minelaying and covert operations missions. Newer submarines, particularly of the SSN variety such as the Sierra, Akula and Alpha, could be expected to have a maximum mine-carrying capacity of 36 to 48. Similarly, newer surface combatants, such as the Slava Class cruiser and Sovremenny Class DDG, could be expected to carry maximum mine loads in the order of 100 and 50 respectively. The new Udaloy Class destroyer could have a capacity exceeding 80 units.

convergent with regional interests, and if Soviet interests are destined to increase it would be foolish to assume that the Soviets would not defend these same interests if they were threatened by a regional state.

Many types of Soviet aircraft (including helicopters) are capable of minelaying in regional waters. Soviet air-laid mines are usually of the bottom influence type, fitted with parachutes to reduce their air speed. They cannot be deployed in depths shallower than 10 metres and can be deployed from altitudes up to 12,000 metres, though this is most unlikely due to unacceptably high navigational errors in deployment. Non-parachute versions (bomb-mines) designed for lower attitude drops, often below 1000 feet, have the advantage of superior accuracy of deployment and reduced detectability. Such mines are also in the Soviet mine inventory, which is estimated to total between 200,000 and 300,000 mines of all types. Land-based Soviet aviation has a major role in offensive minelaying, and this primary role involves blockading enemy naval bases and ports in addition to straits and narrows. The Soviets believe that only aircraft are capable of carrying out rapid, mass laying of offensive mines, '... which ensures their most effective use in combat operations'.

Certain disadvantages do however, exist with aerial minelaying, and the Soviets appear to favour the submarine in several specialised types of mining activity. The submarine is much more covert than the aircraft and can discreetly reconnoitre areas prior to operations so as to lay a field with great accuracy. Thus, a submarine-laid field can sometimes achieve the same result as an aircraft-laid field with far fewer mines and less likelihood of detection and interception. For particularly delicate operations, involving the avoidance by the submarine of shallow water and its inherent dangers, the Soviets are reported to have a SLMM which can travel several miles and is effective in depths of 40 to 70 metres with a radius of action in the range of 30 to 50 metres. Evidence also points to the Soviets giving high priority to increasing the effectiveness of submarine-laid mines, including perfecting their noiseless and bubblefree deployment from torpedo tubes.

83 ibid., p. 1419.
A further advantage of submarine minelays, as far as the Soviets are concerned, is that the numerous Soviet-made mines possessed by many countries around the world give the Soviets an enhanced anonymity during minelaying operations. Even if a Soviet mine is retrieved, it is extraordinarily difficult to positively identify the user, as terrorists have access to modern Soviet mines. A case in point involves the discovery of a large Soviet combination bottom mine laid by terrorists in the Red Sea during July 1984. The mine was of recent manufacture (1981) and, though an export or 'Monkey model', it was of good quality.84

The Soviets were not directly involved in the Red Sea mining operation and indications are that they were quite displeased with the use of their weapons in that particular effort.85 However, the fact remains that the anonymity offered by the mine is perceived as being an attractive attribute, offering considerable flexibility for use in harassment operations.

Though the USSR has no apparent or even likely motive for the use of mines against Australia, it would be unwise to ignore the minelaying ability of the SOVPACFLT and the numerous mines available to it. Firstly, as a previous Admiral of the Soviet Fleet (Gorshkov) stated: ‘... The economies of the Western capitalist countries largely depend on sea transport’, and it is held by many in the West that the interdiction of Western sea lines of communication could be a major element of possible Soviet action against the West not involving escalation to nuclear war.86

Given the possibility of deeper Soviet involvement in our region and Soviet sensitivity in avoiding the risk of direct US military involvement, a minelay against Australia could be an ideal means of ‘teaching us a lesson’ and bringing the Australian government into line over some issue. Such a move, perhaps on behalf of a new-found Soviet friend in the region, could certainly be seen as legitimate by the Soviets. After all, as the USSR could argue, the US used mines as a means of helping its friends in South Vietnam during the Vietnam War, and even more recently in Nicaragua. Why should the USSR not do the same,

84 See Truver, 'Mines of August', p. 109. V. Suvorov, *Inside the Soviet Army* (Hamilton, London, 1982), describes 'Monkey models' as weapons that are built at lower performance levels than those issued to the Soviet military or weapons that have certain feature sub-assemblies taken out of them prior to export.
especially as it was quite tolerant on both occasions and took no firm counteractions?87

The mine is certainly considered increasingly valuable by the USSR, and its widespread use can be expected in a number of possible scenarios. Unlike the Western world, the Soviets have demonstrated a consistent attitude to the practice of politics and waging of wars. They have not been distracted from the essentials of policy-making and defence. The Soviet characteristic of consistently applying the lessons of commonsense and experience to their defence efforts is typified by their maintenance of a huge mine stockpile, with the personnel and platforms by which to deploy the mines. The Soviets aim to use mines widely and in quantity when they consider the situation warrants it. These mines and their deployment platforms are in our region now, and even though the current regional outlook is one of continued stability, things may change. Australians should not be wholly unprepared for the possibility of Soviet minelaying operations in our region. The Soviet minelaying capability in the Pacific can not be ignored.

A New Tactic of International Terrorism

Recent events have shown that minelaying operations are as low risk and easy to perform as ever. They have also demonstrated that the countermeasures problem is more difficult than ever before.

During July/August 1984, 19 ships under 15 different flags were damaged to varying extents by mines in the Red Sea. Maritime mining had emerged as the newest tactic of international terrorism. Despite the intensive efforts of a large international minehunting/minesweeping force, only one of the mines responsible for the damage and confusion was recovered. It was located on 12 September by the British Ton Class minehunter HMS Gavinton in 50 metres of water, about 15 miles south of the entrance to the Suez Canal.88

The mine (serial number 99501 NG63), as mentioned previously, was of recent Soviet manufacture (1981) and was capable of pressure-magnetic-acoustic actuation combinations. Though capable of housing 1500 pounds (680 kilograms) of explosive it only contained up to one-third of this amount (approximately 500 pounds). Experts concluded that it was laid within the last three months (June/August 1984) and

87 See Chapter 7 for a discussion of the US mining campaign against North Vietnam in 1972 (Nixon attended a Moscow Summit less than two weeks after the operation).
Mine Warfare in Australia's First Line of Defence

was charged to scare off or slightly damage surface vessels. It was 10 feet long, 21 inches in diameter and was suitable for deployment from submarines or any surface craft. It was set for activation on 27 July but had malfunctioned.89

Iran was initially suspected to have laid the mines, in order to embarrass moderate Arab states such as Egypt and Saudi Arabia. This possibility was soon discounted. On 31 July, three weeks after the first underwater explosion, the Islamic Jihad terrorist group claimed responsibility for the mining and stated that their frogmen had laid 190 mines in the Suez Canal and its Red Sea approaches to 'punish the imperialists' for 'encouraging the expansion of the Iran-Iraq war'.90 This group was also discounted from being directly involved in the mining.

Evidence, albeit circumstantial, eventually pointed very strongly to a Libyan involvement in this indiscriminate attack against neutral shipping. The Libyan roll on-roll off cargo ferry Ghat entered the Suez Canal on 6 July 1984 while making a return trip from Tripoli to the port of Assab in Ethiopia. Ghat should have been back at the canal by 14 July, however she did not arrive until 21 July. Seven days were 'lost', and to complicate the issue further no record exists as to how long Ghat spent in Assab. No other port calls were made.91

Prior to departing from Tripoli, Ghat changed crew and took on a group of military personnel including a man of colonel rank known to be head of the Libyan minelaying division. Further coals were added to the fires of suspicion when it was reported that on their return to Tripoli (23 July) members of the crew were given military decorations for the 'ferry trip'. Reinforcing this purely circumstantial evidence, the Ghat was inspected by French authorities in Marseilles during August, and damage to Ghat's aft ramp was discovered. It was concluded by French authorities that the '... ramp appeared to have been damaged by waves, presumably because it had been lowered at sea'.92

Libya also had a motive for this attack on Suez Canal shipping. Relations between Libya and Egypt had been very strained for several years and the mining was probably viewed as a low-risk means of

89 ibid.
90 ibid., 96.
91 ibid., pp. 111-112 gives an account of the voyage of Ghat.
92 ibid., p. 112.
seriously affecting Egypt's economy, which gained a major portion of its foreign currency revenue from canal toll receipts.93

A number of lessons have been learned from the Red Sea mines. It is evident that the mining of vital sea routes in peacetime is easier than had been thought and that clandestine mining remains a low-risk method of inflicting damage which cannot easily be prevented. In addition, the perpetrators of such acts can rarely be implicated more than circumstantially, due to the very covert nature of most minelaying operations.

Authorities in the United States seemed to have little doubt of Libyan involvement in the mining, but all the State Department was able to say was that 'there is no conclusive proof ... there is persuasive circumstantial evidence indicating that Libya was involved in mining the entrances to the Red Sea'.94 Another critical lesson, with ominous implications, is that mines must be set to sink or seriously damage ships in order to deter vessels and seriously disrupt shipping. Terrorists may well take this lesson to heart and no longer be content with 20 to 30 per cent 'scare' charge loads of explosive in their mines.

During 1984 other clandestine groups, namely the Costa Rican-based DRA (Democratic Revolutionary Alliance) and the Honduran-based NDF (Nicaraguan Democratic Force) also participated in mine warfare. Using mines apparently supplied by the United States, these anti-Sandinista groups mined the Nicaraguan ports of Corinto and Sandino on the Pacific coast and El Bluff on the Atlantic coast. A dozen vessels flying the flags of several nations were damaged, with a number of injuries to crew reported. The mining campaign was stopped by a May 1984 ruling of the World Court that the US had acted improperly by assisting in the mining of the three ports and, though the US did not accept World Court jurisdiction over its activities in the area, US mining assistance ceased in late April of that year.95

Thus the precedent has been set for the future use of maritime mining in terrorist tactics. Maritime nations such as Australia are readily identifiable as vulnerable to use of mining in order to blackmail or coerce the government. As tighter controls have been implemented on airborne terrorism following the aircraft hijacks of July 1985,

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93 ibid., p. 97.
terrorists have seen the mine as an increasingly valuable and secure tool of terror, as indicated by the Iranian mine deployments of 1987-88.

**Iranian Deployments 1987-88**

Both Iran and Iraq have used moored contact mines in defensive fields in the upper reaches of the Persian Gulf since the early 1980s. Besides a modest supply of probably unreliable US Mk 55 bottom or ground mines, the Iranian stock-pile consists of mines based on blueprints of Soviet moored switch-horn contact mines, which were manufactured in Czarist Russia after the Hague Convention relative to the laying of Automatic Submarine Contact Mines (1907). These mines were used offensively in 1987, when the Iranians deployed a few small fields in the Persian Gulf using a small landing craft capable of deploying approximately 50 mines. Prior to commencement of its second laying operation, the landing craft was intercepted by US forces.

The objectives of the Iranian operations appear to have been to destroy or damage US warships and generally harass Persian Gulf shipping. Casualties of the Iranian offensive minelaying operation were as follows (these casualties are for the offensive fields alone and do not include casualties due to ‘drifters’ from the northern defensive fields):

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Damage</th>
<th>Estimated Repair Cost $US million</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Fast Frigate Guided (FFG)</td>
<td>Seriously Damaged</td>
<td>96</td>
</tr>
<tr>
<td>(USS Samuel B. Roberts)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Medium Tanker (Bridgeton)</td>
<td>Major Hull Damage</td>
<td>2-4</td>
</tr>
<tr>
<td>US Medium Tanker (Texaco Carribean)</td>
<td>Major Hull Damage</td>
<td>2-4</td>
</tr>
<tr>
<td>Oil Rig Support Vessel (OSV)</td>
<td>Destroyed</td>
<td>7.0</td>
</tr>
<tr>
<td>2 Trawlers</td>
<td>Destroyed</td>
<td>0.4</td>
</tr>
</tbody>
</table>

96 Media film reports depicted the LST Iran Arj after capture by US forces in 1989. Approximately 5 rows, each of 10 mines, were on deck.
The 'attack-ratio' was about 1:10. However, most Soviet moored mines are capable of delayed rising, and all 50 mines may not have been active at the time. Therefore an attack rate in excess of 1:10 may have existed. This is approximately the same rate as occurred with the Persian Gulf deployments in 1984, though these deployments took place in a different area, with different mines and probably different objectives. The rate of 1:10 is very high given that the best achieved in World War Two was 1:8 for very precise submarine-deployed minefields in confined waters (see Chapter 9). The presence of 'drifters' from the northern fields may also influence attack ratios in the Gulf, but it is impossible to estimate their effect.

These operations would undoubtedly be seen as major successes by the Libyans and Iranians in terms of drawing a completely disproportionate response from US forces. Major US and allied MCM forces were committed to Gulf operations and the USN was seriously embarrassed by its incapacity to guarantee the safe transit of shipping (Bridgeton struck a mine on 24 July 1987 and was then used as a 'guinea pig' hull to lead three USN warships through suspected minefields).97

The USN had failed to anticipate the threat posed by the very few mines in the Gulf and completely underestimated the Iranians. This was despite a number of other vessels detonating mines prior to the Bridgeton incident. Therefore, US official response from Secretary of Defence Weinberger was surprising when he stated after the Bridgeton incident '... we weren’t looking for mines there because we had never seen a mine in the area'.98

An apt appraisal of events in the Gulf was given by Captain J.F. Tarpey USN (Retd), who stated:

Clearly the historical record confirms that mine warfare is an integral element of naval power. It illustrates that maritime nations are vulnerable to mining in both home and distant waters. It shows that less developed nations and rogue political groups can wage effective mine warfare. And it demonstrates a record of interwar neglect of mine warfare in the US Navy that culminated in the Persian Gulf crisis of 1987 — when the world’s foremost power failed to counter with any celerity the

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97 S. Truver, 'Weapons That Wait ... and Wait ... and Wait', US Naval Institute Proceedings, February 1988, p. 32.
98 Ibid.
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antique mines of a minor power despite knowing beforehand that mines would certainly be laid.99

The poor record of success in dealing with the mine menace continued into 1988 with the successful mining of a US warship.

In mid-April 1988 the US Guided Missile Frigate (FFG) Samuel B. Roberts was mined in the Persian Gulf. Certain aspects of the incident are noteworthy. The mines were deployed in relatively shallow depths and could readily be seen below the surface. This is a similar situation to that of the delayed US major landing at Wonsan, Korea in 1950 (see Chapter 5), when moored mines were visible beneath the surface and helicopters were used to physically spot them. Evidence exists that the US FFG was in fact attempting to avoid the mines through a violent manoeuvre when it was hit. The mine was probably pushed away and downwards by the wash of the warship. Consequently, the mine bobbed up against the keel almost directly below the engine room and exploded, reportedly throwing the vessel’s keel 3 metres upwards.100

As a result of this explosion, drastic flexing occurred and major rupturing of the keel, hull and superstructure resulted. The engine room flooded immediately and the engines were dislodged from their beds, forcing the vessel to ‘limp away’ using a retractable auxiliary ‘get home’ propeller. The ship then had to be towed most of the way to Bahrain and was literally knocked out of the conflict for years in terms of acting as a viable convoy escort. Damage done to the hull, engine room, superstructure and systems would have been of the order of one hundred million dollars.101

It is remarkable that simple countermeasures were not employed against the moored contact mines despite a number of detonations during the previous nine months. The Samuel B. Johnson had no bow sonar dome fitted and could therefore have been protected to a substantial degree against such mines by a simple paravane rig. As already discussed, paravanes are torpedo-shaped floats towed at an

101 Damage to the systems of modern warships may be so extensive that repair is not cost-effective. The cost of an FFG is approximately $US550 million (1990). A destroyer was said to have been ‘written off’ during the Vietnam War for similar reasons, involving the detonation of a DST-36 bottom mine in shallow water. Cost of repairs to the USS Samuel B. Roberts totalled US$96 million.
angle from the bows of ships by cables, which divert and cut contact mine anchor cables. They are inexpensive, relatively easy to fit and can be used at higher speed, though ship manoeuvrability is moderately affected. The paravane lost favour and usage as the bottom mine became the predominant combat mine type in the latter stages of World War Two. However, as the Americans had discovered during the Korean War at Wonsan and many years later in the Persian Gulf, failure to re-adopt old, simple, but effective countermeasures costs dearly. A paravane fitted to the Samuel B. Roberts would almost certainly have protected the vessel to a substantial degree against contact mines, and may have obviated the need to conduct a drastic manoeuvre which exacerbated the damage considerably.102

Another possible deficiency was revealed in this particular mine attack. Since World War One, sudden changes of course when traversing minefields has been against Standard Operating Procedures for exactly the reason which led to the FFG being so badly damaged. The fact that the readily seen mines were not detected earlier also casts serious doubts as to whether efficient lookouts were posted and the vessel’s two helicopters were used effectively for mine visual reconnaissance. The inference is that the crew of the vessel may have failed to learn and apply basic self-defensive measures and may have simply underestimated the mine threat.

As mentioned earlier, the Iranians were known to have limited stocks of air-laid US Mk 55 bottom mines but few, if any, are known to have been laid. These mines were early versions and employed dual-channel magnetic induction firing mechanisms. The Mk 55 contains a 1300-pound HBX-1 warhead, which is quite formidable from a victim’s perspective. Iranian stocks of these mines, besides being small in number, were probably poorly maintained. Yet if they had been deployed their potential for damage would far exceed that of the contact mines actually used. The Iranians apparently chose to concentrate on deployment of more easily maintained, highly reliable and available contact mines. Also, water depths in many parts of the gulf are too deep for effective use of bottom mines which, depending on the nature of the seabed, charge weight and structure of target, have an effective range of 60-80 metres.

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Specific Threats to Australia

The mine threat to Australia could take several forms and might have many objectives. Six broad levels of threat will be examined in ascending order of seriousness.

Level 1 — Nuisance Threats

This type of threat is similar to a bomb threat and it must generally be checked out. Most of these threats would be hoaxes received by phone or possibly by mail. They may consist of something as simple as 'Mines have been laid in Sydney Heads', for example.

The consequences of such threats would generally be far more costly in terms of time and money than bomb threats. Harbours might have to be closed pending the arrival of MCM vessels and clearance divers. This would lead to a net loss in ship days and loss of face for the Australian government. While most threats would merely be hoaxes, if the government failed to adequately check the situation and damage or delay to vessels did in fact occur, the Commonwealth might be liable to suit by shipping companies. A policy of 'Damn the torpedoes [nineteenth-century term for mines] ... full speed ahead' would be successful until the first detonation, which would reveal a major weakness and prove highly embarrassing to the government. Nuisance callers would have to suffer heavy penalties in terms of imprisonment and, if appropriate, payment of compensation for the loss of ship days and countermeasures expenses.

The time scale related to this type of threat is very small and lack of MCM capability can, in effect, invite this threat.

Level 2 — Dissident/Low-Level Terrorist Attack

The primary aim of this threat is to attract the attention of the media and authorities to a cause, with the aim of influencing government policy or decision-making. A terrorist favours the use of fear-inspiring methods of coercing government or the community. 'Imaginative' terrorists are becoming increasingly aware of the mine's psychological warhead, but mine-use may not be limited to only the 'hard core' type of terrorist.
Dissidents, being those at variance with government policy, who elect to use violence or the threat of violence, can be classified as terrorists.

While the prospects for terrorist activity in Australia have been low, future sporadic use of mines by disaffected groups cannot be ruled out and would certainly constitute an act of terrorism. Indeed, for disaffected groups failing to make their point with the government, mine-use could uplift their profile and attract the attention of government and the media with a minimum cost in terms of risk, expense and 'bad publicity'. In the early stages of terrorist development an Australian dissident group, without the assistance of overseas terrorists, might not wish to sour public opinion to an irrevocable extent and might desire to pitch the threat to the lowest level of violence. In this case, the mine stands out as a much more selective initial weapon than bombs, bullets or missiles. Also, unlike bombs, which to do real damage have to be set in heavily occupied and sometimes sensitive areas, mines can be set in remote areas with relative ease, lack of visibility and therefore less risk.

**Level 3 — Terrorist Minelays**

This level of threat represents a serious escalation of threat level 2, with the complexion of the threat changed by possible covert foreign state sponsorship and, consequently, dedication of more resources to providing the threat. Trained terrorists from overseas might be involved in an advisory or executive capacity with organised, indigenous, dissident groups. Attacks could be sporadic or even 'one-off' and take place with maximum surprise.

The aim of these minelays might be to coerce the government into meeting requirements in terms of policy change or simply to make the government 'look bad'. Attacks might occur which were directly aimed at blocking material flow to overseas trading partners who are adversaries of the terrorist group. Australia might in future be chosen as a safer, lower risk area of operations in which to attract attention to a terrorist cause.
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The terrorist group would be likely to have access to small ocean-going vessels capable of carrying a number of mines, probably of the more easily disguised and deployed bottom influence variety. Rather than attempting to wreak major economic damage, which would be difficult without the ability to lay many more mines in critical areas, the group might choose a 'demonstration strike' involving closing off a major population centre for a limited period. This would reveal government impotence and affect the attitude and gain the attention of hundreds of thousands of inhabitants. Targets like Sydney, Melbourne, Darwin, Newcastle, Brisbane or Perth could logically be placed on a 'hit list'.

Mines would be available which are capable of delayed arming (or delayed rising if of the contact variety). Consequently, the vessel could enter the port, preferably at night, drop the mines overboard, remain alongside for a respectable time and then depart. Perhaps a week or two later the mines would become active, with one or two detonations to simply advertise their presence. This maximises confusion and deters transit from port. Deliberate sporadic detonations of mines shortly after deployment was a tactic successfully used by the US to deter sailings from Haiphong harbour in 1972.

Level 4 — Harassment Fields

At this level the threat would escalate to the extent of the involvement of a sovereign state, laying limited numbers of small minefields with the likely aim of influencing the Australian government to grant concessions or change policy. Harassment fields imply an act of war set at the lowest level of violence and might be supported by a limited foreign naval presence. The fields might be deployed in disputed areas of the EEZ as a means of disputing sovereignty and limiting an Australian naval presence. Mines might be used to support future 'resource grabs', when a nation might consider that a test of Australian resolve would be appropriate but might not be prepared to escalate the situation to a directed weapon level, involving probable loss of life.
Several regional nations and the Soviet Union have the ability to deploy these types of field, each of which might only consist of a few mines given the demonstrative rather than destructive aim.

**Level 5 — Dislocation Fields**

The deployment of minefields aimed at substantially dislocating Australian shipping and economic interests would most likely be undertaken by a sovereign state aiming to significantly affect Australian trade and/or the deployment of ADF Fleet units from their bases. Dislocation represents a deliberate escalation which might or might not be supported by a substantial naval presence, depending on the opponent’s preparedness to enter into a ‘hot’ or shooting war.

A dislocation campaign could be undertaken with a number of aims: a counter-value reprisal field (see Chapter 9) could aim at drawing a price from government or it might be an adjunct to a strategy aimed at a ‘resource grab’ or challenge to sovereignty. In any case, dislocation fields would be aimed at maximising ship days lost and the disruption of industry as well as increasing marine insurance rates and the unwillingness of neutral crews to sail. They would also be likely to be aimed at discrediting the government’s defence competence and standing in the international community.

Dislocation fields could be deployed as a sustained, widespread, surface-laying campaign or on a co-ordinated, large-scale, ‘one-shot’ basis. They might even be laid by submarines on a sustained basis. A squadron of three submarines, for example, each carrying 30 to 40 mines, could do as much relative damage to Australia as German submarines perpetrated against the eastern US seaboard in World War Two. In fact, the closure of a harbour for as little as one week not only would affect Australia in terms of lost production but also would affect the ability of the Australian government to expeditiously deploy an armed maritime force capable of upholding Australian sovereignty and demonstrating government resolve. The loss of one week could be decisive during modern conflict.
Varied ship-counts and variable inter-count dormant periods could be employed and fields could be 'mixed' to maximise effectiveness and the difficulty of the MCM task in terms of time required and range of platforms needed. (Mixed fields involve the use of different types of mines with a wide variety of settings).

**Level 6 — Blockade Fields**

A sustained full blockade against Australian ports could only be successfully implemented by superpowers who would be capable of covering their fields with fire and deploying fairly dense, mixed fields widely and quickly, since the legitimacy of blockade by mines alone is open to legal question. Blockade minefields can be laid outside and inside major ports and must be largely effective (see Treaty of Paris, discussed in Chapter 6). However, the complete shutting up of a few select ports for even a week using well-planned, dense minefields would constitute an effective blockade if the blockade were supported by submarines. (See Chapter 9 and also the Operation Starvation precedent described in Chapter 5.)

A sustained mine blockade against Australia by non-superpowers would be unlikely to be effective unless supported by a strong surface combatant/submarine presence. Even so, only a few ports on one coast would be likely to be affected given the limited resources available to regional nations.

This level of threat is by far the least likely but is the most dangerous threat in terms of military and economic implications.

**Some Thoughts on Threat**

Despite the proliferation of intelligence analysts, intelligence-gathering devices and defence-oriented 'think tanks' since World War Two, it
seems that miscalculation of threat, and consequent surprise, occurs time and time again.\(^\text{103}\)

Strategic surprise is one of the greatest threats to a country’s security and national well-being. Surprise, on a strategic scale, involves a nation being in a state of unreadiness to mobilise and deploy appropriate assets to counter a threat or attack: if a nation cannot mobilise and deploy its assets in a timely manner, appropriate to the threat or attack, it is for all intents and purposes surprised. It matters not whether intelligence sources were successful in picking up and indeed successfully analysing threat indicators. Unless possible and suitable steps have been taken to counter the threat, surprise is achieved.

Australian conventional wisdom has for many years sought to nourish a ‘no perceived threat’ syndrome and has put significant stock in the concept of warning time, whereby sufficient time will exist between the identification of a threat and the completed fleshing out of a core force.\(^\text{104}\) Any assessment of the current ADF Order of Battle makes it plain that the core force concept remains with us in practice even if it is now unfashionable in theory. Detailed studies of warning time have been undertaken by the Australian Central Studies Establishment (CSE), in an effort to subject the waging of war and the anatomy of human conflict to the instruments of systematic quantitative analysis.\(^\text{105}\) Average warning times have been worked out, with the obvious conclusion that warning times as such are continually being reduced. This approach is dubious since, with the benefit of hindsight, the factors seen as unambiguous indicators of threat today may have seemed far more ambiguous at the time of crisis.

The purely academic Australian approach to the analysis of threat and war is reminiscent of the over-sophisticated approach taken


by the systems analysts, academic strategists and practitioners of the Planning, Programming and Budgeting System (PPBS) of the US Department of Defense during the Vietnam War in the 1960s. The concept of warning time should be seriously questioned, as the variables taken into account during relevant hindsight analyses fail to adequately accommodate critically important psycho-social factors not amenable to the methods of systematic quantitative analysis. Many of these factors can prove critical, in terms of having an effect far outweighing all quantifiable variables. Such factors include surprise, misperceptions of rational behaviour, fear, hate and inter-cultural resentments. Given such a complex human behavioural equation it might be wise to remember the sobering words of Hamlet, Prince of Denmark, after seeing the ghost of his father ‘... There are more things in heaven and earth Horatio than are dreamt of in your philosophy’. Maintaining a balanced force structure capable of taking the initiative should therefore be the main aim of defence planners in the present atmosphere of extreme uncertainty in defence circles.

Surprise has been and will continue to be a fundamental principle of military operations at any level. It is a valuable, often crucial, force multiplier and can yield huge benefits to the user and invoke heavy penalties from the victim. Surprise is readily achievable in the modern age, despite the plethora of infra-red and photographic satellite reconnaissance methods. Unfortunately, such technological boons are two-edged swords. A talented enemy would aim to attack so as to minimise effective implementation of the victim’s plan of operations. He might endeavour to gradually engineer miscalculation on the victim’s part. Intelligence networks can provide channels by which to feed in false indicators designed to support the victim’s misconceptions concerning the nature of the threat. By reassurance of the victim, the status quo is maintained and an effective state of self-deception is built up. Alternatively, the enemy might simply decide to overwhelm the victim’s intelligence-gathering facilities with


107 From Act I, Scene V of Hamlet.

108 This is implied in the conclusions noted by Betts, Surprise Attack, pp. 309-312.
ambiguities, knowing that politicians, if left to their own devices, will quite properly avoid mobilising and deploying forces until a clear indication of provocation arrives, or the last diplomatic avenue has been followed up. Alternatively again, engineered miscalculation through intelligence networks might be used to cover the use of a novel type of attack, quite outside the scope of the victim’s contingency planning.

Strategic surprises are never ‘bolts from the blue’. There are always definite indications that attacks will probably be made and they invariably occur after a period of rising tension. Whether faulty intelligence, wrong military judgement or political disbelief is the cause, the fact remains that surprises continue to be sprung on even the most astute and alert defence services. In 1973 the Israeli Defence Force (IDF) and the state of Israel found itself surprised in the Yom Kippur War by an Egyptian offensive across the Suez Canal. Prior to October 1973, Israeli intelligence considered that the Egyptians could not possibly invade until the Egyptian Air Force had developed the capability to aerially strike Israel in depth. There was ‘no perceived threat’ until 1975 at the earliest, and this line of thought was shared by US intelligence services, who were equally surprised by the Arab attack in 1973. The Egyptians did not conform to the Israeli and US conventional wisdom, which assumed that the Egyptians would not be able to attack until they had built up a strong air element and selected tactics involving the use of point air defence systems and hand-held anti-tank missiles, to shoot down Israeli aircraft and knock out Israeli tanks respectively. The Egyptians simply elected not to fight the war according to Israeli perceptions of how it would be fought. One decade later Britons were surprised when Argentina took the Falkland Islands. This was not anticipated, as the Royal Navy was evolving towards meeting only a single threat: Soviet submarines in the North Atlantic.

On both these relatively recent occasions an enemy simply selected a method of attack outside the victim’s current contingency planning focus. In the initial stages of each conflict considerable success

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109 This is a major argument of Betts in *Surprise Attack*. He goes into much detail to show the multitude of indicators existing before the German invasion of Russia, the Japanese attack on Pearl Harbor and the Yom Kippur War. Political and military disbelief emerge as major contributory factors to the achievement of surprise.


111 Prior to the Falklands War the Royal Navy was to be reduced to a navy capable only of satisfying its primary NATO mission, the ASW mission in the North Atlantic. The scaling down involved the selling of force projection assets.
was enjoyed by the aggressors. In each case the victim had to draw upon all its reserves and international military aid to regain the initiative and the costs of miscalculation proved extremely high.

Today's politicians, academics and military planners should not delude themselves into believing that their unique insights, analytic abilities and superior instincts make them immune to surprise. Even Stalin, a man well tutored in the arts of deception, tactics and intrigue, was strategically surprised by the German invasion of Russia in 1941.112 What may be viewed as totally irrational, unjust and undemocratic by a middle-aged, middle-class Australian bureaucrat or academic may be seen as a stroke of political and military brilliance by groups with different perceptions of reasonable, balanced ways of going about things. Like beauty, rationality is in the eye of the beholder. In fact, specific examples of surprise and miscalculation in the Australian context took place in 1985, 1987 and 1990. In 1986, Indonesia exhibited a surprisingly sharp reaction to Australian press reports concerning the Indonesian leader, President Suharto, and members of his family. The bureaucratic establishment in Australia was stunned by the range of punitive actions taken by the Indonesian government. (This situation is described in more detail in Chapter 9.) Similarly, the bureaucratic establishment was surprised by the two Fijian coups of 1987, which were acts beyond the comprehension of many 'expert analysts'. And who would have thought that, after a decade of developing the doctrine of defence self-reliance in terms of the continental defence of Australia by the ADF, an Australian 'expeditionary force' would be despatched to the Persian Gulf in 1990 as an adjunct to United States blockade forces?113 Circumstances concerning the decision to sail are irrelevant to this discussion. The point is that miscalculation and the unexpected again prevailed and Australian decision-makers were again forced to adapt to completely unexpected contingencies.

Concepts such as 'no perceived major threat' and 'adequate warning time' for development and deployment of forces lie within the realms of bland generalisation, conjecture and downright wishful thinking. Excessive confidence in the concept of warning time can hamstring defence contingency planning and yield a dangerous

112 See Betts, Surprise Attack, pp. 34-50.
113 In August 1990 an Australian naval task force comprising three vessels sailed for the Middle East at the request of the President of the United States to contribute to the blockade of Iraq.
complacency within the defence establishment. Unfortunately surprise remains the exception to a good generalisation and, by definition, it cannot be countered. However steps can be taken to mitigate its effect and increase the speed and power with which a state can regain the initiative.

Suffice it to say that, despite the use of the best tools provided by modern surveillance technology together with the concentrated efforts of the most talented analysts, surprise attacks continue to be sprung on even the most alert of nations. Credence should not be placed in the concepts of ‘warning time’ and ‘no perceived threat’, which are often put forward in disguised forms. There are simply too many ambiguities in threat recognition, especially with the rapid changes which can occur in human motive and intent. Given these uncertainties, which stem partly from human nature itself, a sensible planner has no practical alternative but to mitigate the effects of surprise by acting to shore up obvious vulnerabilities which can inhibit the ability to respond to threat. Vulnerability to maritime mining attack is a salient weak spot in the ‘hull’ of the Australian Ship of State and this weak spot should be shored up. Chapter 4 will offer an Australian Mine Countermeasures Plan (AMCMP), which offers a diversified array of affordable mine countermeasures capable of mitigating the effects of surprise mine attacks.

Conclusion

Mines were used as first enemy strike weapons against Australia and New Zealand in both world wars. They were perceived by the enemy as obvious weapons for widespread use against isolated nations such as Australia with long, exposed coastlines, heavy reliance on foreign trade and minimal countermeasures resources. These vulnerabilities have not changed and, considering the enormous advances in mine design, Australia’s inherent vulnerability becomes even more pronounced. The results of German offensive minelaying operations against Australia and New Zealand were highly successful and drew a vastly disproportionate response in terms of ships sunk and countermeasures efforts, which had to be sustained over long periods. The mine menace is not merely one threat chosen from a wide spectrum of threats. It is the menace with precedent.

Regional nations have the ability to covertly deploy mines against Australia using all manner of surface vessels and submarines.
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Also, the Soviets have traditionally been keen advocates of the use of mines in a variety of scenarios and their sincerity is well attested by huge stocks held, level of offensive minelaying training and the number of vessels equipped for deployment.

In 1984 maritime mining became a new tactic of international terrorism and revolution with the mining of the Red Sea and Nicaraguan ports. The future use of mines by terrorists will probably not involve the use of ‘scare’ charges, as has been the case to date, and there is no reason to believe that terrorists will not enjoy continued access to modern, capable combination mines. Even if modern mines are unavailable, the simplest of mines can be used to devastating effect by the weakest of maritime nations, as indicated by the events in the Persian Gulf in 1987-88.

Finally, in view of the obvious and historically established vulnerability of Australia to the mine menace, it appears logical for any party wishing to harass Australia to consider the mine a low-risk/high-gain weapon for widespread use against Australians and their interests. This is particularly the case in low-level harassment scenarios.
CHAPTER FOUR

MINE COUNTERMEASURES (MCMs)*

The most effective form of MCM involves closing all mined ports and waiting from 2 to 5 years for the mine's battery life to expire! This MCM method is one hundred per cent effective and can be done easily, if millions of tonnes of supplies are stockpiled during peacetime and the government is prepared to face a sustained, massive level of negative economic growth. Obviously, the option of doing nothing about mines is unacceptable. Mines and their users have to be deterred, avoided or 'fought' using direct and indirect methods of countermeasure. Direct methods of countermeasure basically involve the processes of minesweeping and minehunting as applied once the mines have been laid or are thought to have been laid. Indirect methods of countermeasure involve techniques which reduce the possibility of effective minelays in the first place. An effective Mine Countermeasures Plan (MCMP) involves a combination of direct and indirect methods appropriate to the peculiar vulnerabilities, needs and budgetary constraints of a nation. The aim of this chapter is to develop fundamental aspects of an affordable, comprehensive MCMP appropriate to Australian defence needs.

The Direct Approach to MCMs

Minesweeping

While it does not cost much to build a smarter mine (see Chapter 8), it does cost an enormous amount to enhance the capability of platforms to 'fight' the smarter mine. By the end of World War Two the MCM problem had become extremely complicated. Elliott states that:

... By early 1945 the cunning of the mine designers (both German and Anglo-American) seemed to be outstripping the effectiveness of the sweepers devised as antidotes — and this was not restricted to the problems of sweeping the pressure mines. When German mining officers were

* Some developments in the Australian MCM force structure suggested in this chapter have been overtaken by events, particularly with regard to the MHI and COOP programme.
interviewed after V-E day, it was found that two fields had actually been laid with mines having arming delay clocks running up to 200 days, while others had 'interrupter clocks' which rendered the mines passive for 24 hours while the sweepers hunted for them, and then active again when the convoys were passing over! ... Pulse delay mechanisms (the ship 'clickers') were by then running for up to 15 'clicks', and mines laid in calm water had a very long life ... One mine, which fortunately did not appear at sea, had a triple unit; a magnetic device actuated the pressure unit, this in turn operated the acoustic unit, and if this too reacted to the sweep (or ship) the mine would fire.1

Looking toward the future it was concluded that:

... Mine clearance was completed in the years after the war, but the last messages from 1945 were clear ... it had become possible to lay well-designed minefields, with a mixture of anti-ship and anti-sweeper mines, which might well prevent effective clearance. Arming clocks and pulse delay mechanisms, too, were approaching a level of sophistication which might well defeat the minesweepers.2

This view was similar to that held by the Director of Minelaying, British Admiralty who commented that:

It is however, common knowledge that, even by the end of the war, design was tending more and more to the production of mines requiring the presence of true 'ship phenomena' to detonate them and this type of mine, however actuated, is likely to provide the greatest headache from the countermeasures point of view.3

During the post-war decades technological developments continued to favour the mine. Consequently, influence sweeping, even against relatively simple devices, was reduced in its capacity to counter

1 Elliott, Allied Minesweeping in World War 2, p. 178.
2 ibid., pp. 181-182.
3 Cowie, Mines, Minelayers and Minelaying, p. 197.
the mine menace. Even during the Vietnam War sweeping operations against simple DST devices proved very demanding. This situation was best summed up by the Mine Warfare Officer for Commander Mobile Countermeasures Command, during Operation Endsweep. Commander J. McCoy, USN, formulated all detailed minesweeping instructions for airborne (helicopter) and surface units and was the main technical adviser during negotiations with the North Vietnamese. In 1975 he stated:

... We continue to perpetuate the myth that our mine countermeasures forces are capable of clearing a minefield in a timely manner. They are not. Even at full strength they are not. And the miners will remain several steps ahead of the mined as long as we continue to be oriented toward fooling the mine into detonating on a phoney signal ... If the approximately 11,000 US mines planted in North Vietnam had not had sterilization and self destruct features, and if they had contained batteries of indefinite active life, then the completion of that operation (Endsweep) would have been measured in years rather than months. Hundreds of passes over each mine field would have been required. Equipment and personnel casualties probably would have been high.4

Regarding the problem of sweeping unknown enemy mines he also mentioned that:

... Following exhaustive (influence) sweep efforts, an area could easily be evaluated as 'safe' and actually contain many mines posing a considerable threat. The mine’s logic circuits would have remained poised to detonate on real targets generating the proper rate of build-up, amplitude, signal decay and combination of influence.5

In his final analysis McCoy believes the future of mine countermeasures lies in vastly improved minehunting techniques and

5 ibid., pp. 41-42.
that influence sweeping is of very limited value against modern mines. This conclusion would appear to be confirmed by the fact that not a single mine was influence swept in the Red Sea during the terrorist minings of 1984.6

Minchunting

Minchunting involves detection and identification of mines using sonar followed by a neutralisation process often achieved by countermining, or laying a charge near the mine and inducing a sympathetic explosion. Mines are located one by one, often under very difficult and dangerous conditions. At best it is an extremely time-consuming process and a high rate of false contacts is made. Minehunters are by far the most expensive warships afloat tonne for tonne. This is because of stringent requirements for high shock resistance and extremely low magnetic, acoustic and pressure signatures. Expensive navigation, action information and mine neutralisation systems also contribute to making minehunters very expensive.

A purpose-built minehunter will generally commence its operation in a lower frequency (100khz) sonar search mode using its detection sonar.7 Depending on conditions of weather, sea state and nature of the seabed the vessel may detect a mine-like object at a range between 200 and 500 metres.8 Once the mine-like object has been detected, the sonar is switched to a higher frequency (200-500 khz) identification mode which gives higher definition and better bearing resolution.9 Identification of the mine type can be given by direct ensonification using the classification sonar or by a ‘shadow’ classification technique. The shadow classification method identifies the mine by analysis of its sonar ‘shadow’, which is projected on the sea floor after sonar illumination (ensonification).

7 The typical hull-mounted, high-definition minehunting sonar selected in this example is the French DUBM 20A (TSM 2000), which is fitted to CIRCE Class minehunters.
8 While the TSM 2000 has a range of up to one half a kilometre, it can only detect and classify to a depth of approximately 60 metres.
9 Sonic imaging of the mine or mine-like object improves in quality as the wavelength of the sonar beam becomes a smaller fraction of the target length; i.e., when frequency is increased. Increasing frequency also increases water penetrability and echo returns are stronger.
Navigational accuracy of a very high level is essential in the MCM process. This is to ensure exact knowledge of where the mine is in absolute terms and also where the mine is in relation to the hunter. Positioning data inputs come from the autopilot, wind sensor, doppler log, radio-navigational system, navigation radar ranges and bearings relative to drift-free buoys if fixed navigational beacons are not available ashore. Such extreme navigational accuracy is especially necessary during helicopter minesweeping, when position changes are much more rapid. US RH-53D minesweeping helicopters, for example, are equipped with the Raydist hyperbolic navigation system, which is said to produce a computer-predicted course with a net error of plus or minus less than 5 metres per 200 nautical miles flown.10

A sophisticated, computer-based action information system is needed to correlate and display all navigational inputs and many other items of tactical data, including information which can be programmed into the computer before sailing such as general area navigational information, search area bounds and classification information relative to known enemy mine shape signatures. Also, information from previous route surveys, or Mine Warfare Pilot Surveys (MWPSs), can often be taped into the system so that comparative analysis can determine any recent changes to the bottom topography.

Once a mine-like object is actually classified as a mine the process of mine neutralisation commences. For many years clearance divers were widely used for this type of Explosive Ordnance Disposal (EOD), but there were many disadvantages associated with this since diving could only take place under favourable conditions of depth, light and current. There is an increasing tendency to countermine using Remotely Operated Vehicles (ROVs) capable of being guided to the mine from a safe distance. Once the ROV is near the mine it deposits its countermine charge and is returned to the minehunter, where it can be winched back on board. Remote detonation of the countermine charge should then destroy the mine.

Problems with Minehunting

Despite the many advantages of minehunting, this MCM technique faces many problems. Its efficiency is seriously degraded in high scale-

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states, moderate to strong currents and even moderate swells. Further, sonar conditions are seldom ideal and often poor. This is especially the case when operating in inshore areas. Sonar detection and classification methods are sensitive to the state of the seabed: large stones, rocky outcrops, gravel, mud and silt make detection and classification very difficult. This situation is exacerbated by the increasing amount of debris, originating from ships, that litters harbour approaches and harbour seabeds. To complicate the problem of mine location even further, mine designers have been far from inactive in the area of mine camouflage.

The new techniques of mine camouflage aim at decorrelating sonar echoes by using shape and structure to induce a blending in with sonar backscatter on the seabed. This can be done using a number of methods, including the use of smooth, non-reflecting surfaces and rubberised anechoic (sonar-absorbent) coatings. Rough, corrugated surfaces can also reduce the identifiability of a mine's sonar signature. Mine cases can be made out of sonar-absorbent materials such as fibreglass (e.g. Italian MR80, US Mk 57) and research has been conducted into moulding the entire mine out of plastic explosive with an implanted target detection device and power supply.

Such developments as these, together with the many man-made and natural objects resembling mines on the seabed, make the minehunting job extraordinarily difficult even with state-of-the-art equipment and good sea conditions. This was amply demonstrated by the fact that extensive minehunting in the Red Sea by the forces of several countries managed to locate only one mine during a two-month period (see Chapter 3). Even under the best possible conditions, a medium-sized minefield would almost certainly take weeks to clear given the relatively small numbers of minehunters available to most nations. Slow clearance times must be alleviated by new approaches and initiatives, since enormous problems and consequent costs would result if high-density shipping areas were not cleared promptly.

The Current Australian Approach to MCMs

It has long been recognised that three basic mine countermeasure capabilities are required to reduce the risk of mines attacking shipping in Australian waters. These capabilities are:

- shallow water minehunting (0-90 metres),
- shallow water minesweeping (0-90 metres), and
intermediate depth minesweeping (90-200 metres).\(^{11}\)

The first two capabilities help to ensure safe entrance to and exit from major ports while the third capability contributes to the enhanced security of Australia's deeper maritime approaches.

**Shallow Water Minehunting**

The primary solution to the problem of minehunting in shallow waters has been the development of an Inshore Minehunter (MHI) capable of detecting, classifying and neutralising bottom mines in water depths up to 70 and possibly 90 metres. Inshore waters include inner harbour waters, sheltered harbour approaches and estuarial waters.

The initial aim of the MHI development project, in 1975, was to produce a craft that was cheaper than conventional MCM vessels and could be produced, in Australia, reasonably quickly. However, the project proved to be a very long one and it was not until late in 1986 that the first prototype MHI, HMAS Ruchcutter, finally left the slips to begin a long series of acceptance trials in the Sydney/Jervis Bay area. By the end of 1986 total project cost had escalated to approximately $100 million for the first two phases of the programme. Phase I involved project definition studies, which took place over an eight-year period. Phase II, which involved the construction of a land-based magnetic test range and the two prototypes, commenced in 1983 and was not completed until 1988. Ironically, by the time the MHI is declared operational, European MCM vessels that also commenced development in the mid-1970s will have been fully operational for over a decade. Such lack of expeditious progress has led to justified criticism of many aspects of MHI and general MCM project management over the period. As a result of lack of expertise, total project cost per vessel has doubled from $35 million (Australian 1986) to $86 million (Australian 1989).

The serious sonar detection deficiencies of the Australian 'Bay' Class MHI are unlikely to be overcome without further major changes which involve much time, manpower and money. Indeed, progress in Australian MCM projects has been plagued by delay and poor planning since 1971 and extraordinarily long delays in making the MHI fully operational led to a failure to effectively contend for a lucrative Saudi Arabian contract for the production of 8 Mine Countermeasure Vessels

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(MCMVs). Also, in 1988 a common mine-hunting requirement is said to have been drawn up by the Gulf states of Abu Dhabi, Bahrain, Kuwait, Oman and Quatar, involving the production of 15 MCMVs, and it appears that the ‘Bay’ Class will not be a likely contender if and when tenders are called for.12

A brief history of the origins and development of the Australian MHI requirement is instructive to gain an insight into the mismanagement and lack of clear direction in the development of Australian MCMVs.

During 1971 the Defence Force Development Committee (DFDC) directed the RAN to develop proposals for the replacement of the Ton Class mine countermeasures vessels, which were acquired in the early 1960s. In 1975 the Committee agreed to the Australian development of an MHI, plus a minesweeping capability to be progressed as a separate but parallel project. Six years later the DFDC expressed concern that progress had been extremely slow and much greater attention was required to overcome existing deficiencies. Five years later, in 1986, the Review of Australia’s Defence Capabilities stated that ‘... As a result of poor planning and procrastination, the development of mine countermeasures forces has been under consideration in the Defence community for over 15 years’.13 The MHI Project has also been heavily criticised by the Auditor General and Joint Parliamentary Committee on Public Accounts. The Committee’s Review of Defence Project Management included a full account of the deficiencies in MHI project management.14 The Committee in fact described the MHI project as being one of four ‘especially unsuccessful’ Defence projects.

Criticism of the MHI has not only come from outside the ranks of the RAN. In 1984 one of the RAN’s most experienced MCM specialists, Commander David Ramsden, made the following statement:


The overall aim was to produce a craft that was less expensive than conventional MCM vessel designs and which could be produced relatively quickly in Australia. This very desirable aim was to be achieved at the cost of having a smaller and therefore a less deployable and more support dependent craft than a conventional MCM vessel. The overall cost of developing the Australian design has become high. Although the direct financial cost of the MHI still compares favourably with other MCM vessels, the indirect costs are significant. Not only is the craft deployment limited, compared to conventional MCMVs, but considerable man years of Naval Technical Services effort since 1975 has gone into acquiring the specialised skills and producing the design. Perhaps most serious of all, from a Defence capability viewpoint, a number of MCM vessel projects in other nations have overtaken the MHI prototype and are now in service while Australia faces a significant MCM capability gap. Finally, the infrastructure required to support the unique Australian minehunter through trials and evaluation into operational service is proving a significant drain on the overall available manpower and finance resources.\(^\text{15}\)

The main features aimed for in the MHI include:

- Small pressure and magnetic signatures together with a relatively low acoustic signature. The pressure signature is reduced by a small displacement (160-180 tonnes) and the catamaran hull type which gives a full load draught of only 2 metres. Another advantage of the catamaran type hull is increased propeller spacing which should enhance station keeping ability.

- To minimise the magnetic influence signature the MHI is constructed from non-magnetic, glass-reinforced

\(^{15}\) D. Ramsden, 'Australian Mine Countermeasures Vessels: A Dilemma', *Journal of the Australian Naval Institute*, November 1984. Commander Ramsden is an ex-Minesweeper Project Officer and has wide experience of MCM command and staff positions.
plastic (GRP) and intricate efforts have been made to minimise the amount of ferro-magnetic material used throughout the vessel. In fact, the vessel does not even have a galley. Victualling consists of using pre-prepared meals which can be heated in a microwave oven.

- Acoustic integrity should be enhanced by minimising the likely sources of vibration and by extensive anti-shock-vibration mounting ('shock-mounting') of equipment. Propeller cavitation noise is reduced using a special, low-noise propeller design. It should also be noted that each propeller can vector thrust through $360^\circ$. This enhances station-keeping ability and manouevrability and should allow the craft to reverse direction without changing the direction of propeller rotation.

- Modular construction allows major compartments in the MHI to be containerised and removed quite quickly. The complete operations room falls into this category and it can be transported by road, rail, air or sea to replace a damaged operations room on board a vessel. This capability minimises the vessel's time in dock and maximises time on task if sufficient support in terms of spares and personnel exist.

- Crew size is minimal. A complement of 14 persons (3 officers, 3 senior sailors, 8 junior sailors) form the ship's company. During periods of sustained minehunting, complete crew rotations may be instituted every 12 hours.

- A minehunting weapons system is incorporated in the vessel. Minehunting command and control is based in the operations room, in which is placed the minehunting sonar console, tactical data system, precision navigation system and the control console for the Remotely Operated Vehicle (ROV). The sonar system currently consists of the Krupp Atlas Electronik DSQS-11H system. This sonar provides $360^\circ$ ensonification with full quadrant $(90^\circ)$ azimuth coverage. Sonar information is fed, together with
information from the MR-S3 precision navigation system, into the tactical data system, which theoretically establishes the exact position of the mine-like object. Positional information is then displayed and recorded for future use. However, the DSQS-11H has failed to achieve the required level of performance after several years of trials.

Despite these impressive ‘on paper’ characteristics the MHI does not give Australia anything like a full shallow water minehunting capability. Inshore minehunting is not the same as shallow water minehunting, because there are enormous areas of unprotected shallow waters around Australia. The MHI cannot operate efficiently in unsheltered shallow waters because of its small displacement, draught, length (31m), and generally very limited sea-keeping capability. The vessel is limited to operating in only very favourable sea-states (up to sea-state 3). In fact, during the late 1970s YARD Consultants, Australia advised the RAN that MHI length and beam as specified were both too small for successful operations even in sea-state 3. This advice was not accepted, leading to a drastic lowering of performance and a consequent need for expensive hull modification to enhance stability. In short, even if the MHI evolves from the prototype stage, its deployment area and application will be quite limited.

Shallow Water Minesweeping

This capability is a complementary one to that possibly afforded by the MHI and may be undertaken on a widespread basis if suitable, low-drag magnetic and acoustic sweeps are available. A moderately effective, low-drag magnetic sweep has been developed by the Materials Research Laboratory (MRL) for use by Craft of Opportunity (COOP), which are civilian vessels performing MCM tasks with minimum modifications. The sweep is known as a Buoyant Vehicle Dyad (BVD) (see Figure 4:1) or ‘Super-MOP’ (Magnetised Orange Pipe). The MOP concept was developed in the US and involved towing a highly magnetised, orange-coloured metal pipe to significantly change the magnetic flux density in the sweep area. This would hopefully cause magnetic mines to

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detonate. There were problems with the original MOP, since it was simply an electrically pre-magnetised metal pipe which fairly quickly lost its magnetic field strength while under tow. This led to relatively frequent returns to base or support areas for re-magnetisation. The Australian modification to the US MOP offers advantages in terms of manoeuvrability and convenience in terms of no requirement for re-magnetisation.

The MRL Dyad magnetic sweep is essentially a floating permanent bar magnet. Instead of being an open pipe its ends are sealed and it is fully buoyant. Discs of highly magnetised strontium ferrite are sandwiched between hollow steel tubes so as to form a hollow composite magnet. Prior to construction of a full-scale Dyad prototype in 1984, the device was computationally simulated using the fictitious poles in free space model as first approximation. Adjustments to reproduce the surface condition of the magnet under approximate operational conditions then contributed to a theoretical magnetic solution. Actual performances of the Dyad full-scale prototype were alleged to come within one per cent of computer-simulated predictions. The net result of the research was the construction of a low-drag, high-field-strength sweep that maintains adequate magnetic field intensity for long periods and allows much longer operating time at sea. The Dyad is also of robust design and is shock resistant. Arrays of Dyads can, in theory, be used to replicate substantial changes in local flux density from the passage of larger vessels.

Unfortunately, the BVD has been the subject of some misperception in terms of its sweep effectiveness. While it offers definite advantages concerning permanency and manoeuvrability, its sweep effectiveness is essentially not much better than the MOPs used with little effect by Commander McCoy during Operation Endsweep. It has basically the same limitations as the US MOP and is of very limited effectiveness against modern influence mines. McCoy was very critical of the MOPs' effectiveness and emphasises the limitations generally involved in influence minesweeping.

McCoy has been supported in his criticism of MOP-style sweeping and influence sweeping techniques generally by many high-level overseas MCM specialists who believe that mines are now at the stage where they can distinguish between a real target and the influence.

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countermeasure designed to simulate it.\textsuperscript{19} Indeed, US application of BVD/MOP influence sweeping in Vietnam (1972), the Suez Canal (1973-74) and the Red Sea (1989) were apparently quite unsuccessful.\textsuperscript{20} Consequently the Australian defence community should not be unduly exuberant concerning claims of 'breakthroughs' made in sweep technology.\textsuperscript{21} In any case, no foreign orders have been forthcoming for the Australian variant of the US MOP.

**Intermediate Depth Minesweeping**

The intermediate or mid-depth (90-200m) minesweeping requirement could be satisfied by an ocean-going minesweeper (MSO, Minesweeper Ocean). Since it would be operating in deeper waters, less stringent influence characteristics in terms of the need to suppress magnetic, acoustic and pressure signatures are required. These lower performance requirements contribute to markedly reduced costs.\textsuperscript{22} Production of MSOs would depend on the success of the Craft of Opportunity (COOP) programme, which is discussed in the next section and remains a cheaper alternative to MSO production.

An MSO must have enough deck space for efficient crew manipulation of sweeps and trawls, since the mines that may be encountered in the intermediate depth range are Short-Tethered Rising Mines (STRMs) together with normal moored influence and standard contact mines. Appropriate acoustic and magnetic sweeps would also have to be streamed from this vessel. The MSO vessel requires good sea-keeping capabilities in terms of adequate draft, displacement and length. It should also have sufficient tow strength for mechanical team sweeping in consort with another vessel and a sufficient electrical power generation capability to operate electro-mechanical acoustic sweeps.

\textsuperscript{19} ibid.

\textsuperscript{20} See Hartmann, *Weapons That Wait*, p. 129. Professor G.K. Hartmann was involved in the US mine/MCM programme from 1974-1979 and retired as Head of the US Naval Ordnance Laboratory.

\textsuperscript{21} Only one of hundreds of active US DST-36 magnetic/seismic mines was recorded as having been swept during Endsweep! Though thousands of DST-36s had self-sterilised, the figure of one swept is suspiciously poor. During the Red Sea sweeps no mines were swept by US or other forces (though other factors could impinge on this).

\textsuperscript{22} Ramsden, 'Australian Mine Countermeasures Vessels', p. 55.
THE MRL BUOYANT DYAD OR 'SUPER-MOP'
(Australian version of US MOP)

which will increasingly be required to deceive the early target acquisition acoustic sensors of STRMs and smart mines generally.\textsuperscript{23}

An Australian MSO need not be a purpose-built vessel. Coastal vessels on the civil inventory may be able to satisfy the requirements for the basic MSO platform. Huge economic savings could result if this concept proved successful and the employment of fishermen, using their own vessels, would have enormous advantages in terms of utilisation of local knowledge.\textsuperscript{24} This is an important factor in terms of effective STRM sweeping close to the bottom. With regard to the use of civilian vessels as possible MSO platforms, a decision can only be made once the COOP concept has been validated under Australian conditions. However a major hurdle facing the COOP programme will be the shortage of suitable vessels in Australian ports.\textsuperscript{25}

\textbf{The Craft of Opportunity (COOP) Programme}

Given Australia’s huge coastline, along which there are a number of important ports, there is an obvious requirement to have MCM assets in several locations. At best, a permanent naval cadre force of six MHI may be available by the end of the century.

In an effort to develop greater MCM defence in depth the RAN is endeavouring to offset the current and prospective shortage of dedicated MCM assets with a Craft of Opportunity (COOP) programme. The COOP programme is aimed at augmenting permanent naval force MCM assets and involves identifying and listing civil sector craft best suited (with minimum alterations) for MCM employment on mobilisation. Various types of equipment may also be identified which allow the COOP to act as an auxiliary minesweepers or possibly minehunters.

The Royal Navy (RN) and United States Navy (USN) have invested considerable time and effort into investigating this concept. Ships Taken Up From Trade (STUFT) were widely used during the Falklands conflict by the RN.\textsuperscript{26} During the conflict the RN took five Hull stern trawlers up from trade and after limited conversion and

\textsuperscript{23} Hartmann, \textit{Weapons That Wait}, pp. 129, 130.
\textsuperscript{25} Suitable COOP must have sufficient towing power (bollard pull) and size (over 60 feet) and a low magnetic signature (wooden hulls).
storing they were commissioned as elements of the RN Eleventh MCM squadron. Little alteration was required to convert them to deep-water minesweepers and in less than two weeks after being taken up from trade they were on their way south to the Falklands. These sweepers encountered and swept minefields which were ‘... laid in a conventional fashion and covered anticipated shipping routes which would be followed by the British together with Barrier fields offshore protecting shore installations which might be the subject of British attack’.27 The sweepers were described as performing ‘... exceedingly well in their minesweeping role and by the beginning of July the task had been completed’.28 No trawler damage or loss was incurred.

The potential of the COOP concept was also demonstrated by American trials in 1980. During Exercise Solid Shield 80, a 25-metre fishing vessel was chartered by CINCLANTFLT (Commander-in-Chief, Atlantic Fleet). After comprehensive tests it exhibited a capability to perform mechanical, acoustic and magnetic sweeping in addition to route surveillance using sidescan sonar.29

Besides having the potential to satisfy the RAN requirement for auxiliary minesweeping and mine reconnaissance services on mobilisation, these vessels could be involved in regular route survey operations in which detailed knowledge of the seabed can be built up in peacetime. COOP craft could also make significant contributions to port breakout plans in wartime by making rapid mine reconnaissance sweeps.

Operation of COOP vessels has been identified as a possible additional mission area for the RAN Reserve (RANR) force. Thereby, use could be made of RANR personnel’s seagoing knowledge of their own ports and a direct peacetime investment return in the form of extensive and detailed route surveys would result. This would reduce the route survey burden at the onset of conflict and allow specialist MCM forces to concentrate at critical areas such as forward fleet anchorages and major port approaches.30
The COOP programme may have significant potential to enhance Australian mine reconnaissance, trawl sweep, mine neutralisation, influence sweep and perhaps minehunting capabilities. All COOP vessels need a precise navigation system and mechanical sweep equipment by which to counter conventional mines and perhaps STRMs. COOP could complement the MHI in inshore waters and operate in unsheltered shallow areas where the MHI could not effectively operate. The COOP also would require high-resolution side-scan sonar to do this job as well as some form of ROV for mine classification and neutralisation. A commercial ROV may very well prove adequate for this task since the RN made extensive and successful use of commercial ROVs during the 1984 Red Sea clearance operations.\(^{31}\)

Side-scan sonars can be easily fitted to low-tonnage vessels. This type of sonar scans either side of the ship with a fixed beam which passes across the bottom due to the ship’s forward motion. A permanent recording of seabed features can be made on tape for future use and comparative analysis during mine reconnaissance sweeps. The real advantage of using side-scan sonar is that it is a relatively quick and often effective method for mine reconnaissance and the initial confirmation of safe (swept) channels. However the major disadvantage of side-scan sonar is that the mine is only discovered once the vessel goes over the top of it! Side-scan sonar equipped COOP may nevertheless be used to examine a previously swept channel to ensure that mines have not been recently laid. This is a particularly important requirement for missions involving COOP lead escort of high-value shipping targets. Side-scan sonars for fitment to COOP vessels have undergone RAN assessment in conjunction with some identification, listing and inspection of potential COOP vessels. However, such a task probably requires considerably more manpower than is currently dedicated to it. The COOP programme requires more than compilation of a suitable vessel database. Fitting of equipment and above all the development of training procedures remain the tangible foundations of any successful COOP programme.\(^{32}\)

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31 The mine recovered during MCM operations was investigated by a civilian ‘Sea-Owl’ ROV of Swedish manufacture. See Truver, ‘Mines of August’, p. 109.

32 Even within the mine warfare community the difficulty of implementing an effective COOP programme is, in the author’s view, widely underestimated. Continual
A major attraction of the COOP method of MCM augmentation is its relative lack of expense:

(a) The programme makes use of available platforms, though substantial modification must still take place.

(b) 'Off-the-shelf' equipment purchases can be made. This includes some commercial side-scan sonars, ROVs33 and precision navigation equipment (e.g. LORAN-C34 and Mini-Ranger).

(c) Prompt and open purchase of spare parts can be made.

(d) Readily available commercial maintenance support can be used.

(e) Resources in the fishing and offshore industry can be drawn upon. This includes resources and equipment such as trawls, fish-finding sonars and the experience of local fishermen.

Consequently, the COOP programme recommends itself as a practical mine risk reduction resource. But it must be emphasised that such a programme is complementary to dedicated RAN MCM assets and should not be seen as a replacement for specialist systems. Table 4:1 summarises the envisaged RAN direct approach to MCMs in terms of force structure planning for the 1990s. In 1990 five COOP had been leased or purchased for dedicated RAN use and evaluation.

Unfortunately the COOP have very little in the way of dedicated MCM vessels to augment and plans for the defence of Australian ports, almost exclusively using COOP vessels, do not seem broad enough in scope. The following COOP strategy is proposed for Australian conditions:

(a) Nine ports to act as headquarters for COOP assets: Brisbane, Newcastle, Sydney, Melbourne, Hobart, Adelaide, Fremantle, Geraldton and Darwin. Full use would be made of Naval Reserve Port Divisions where

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practice, detailed preparation and complete familiarity with equipment are the fundamentals of direct mine countermeasures. These objectives can only be achieved by regularly sending RANR crews to train at sea, under realistic MCM conditions, with adequate equipment.

33 See above (note 32) regarding the use of civilian ROVs.

34 Commander R. Bell, Craft of Opportunity (COOP) Status Review Presentation, 21 August 1983. US Coast Guard trials in Charleston harbour have determined that the LORAN-C navigation system is accurate to within 30/50 metres if a port is surveyed for repeatability. LORAN-C is widely used by US fishing craft and accurate receivers are relatively inexpensive.
TABLE 4.1

RAN MCM FORCE STRUCTURE PLAN

<table>
<thead>
<tr>
<th></th>
<th>Shorter Term Contingencies</th>
<th>More Substantial Conflict</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Cost $m^2</td>
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<tr>
<td>Minehunters</td>
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<td></td>
</tr>
<tr>
<td>MH1</td>
<td>6</td>
<td>465</td>
</tr>
<tr>
<td>Minesweepers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COOP</td>
<td>10</td>
<td>47</td>
</tr>
</tbody>
</table>

Note:  (1) Manpower figure is based on ships' complements and assumes single crewing for the COOP.
(2) Costs are given in $A1988. Cost rises above these figures of approximately 20% can be expected, given the unanticipated extra cost of COOP fitment and modification in addition to MH1 sonar replacement and trialling costs. The project cost per MH1, assuming it reaches operational status in 1993, will be three times its originally estimated real cost.

ESTIMATED MANPOWER FOR MCM FORCE

<table>
<thead>
<tr>
<th></th>
<th>Service</th>
<th>Civilian</th>
<th>Reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Strength</td>
<td>123</td>
<td>11</td>
<td>50</td>
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<tr>
<td>Required Strength$^1$</td>
<td>345</td>
<td>33</td>
<td>276</td>
</tr>
<tr>
<td>Additional Manpower Required</td>
<td>222</td>
<td>22</td>
<td>226</td>
</tr>
</tbody>
</table>

Note:  (1) These estimates include manpower for ships' complements (including four crews per COOP), base and forward support (e.g., operations, supply, maintenance and administrative support) and a Mine Warfare Systems Centre.

they are currently in place and Port Divisions could be formed where they are not currently in place, e.g. Newcastle, Geraldton. These ports are evenly spaced around the continent and transit time of COOP to any trouble area would be reasonably short.

(b) During peacetime one COOP per port could be acquired or leased by the Commonwealth for RANR Service. This would become a dedicated Port Division training vessel and three RANR crews, comprising 10-12 men each, could be allocated to the vessel. Each crew could use the vessel for at least one weekend per month on a rotation basis. Actual mine reconnaissance operations could then be conducted at least monthly, and an up-to-date database could be maintained.

(c) During wartime, or under mine threat, a COOP squadron comprising three vessels would then be potentially available in each nominated port. The squadron would consist of the operational training vessel and the other two identified COOP, which will have been drawn into service and fitted with necessary equipments which would preferably be kept in store with the Port Division. One RANR crew per craft could man the squadron. Every attempt should be made to provide Port Divisions with equipment and training capable of allowing COOP to sweep (mechanical and influence) and, if possible, detect mines.

The Indirect Approach to MCMs

An indirect approach to MCMs includes being able to deter those who might deploy mines. If Australia develops an assertive mining capability equal to that of a potential adversary this would generally deter the opponent, since the same damage could be inflicted on him. The ability to deliver mines as a proportionate reprisal for the laying of mines in Australian waters is known as an assertive mining capability. If Australia were to develop a superior mining capability then it would appear irrational to act against Australia in terms of using mine deployments. A potent assertive mining capability can deter even the most resolute and 'irrational' foe. It is of interest to note that, as was the case with chemical weapons, the British and Germans both had pressure
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mines developed early in World War Two but each side refused to use them. Each nation was fully aware of the potential devastation which could be wrought by the other’s reciprocal capability and ‘... it was only on the direct orders of Hitler himself that their version [of the pressure mine] was used as a last desperate measure’.35

Another part of the indirect approach to MCM involves the education of ship operators and crews in basic Self-Defence Measures (SDMs), which can make a major difference when combating the mine menace. SDMs are listed in Table 4:2 and their aim is to minimise ship signatures and put as much water depth between the hull and the mine as possible, in order to reduce potential damage effects.

Deterrence of mining would be enhanced if a series of complementary MCM measures was undertaken, indicating Australian resistance to mine attack. Covert surface minelaying by merchant vessels in harbours and harbour approaches can be made more difficult by a system of random search and inspection visits before the vessels arrive in likely mine deployment areas. Submarine minelaying can be discouraged by using relatively economical acoustic detection arrays supported by mine charges in harbour defence rings around vital ports (see Chapter 9).

Aerial minelaying against Australia could be deterred and countered by an effective national air defence network and early warning radar system. Most aerially deployed, highly capable combat mines need some form of parachute to reduce velocity and hence shock prior to water entry. Consequently, even if enemy aircraft manage to infiltrate Australian airspace a system of minewatching could be effective in locating even approximate positions of air-deployed mines. After the first German magnetic mine deployments in World War Two, it was rapidly realised that knowledge of even an approximate position for aerial minelaying substantially reduced the time to sweep fields and gave early warning to divert shipping. The Reserve units that did this job were known as the Royal Naval Minewatching Service.

The Japanese also had success with ‘mine-spotting’, as they termed it, and this simple form of countermeasure contributed to alleviate some of the pressure of US mining attacks against the Japanese home islands in World War Two. Captain Kyuzo Tamura, IJN was interviewed by the US Strategic Bombing Survey concerning his role as

### Table 4:2 Self-Defence Measures (SDMs)*

<table>
<thead>
<tr>
<th>MAGNETIC</th>
<th>ACOUSTIC</th>
<th>PRESSURE</th>
<th>MOORED CONTACT/INFLUENCE</th>
<th>ELIPFI (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain Water-Tight Integrity (WTI)</td>
<td>Maintain WTI</td>
<td>Maintain WTI</td>
<td>Maintain WTI</td>
<td>Maintain WTI</td>
</tr>
<tr>
<td>Maintain constant speed and bearing</td>
<td>Maintain constant speed and bearing</td>
<td>Maintain constant speed and bearing</td>
<td>Maintain constant speed and bearing</td>
<td>Vary speed and bearing</td>
</tr>
<tr>
<td>Sail on high tide</td>
<td>Sail on high tide</td>
<td>Sail on high tide</td>
<td>Post lookouts</td>
<td>Sail on high tide</td>
</tr>
<tr>
<td>Degauss vessel</td>
<td>Maintain clean hull and propellers to reduce 'self-noise' and cavitation</td>
<td>Travel at very slow speed (4-6 knots) until safe depth achieved (60f metres) (1)</td>
<td>Helo reconnaissance</td>
<td>Use of acoustic decoys and explosive 'jamming'</td>
</tr>
<tr>
<td>Regular damage control drills</td>
<td>Turn off all non-essential equipments, especially rotating machinery</td>
<td>Sail with a heavy swell, to disguise own signature</td>
<td>Regular damage control drills</td>
<td>Regular damage control drills</td>
</tr>
<tr>
<td></td>
<td>Regular damage control drills</td>
<td>Regular damage control drills</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. An alternative method is to go 'flat out' and beat the suction 'hold on' time of the mine's pressure change detector. Most pressure mines are set to detonate after a suction or pressure drop is experienced for at least several seconds. This tactic is not recommended for the faint-hearted. For example, a 1000-metre destroyer attempting to overcome a mine with a 7-second (medium) hold on time would have to cover its own length in that time frame, i.e. make good 32.5 knots.

2. See Chapter 2 for a description of the Electric Potential Field (ELIPFI) effect.

a senior mine countermeasures officer in the Japanese Inner Zone. Tamura said:

The minelaying planes always laid their mines in a simple row which made it easy for our lookout activities to analyse the plan and determine where the mines were and adopt effective counter measures.36

Mine-watching is not necessarily an anachronism. It remains effective in the Australian context because aircraft capable of mining Australian shipping focal areas would have to be large, long-range types with a commensurate radar signature, and focal areas are often near significant population centres.

Yet another indirect method of minelaying deterrence involves bottom conditioning. Certain types of seabed assist rapid mine reconnaissance and efficient minehunting. During peacetime, safe routes can be determined which only need a few sweeps to ensure a high probability of safe transit during periods of mine threat. Appropriate seabeds are those where mines cannot be embedded, hidden amongst debris or rocky outcrops, or camouflaged. Removal of 'bottom junk', jettisoned by passing merchant ships, would have to be done regularly and heavy fines could be imposed on any vessel jettisoning any material capable of fouling the seabed in harbours or harbour approaches.

The Australian Minewarfare Pilot Survey (AMWPS), which is basically aimed at developing accurate sonar-derived charts of seabeds, also contributes as a mine countermeasure. This is by virtue of the fact that transit routes can be selected in peacetime and checked relatively rapidly in time of crisis.

A lightering system could also contribute to deterring mining in Australian waters by vastly increasing the number of mines needed for effective blockade of an area of coastline. Lightering involves taking essential cargoes off vessels near the shore using various types of barge or lighter. There are many points along the Australian coast where lightering of critical cargoes could be undertaken. The road transport system could take the job of conveyance when cargoes were ashore. Lightering provides a safe, though constricted, supply line for the

36 In S. Frey, The Offensive Minelaying Campaign Against Japan, NATMAT P-9810 (US Naval Material Command, Washington DC, 1969, reprinted from original by Naval Analysis Division, United States Strategic Bombing Survey, 1 November 1946) p. 37.
import of vital seaborne materials, such as certain chemicals, machine
tooling, capital equipment, weapons and other strategic materials. As
mentioned above, enemy minelaying capabilities would have to be
greatly expanded in order to attack all potential lightering points. For
example, during the Vietnam War only about 1,500 mines were used to
mine the three critical North Vietnamese ports. A further 8,500 were
required to seal areas of coast where lightering of cargoes was likely to
take place. In fact, government assessments made in the United States
during the mid-1960s noted lightering as a means by which the North
Vietnamese could adequately maintain seaborne imports. This
cclusion contributed to deterring the Americans from mining North
Vietnam for a number of years (see Chapter 7). A modest Australian
Lightering System (ALIS) could be instituted at relatively small cost
during an emergency and need not be restricted to barges. Modern
airships have high lift potentials of several hundred tonnes and could be
very effective in lifting cargoes from ships to nearby road links.37

It should be remembered that the indirect methods of MCM are
far from total solutions. Each measurably contributes to increasing the
cost and risk assessment of an adversary. A comprehensive array of
these cheap, indirect MCM methods, supporting direct methods of
MCM, would have a synergistic effect which would make Australia
much more resilient and less reactive to mine attack than is presently the
case.

An Australian Explosion-Resistant Multi-Influence Sweep System
(ERMISS)

Novelty in mine design is the aim of most mine development. Novelty
causes surprise, confusion and eventual closure of ports if no suitable
countermeasure is available and casualties mount. New mine types are
increasingly resistant to countermeasures and escape from a port may
require a countermeasure involving the simulation of ‘true ship’
phenomena. In 1979, after thirty-five years of association with mine
research and development at the highest level, the Director of the US
Naval Ordnance Laboratory stated:

... [there is] a point which I think to be of considerable
importance and it is this. As mines and their

37 See A. Stormer, ‘Airships: Prejudice Versus Potential’, Defence Force Journal, No. 11,
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mechanisms and their data processing computers become more sophisticated — and they are virtually at this stage now — they will be able to distinguish between a real target and the counter-measure designed to simulate it. It is now virtually impossible to sweep a mine which requires magnetic, acoustic and pressure influences properly sequenced in time without providing to the mine a simulator of these influences which is actually a ship! Therefore, the future of countermeasures may depend more on ordnance oriented devices than ship oriented devices.38

Consider the following hypothetical mine, which possesses characteristics capable of making it all but impossible to sweep or minehunt:

- The mine consists of 1500 lbs of special, sonar-absorbent plastic explosive with an implanted target detection device and firing circuit. Implants are effectively non-magnetic.
- It is irregularly shaped or moulded so as to look like a rock.
- It is well camouflaged in 40 metres of water; being surrounded by seabed debris, rocky outcrops and various mine-like objects.
- It is sensitive to pressure change and is set to fire when detecting a certain suction for a set minimum period. This suction is larger than that caused by the area’s normal surface swells at a depth of 40 metres. Also, to avoid premature activation of other circuits arising from the effects of larger than normal ocean swells, the pressure sensor is linked to a magnetic sensor which is capable of detecting magnetic aberrations associated with the ‘rolling’ of large, metal vessels.
- To activate the pressure detection circuit, the acoustic frequency band of a particular vessel type must be detected. This involves picking up the basic band and also three discrete spectral lines formed by the

38 Hartmann, Weapons That Wait, p. 129.
operation of three particular equipments on the target vessel type.

- The magnetic detector, which is also enabled by the acoustic 'fingerprint' device, must detect a specific rate of rise of flux density above that of the ambient magnetic field in order that the mine ignite.

- The mine contains a photo-electric unit responsive to rapid changes in the intensity of illumination brought about by the passage of a large opaque object anywhere within a 60-metre radius.

- It has a battery life of 5 years.

- It, and 30 others like it — except for varying target settings — are planted in the vicinity of Sydney Heads.

Such mines are not able to be swept or hunted using the direct countermeasure techniques discussed so far.

A possible solution for rapid port breakout under these conditions is the development of a full-scale explosive-resistant hull which can be 'driven' through an unsweepable/unhuntable minefield, detonating mines and clearing paths for specific target ships.

This concept has been tried with limited success in the past and two distinct approaches were usually taken. Actual ships' hulls were first reinforced and converted to 'guinea-pigs' that would make passes along channels while crew members were strapped into various positions or surrounded by mattresses. These vessels could only survive a very limited number of mine attacks and many were sunk outright during their first sweep. This was because the water/air interface at the hull acted as a barrier to the shock wave generated by mine ignition and the full force of the shock wave and whipping effect was experienced.39

Efforts were made to remedy this situation using huge, rubber, water-filled bags to simulate the effect of a ship's motion; that is, the slow but massive movement of a large body of water. Water was on both the inside and outside of the bag, so the bag acted as a 'window' to the shock wave and the explosive effect was transmitted harmlessly through the bag. However, the bag — known as the 'Loch Ness monster' — was impossible to tow and manoeuvre effectively. Its swept

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39 Elliot, Allied Minesweeping in World War 2, p. 91.
path was extremely narrow and other creations, such as huge unsinkable steel cylinders called ‘eggcrates’, had similar problems.40

In recent years serious attempts have been made to develop an explosion-resistant hull capable of good steerage, faithful reproduction of signatures and high resistance to multiple underwater explosions. NATO countries have been working on an Explosion-Resistant Multi-Influence Sweep System (ERMISS) to satisfy these requirements.41

In 1980 the NATO Naval Armaments Group (NNAG) indicated that the development of an ERMIS was within the scope of currently available technology.42 The NATO ERMIS was initially based on the captive air, space craft concept, involving an air-filled, rubberised hull surrounding a metal structure containing a number of vertical cellular elements partially filled with water. The cells were open at the top and sealed with flexible diaphragms at the bottom. The purpose of the flexible diaphragms was to transmit the momentum of the underwater explosion to the water mass in the cellular elements, which were essentially ballast tanks. A gridwork was set over the tops of these tanks for operational reasons. Of course, ballast water thrown up by an explosion must be allowed to pass freely through the grid so that shock wave energy is efficiently absorbed. The NATO ERMIS also included the provision of a shock-mounted bridge and a shock-mounted propulsion and fuel storage system.43

Unfortunately, the NATO ERMIS proved to be extremely expensive, due to its novel and sophisticated cellular construction features. Active research on the NATO ERMIS in Europe was stopped after a few years due to excessive costs derived from a failure to simplify the structure. To simplify construction, an Australian ERMIS should take the form of a large, self-propelled, water-filled metal hull buoyed by a plastic gridwork deck. It would also need a shock-mounted bridge and deck space for the streaming of an electro-mechanical acoustic sweep capable of underwater projection of the pre-recorded frequency

40 The original ‘eggcrate’ was a steel-built compartmentalised barge built by the British and Americans when German pressure mines appeared off Normandy. This design proved inadequate and an unsinkable cylinder called the XMAP, which was 100 feet long and 25 feet in diameter, was tested. Once again, this design proved impossible to manoeuvre. (See Hartmann, Weapons That Wait, pp. 92, 132.)
43 ibid., p. 28.
spectrum of a variety of target vessels. Magnetic buoyant dyads might be streamed to increase the ERMISS magnetic signature, so that larger vessel signatures could be replicated.

An Australian ERMISS would need to be large enough and fast enough to generate a reasonable pressure signature, to cover the larger type of merchant and container vessels plying Australian waters. A suitable total displacement would be of the order of 10,000 tonnes and the vessel would have to be capable of making good 10 knots in 40 metres of water. (This is because 9 knots is the maximum safe speed for ships of such size in that depth.) Pressure sweeping out to this depth would allow larger vessels led by ERMISS to slowly proceed by themselves until deeper water was reached. For example, a 30,000-tonne vessel could proceed unescorted fairly safely at a speed of 5 knots once it passed the 40-metre isobath. This speed would allow it to make headway in moderate seas while reducing its pressure signature considerably. The ERMISS would make a number of sweeps prior to leading vessels into a dangerous area.

If the ERMISS was required to pressure sweep at greater depths it would have to be capable of far greater speed, in order to exert a detectable pressure influence on the seabed. This derives from the fact that seabed pressure increase is proportional to the square of the ship’s speed. A 10,000-tonne ERMISS could not make good a speed greater than 10 knots without a massive and very expensive boost to total engine horsepower. Indeed, the ERMISS proposed in this section would almost certainly require a total engine output in excess of 4,000 horsepower to propel 10,000 tonnes at a speed of 10 knots. Nevertheless, such a vessel could be a suitable answer to even the most

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44 It would be impractical to build an ERMISS of displacement exceeding 15,000-20,000 tons since such a vessel would be all but impossible to propel at any speed greater than a few knots.

45 Elliot, Allied Minesweeping in World War 2, p. 118. 10,000 tonnes is the approximate displacement of a ‘Liberty ship’. The reference cites the safe speeds given by the Admiralty in certain depths of water for certain types of vessel. For example, the maximum safe speeds (against pressure mines) in depths of 10 and 20 fathoms (20 and 40 metres) are given as 4 and 9 knots respectively.

46 30-40,000 tonnes was the approximate displacement of a World War Two battleship (ibid.).


48 This is a substantial power requirement, which could not be provided from a single or even two engines given the nature of the vessel’s construction. Up to 8 x 500 hp engines would have to be outrigged and shock-mounted.
Menacing of mines in the most dangerous water depths (10 to 40 metres). It is in this depth range that a majority of vessels are sunk outright. This is because high-explosive bottom charges of less than 1,000 pounds are seldom able to actually sink soundly constructed vessels in depths greater than 40 metres.

Given its simplicity of construction and general lack of engineering sophistication, the proposed ERMISS may be a relatively cheap and quite effective complement to the MCM force. Certainly the ERMISS could be used to 'bulldoze' through a number of minefield types during emergencies, when time constraints may prohibit more sophisticated solutions being attempted. While hardly an ideal solution, the ERMISS is a viable MCM adjunct in a spectrum of MCM capabilities needed to combat the variety of potential threats posed by future mine developments.

The Australian MCM Plan (AMCMP): An Integrated Solution

The AMCMP depicted in Figure 4:2 directly relates mine threat levels, as described in Chapter 3, to appropriate countermeasures which have been outlined in this chapter. Four basic MCM capabilities or techniques should be in place at all levels of threat, even at the relatively low level 1 threat, which should be guarded against at all times. These basic capabilities are:

**Level 1 — MCM**

(a) training and education in the use of Self-Defence Measures (SDMs);
(b) maintaining an effective inshore minehunting/mine reconnaissance capability;
(c) ensuring that regular and comprehensive ‘Q’ route or port breakout surveys of major ports are conducted; and
(d) establishment of a comprehensive craft of opportunity programme as described in this chapter.

To cope with the level 1 threat, well-mapped ‘Q’ or port breakout routes should be in existence in major ports and COOP vessels should be available for regular mine reconnaissance capable of quickly determining any change in seabed conditions in terms of the presence of mine-like objects. Also, a purpose-built, proven and operational minehunter must be available to neutralise mines if they are laid. Approximately four such MHI craft would be needed for the east coast and four for the west
FIGURE 4:2
THE AUSTRALIAN MCM PLAN

MINE THREAT SPECTRUM

APPROPRIATE COUNTERMEASURES

1. NUISANCE THREATS
2. DISSIDENT/LOW LEVEL TERRORIST ATTACK
3. HARASSMENT MINEFIELDS
4. DISSOLUTION MINEFIELDS
5. BLOCKAGE MINEFIELDS

INCREASING THREAT

High Level Threats
Medium Level Threats
Low Level Threats
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cost. This would provide basic protection for two vital ports on each coast.
All ships' masters should also be aware of the basic self-defence measures that can be taken against various types of mine. SDM drills can be conducted at negligible cost and should be conducted on a regular basis.

Level 2 — MCM
The MCM capabilities required for a level 1 threat are also required for second tier threats. In addition, covert surface minelaying by merchant vessels in harbours and harbour approaches may be rendered more difficult by implementing a system of random search and inspection visits before the vessels arrive in likely mine deployment areas. This level of threat may also warrant the deployment of an ERMISS.

While the basic design elements of a potential Australian purpose-built ERMISS have been described, cheaper ERMISS craft or 'guinea-pig' ships are available in the form of large, heavily built merchant vessels which can be further structurally reinforced so as not to be sunk by multiple, normal mine explosions. This type of vessel enables the (skeleton) crew to be kept at a safe distance above the water line; shock-mounted, remote bridges can be installed as added protection. Also, this type of vessel (20,000-35,000 tons) is widely available second-hand in world markets at costs ranging from approximately $A5-20 million for hulls built in the 1970s.49
An added advantage of acquiring two such vessels, one for each coast, is that techniques exist by which to rapidly convert them to helicopter carriers capable of carrying and supporting approximately eight utility helicopters or six of the larger Anti-Submarine Warfare (ASW) variety.50 The purchase of such vessels at relatively cheap prices merits further consideration,

49 A monthly record of world-wide merchant ship sales can be found in Lloyd's Ship Manager, a monthly publication produced by Lloyd's of London. Listings of monthly shipping transactions detail types of vessel sold and numbers of tankers, bulk carriers, etc. laid up world-wide.

50 See Vikinge, 'Rethinking RAN Missions', Journal of the Australian Naval Institute, November 1987, p. 16 for a description of the Arapahoe helicopter carrier conversion kit.
especially given their multi-role capability and the importance of their roles given Australia’s strategic priorities.51

**Level 3 — MCM**

This threat level would be mitigated by the deployment of an ERMISS to ‘bulldoze’ a path through a suspected minefield or minefields and rapidly confirm the integrity of ‘Q’ routes. This tier of threat would also warrant limited bottom conditioning of ‘Q’ routes. Certain types of seabed assist rapid mine reconnaissance and efficient minehunting. During peacetime, routes can be determined which only need a few sweeps to ensure a high probability of safe transit during periods of mine threat. Appropriate seabeds are those where mines cannot be embedded in mud, hidden among rocky outcrops or ocean gullies, or easily camouflaged. Removal of ‘bottom junk’ deposited by transiting ships could be selectively undertaken on a regular basis and heavy fines could be imposed on vessels jettisoning any material capable of fouling the seabed in critical harbours or harbour approaches.

**Level 4 — MCM**

At this level of threat a quantum increase in operational mine countermeasures capability is necessary, given that the potential for escalation into a ‘hot’ or shooting war has substantially increased. All MCM capabilities previously discussed will probably be needed. An effective, purpose-built Ocean Minesweeper (MSO) would be required to sweep for mines in the 90-200-metre depth range, since fields could be laid in the vicinity of oil/gas rigs and in any disputed areas in or near Australia’s Exclusive Economic Zone (EEZ). About 80 per cent of the EEZ is 200 metres or less in depth. COOP and their crews would generally not have the operational endurance and crew expertise for sustained operations in this type of environment and specialised mines, such as STRMs, may be encountered in these depths. The magnetic, acoustic and electromagnetic signatures of the COOP would also probably not be ‘clean’ enough for operations involving a larger number of more capable mines.

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51 One of Australia’s strategic priorities is enhancing the stability of the South West Pacific and a lack of helo-lift capability was keenly felt by ADF forces during the Fijian coups of 1987.
The MSO would need to be capable of both influence and mechanical sweeping and may ideally be equipped with a side-scan sonar for mine detection and classification. The Thomson Sintra DUBM 42 side-scan sonar could be effective in this role, given that it is said to operate between depths of 80 and 300 metres with a 'swept path' of 400 metres (200 metres on each side), and to be capable of detection and classification in a single pass.52

At level 4 a _de facto_ state of war, albeit pitched at a muted level, exists. It is therefore important that Australia should have a demonstrable capability to reciprocate the threat and thus deter escalation. An assertive minelaying capability, with the potential to be used in reprisal for the laying of mines in Australian waters or against Australian allies, is therefore highly desirable.53

The development of an assertive minelaying capability is probably the most important means of higher level MCM because of its deterrent value, in terms of giving Australia the ability to inflict at least as much economic hurt on an aggressor as Australia might suffer.

In addition to the deterrent value of assertive minelaying as a primary mine countermeasure, other benefits of the proposed Australian Mine-Use Model (AMUM)54 include the advantages offered for conflict management in a variety of contingencies ranging from low-intensity conflict to higher level contingencies.

_Level 5 — MCM_

The persistent and potentially costly threat posed by dislocation fields could best be countered, or at least mitigated, by deploying Australian counter-value reprisal minefields in the territorial waters of the aggressor, to keep him occupied with his own MCM problems and to deter further action against Australia.55

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52 Dawson and Hewish, ‘Mine Warfare’, p. 980.
53 See Chapter 9 for further discussion of the need for Australia to develop an assertive minelaying capability, the family of Australian-produced mines which could provide this capability, and methods of assertive deployment.
54 See Chapter 9.
55 Chapter 9 describes these fields and lists the arguments for their deployment.
Since a degree of overt minelaying by aircraft may be involved, a mine-spotting system could be cheaply instituted in and around important ports and shipping focal areas in emergencies. During the US mining of the rivers, harbours and coasts of North Vietnam, the Vietnamese made extremely accurate maps of US minefields using mine-spotting techniques and, in fact, these maps were reportedly more accurate than US maps and were extensively used by the Americans during US Operation Endsweep clearance operations during 1973. As with countering buoyant contact mines, the simple merit of the ‘Mk 1 human eye-ball’ should not be underestimated! Mine-spotting also involves the use of clearance divers on towed underwater sleds to visually detect bottom mines. This method of detection and classification can be very effective and rapid under suitable water and operational conditions. Since minelaying surface vessels, submarines and aircraft may be involved in ‘topping up’ dislocation fields on an opportunity basis, certain means of deception may be employed to make their minelaying task more difficult and less accurate. Captain Kruder of the German raider *Pinguin*, during his minelays off the NSW coast, noted in his log on 28 October 1940 that ‘... lights are shining in accordance with peacetime regulations’. This made accurate minelays possible by giving him his exact position. Despite the use of modern navigational aids, such as satellite navigation, minelaying platforms can be deceived by turning off certain navigational aids, such as radio beacons and lights, and setting up dummy aids designed to increase the probability that mines are laid in the wrong place. Mine warfare in terms of minelaying and mine countermeasures demands the highest levels of human cunning. Means of deceiving the minelayer and making his job more difficult are only limited by the boldness and imagination of a nation’s mine warfare community. Both boldness and imagination have been lacking in many Australian MCM efforts to date.

56 For a first-hand account of the Endsweep operation see McCauley, ‘Operation Endsweep’. Admiral McCauley was in command of all US mine clearance in North Vietnamese waters 1972-73.

57 Ruge, *Seawarfare* 1939-1945, p. 138. Vice-Admiral Friedrich Ruge was the senior German mine warfare officer throughout World War Two. Ruge described Kruder as ‘... the most successful and enterprising of the Raider Captains’.
Of course, interference with navigational aids can be as dangerous, if not more dangerous, to one's own shipping than to that of the enemy (if proper organisational and adequate security arrangements are not made), but significant success can nevertheless be achieved. In mine countermeasures, every bit of success helps.

**Level 6 — MCM**

At this level, substantial resources would be dedicated by an enemy to blockading several Australian ports. It is likely that the widest possible mix of mines would be used, so that maximum demands could be made on Australian MCM capabilities.

Various forms of obstructor mines could be sprinkled through fields, together with specialised mines aimed specifically at destroying MCMVs attempting to break the blockade. Mixed fields could include standard bottom mines, STRMs, moored contact and influence mines, bouquet mines and even independent or floating mines.58 Mine setting parameters could also be varied, to maximise the difficulty of the MCM task. Among the common parameters that could be varied are:

- Ship count number.
- Intercount dormant period.
- Sensitivity setting (milligauss — magnetic, modulation pulse cycle — acoustic).
- Rate of rise levels (magnetic, acoustic).
- 'Hold-on' time (pressure 3-15 seconds).
- Arming delay time.
- Delayed rise time.
- Sterilisation/self-detonation time.
- Field detector (vertical component, horizontal component, vectored or total field).
- Acoustic level (audio, low or high frequency).

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58 'Mixed bag' minefields draw an enormously disproportionate response. A combination of expensive countermeasures is required to counter them over a long period of time.

59 A=Acoustic, M=Magnetic, P=Pressure, S=Seismic, are actuation signature types commonly used.
The range of mine types and deployments could be made very large and would have to be met with an equally formidable and cunning range of countermeasures. In addition to all the countermeasures previously discussed, an Australian Lightering System (ALIS) could be introduced in emergencies involving critical cargoes.

Conclusion

Conventional forms of mine countermeasures are extremely expensive and time-consuming, since the initiative invariably lies with the mine designer and the mine itself will always have an inherently high degree of ‘invisibility’. The Australian MCM Plan (AMCMP) relates threat levels to appropriate countermeasures and suggests a systematic, integrated approach to Australian mine countermeasures.

The Australian Defence Force is making some progress in ancillary aspects of mine countermeasures, such as the COOP programme and influence sweeping. However, apart from Mine Warfare Pilot Survey (MWPS) work, little research has gone into the indirect forms of mine countermeasures, which include self-defence measures, search and inspection procedures, bottom conditioning, ALIS, re-routing tactics, mine-spotting and above all the development of a solid and diversified general mining capability.

No one method can suffice for mine countermeasures, for the mine will always have too many advantages. What is important is confronting the mine and its layer with a broad selection of direct and indirect countermeasures that will deter the layer and, if that fails, at least compromise the mines’ effectiveness. By adopting the MCM methods depicted in the AMCMP, Australia can have an effective and affordable MCM system that derives its strength from the synergistic effects of mutually reinforcing techniques.60

60 The Sub-Committee on Defence Matters of the Joint Parliamentary Committee on Foreign Affairs, Defence and Trade has addressed the dilapidated state of Australian MCMs. (See Parliament of the Commonwealth of Australia, Joint Committee on Foreign Affairs, Defence and Trade, The Priorities For Australia’s Mine Countermeasure Needs (Australian Government Publishing Service, Canberra, 1989).) The Committee felt ‘... compelled to record its strong dissatisfaction with the fact that the MCM program has been so inordinantly protracted’ (p.xxi, paragraph 19). This conclusion is fair comment, but unfortunately the Committee lacked independent technical advice on which to base judgements on much of the evidence put before it and its report was therefore not as penetrating as it needed to be.
CHAPTER FIVE
OPERATIONAL ASPECTS OF MINE-USE

The Mine’s Combat Record

Effective weapons are highly valued and extensively used in time of war. The mine is no exception to this rule, as indicated in Table 5:1. Mine use has been widespread throughout this century, with almost one and a half million units being deployed in the seas and major river systems of the world. As will be seen in the operational case studies to follow, the mine has achieved its most spectacular successes when used by nations smaller in terms of maritime strength.

The main reasons for the consistent and extensive use of mines this century have been their inherent flexibility in the sea denial role, their availability and their well-established reputation for cost-effectiveness. Of course, these factors still apply to the same or an even greater extent than in World War Two (see Chapter 8). The aim of this chapter is to examine the political utility of mine-use in modern times.

Ship Sinkings Versus Shipping Control

During the two world wars the mine was used widely by all major powers and by many smaller nations. Enormous damage was inflicted on the combat and merchant fleets of Britain, Germany, Japan and the United States. Approximately 100,000 mines were laid in offensive minefields (i.e., minefields laid in enemy-controlled waters) by the US and UK during World War Two. These mines sank or damaged a total of 2,665 vessels, giving an overall result of one ‘ship attack’ for every 37 mines deployed.2 The Germans alone lost 250 combat vessels and 800 merchant vessels sunk, together with 540 ships damaged.3 For a detailed examination of the widespread military and general economic havoc created by the use of offensive fields against a nation in World War Two see Table 5:2:4

1 ibid., p. 236.
2 ibid.
3 Cowie, Mines, Minelayers and Minelaying, p. 166.
4 See ibid., p. 190, for a discussion on the disproportionate effect of sinking ‘specialised craft’ such as ferries, dredges, tugs, etc.
TABLE 5.1
MINE-USE IN THE TWENTIETH CENTURY

<table>
<thead>
<tr>
<th></th>
<th>Russo-Japanese War</th>
<th>WWI</th>
<th>WWII</th>
<th>India-Korean-Pakistan War</th>
<th>War</th>
<th>Vietnam War</th>
<th>Kippur 1980-90 War</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>45,000</td>
<td>223,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria-Hungary</td>
<td>6,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>900</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>1,000</td>
<td>51,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td></td>
<td>5,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulgaria</td>
<td></td>
<td>1,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rumania</td>
<td></td>
<td>6,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>129,000</td>
<td>263,376</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USA</td>
<td>57,600</td>
<td>44,000</td>
<td>333,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>USSR/Russia</td>
<td>1,000</td>
<td>52,000</td>
<td>40,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td>12,000</td>
<td>54,457</td>
<td></td>
<td></td>
<td></td>
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<td>France</td>
<td>5,000</td>
<td>?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denmark</td>
<td>1,200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Norway</td>
<td>400</td>
<td>5,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td>4,346</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Greece</td>
<td>?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poland</td>
<td>110</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N. Korea</td>
<td></td>
<td>3,500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Others*</td>
<td>600</td>
<td>1,000</td>
<td>2,000</td>
<td>5,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2,000</td>
<td>309,700</td>
<td>700,000</td>
<td>3,500</td>
<td>1,000</td>
<td>333,000</td>
<td>2,000</td>
</tr>
</tbody>
</table>

* In the 1980s 'others' include Argentina, Iran, Iraq, Libya and various Central American resistance groups, as described in Chapter 3.

Source: Updated table based on Hartmann, Weapons That Wait, p. 240.
TABLE 5:2
GERMAN CASUALTIES DUE TO BRITISH MINES, WWII

<table>
<thead>
<tr>
<th>Type of Enemy Ship</th>
<th>Surface Vessels</th>
<th>Submarines</th>
<th>Aircraft</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sunk</td>
<td>Damaged</td>
<td>Sunk</td>
<td>Damaged</td>
</tr>
<tr>
<td>Battleships</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Battle-cruisers</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Destroyers and torpedo boats</td>
<td>12</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Minelayers</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Patrano escort vessels</td>
<td>3</td>
<td>8</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>U-boats</td>
<td>17.5</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Sperrbrechers</td>
<td>9</td>
<td>3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Minesweepers</td>
<td>8</td>
<td>14</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>E-boats</td>
<td>5</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>R-boats</td>
<td>7</td>
<td>9</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Naval auxiliaries</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Depot ships</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Merchant vessels</td>
<td>38</td>
<td>7</td>
<td>34</td>
<td>3</td>
</tr>
<tr>
<td>Tankers</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Train ferries</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dredgers</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tugs</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Armed trawlers</td>
<td>3</td>
<td>-</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>Sailing vessels and small craft</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Fishing vessels</td>
<td>7</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lighters and barges</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Unclassified</td>
<td>9</td>
<td>1</td>
<td>6</td>
<td>-</td>
</tr>
</tbody>
</table>

Totals                    | 124.5| 50   | 59   | 8     | 864  | 483     | 1047.5| 541     | 1588.5       |

A total of 75,000 mines was required to achieve these massive German losses (47 mines per casualty). Japanese losses were even more severe in relative terms, since 1075 vessels were sunk or damaged by 25,000 mines. This works out at one Japanese casualty per 23 mines deployed. German offensive mines managed to sink 281 combat vessels and 296 merchant ships and damage many more.\(^5\)

Ship sinkings, however, are only one aspect of the use of minefields. Minefields are often used simply to control ship movements. Naval blockade is often their primary mission and a blockade is really only one hundred per cent successful when no ships are sunk. The more a minefield can control ship sailings, the greater the effectiveness of the minefield. This control stems from perceptions of potential damage which could result from challenging minefields. Achieving a level of control over enemy movement is obviously a major advantage in warfare. The ships that remained in port in World War Two and did not challenge the minefields were certainly not disabled, but neither could these vessels contribute to disabling anything else. These factors are as relevant to victory as ship sinkings.

In most of its applications the minefield performs a unique function, which was specified when Vice-Admiral Friedrich Ruge commented that:

> The mine is the only weapon of naval warfare that is to some extent capable of altering geographic circumstances by making certain areas unpassable to ships. Thus an area which has been declared dangerous because of the use of mines is usually treated with great respect and is avoided as though it is land.\(^6\)

Minefields can seldom be used as complete substitutes for the activities of mobile forces, yet they can supplement these forces and act as a powerful force multiplier to enhance the effectiveness of a nation’s air, sea and land forces. The utility of minefields is best appreciated by considering a number of the traditional military applications of minefields, as a basis for contemplating their potential use in the defence of Australia. Traditional uses of minefields include:

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(1) Choke-point blockade.
(2) Counter-amphibious operations.
(3) Strategic blockade.
(4) Tactical blockade.
(5) Economic warfare.
(6) Forced re-routing operations.
(7) Ambush operations.

Operational Aspects of Mine-Use

Case 1 — Choke-Point Blockade: The Dardanelles, 1915

Few Australians associate the mine with the Gallipoli campaign of 1915. But there is an interesting, if tragic, link between the mine and the landing of ANZACs on the Gallipoli Peninsula in April 1915.

The basic concept of the Dardanelles expedition was for the British Navy to force the Dardanelles, attack Constantinople and eliminate Turkey from World War One. At that time Turkey was militarily weak and no problem was envisaged by the British Admiralty if a sufficiently strong naval force was dedicated to forcing the straits by simply pulverising coastal fortifications. A powerful Anglo-French Naval Task Force was assembled for the operation in the Aegean Sea. The force consisted of 8 Dreadnoughts (heavy battleships), 3 cruisers, 15 destroyers, 4 submarines and a large number of auxiliary vessels including several minesweepers. Leading the British force was HMS Queen Elizabeth, the newest and most powerful battleship in the world.

It was known to the British that German naval and military advisers were organising the defence of Turkey. A German Flag Officer (Rear-Admiral Von Usedom) was at the time Turkish Naval Commander and this officer had extensive experience in mining and harbour defence. Von Usedom had been the Imperial German Navy’s Inspector-General of Coastal Artillery and Mines, and would use these weapons to frustrate the Allied attacks. By mid-February 1915 ten rows of mines had been set up in the narrows of the Dardanelles from Chanak to Kephez Bay (see Figure 5:1). These fields were covered by fixed and

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8 ibid., p. 30.
FIGURE 5:1
THE DARDANELLES MINEFIELDS, 1915

mobile shore artillery batteries. This combination of weapons, involving mines supported by coastal artillery, was to prove decisive.9

On 1 March sweepers started to work the Kephez fields, but they were driven off by Turkish shore artillery fire. Follow-up sweeps failed to penetrate the fields, even with covering fire from cruisers and battleships (which could not bring accurate fire to bear on the shore batteries until the mines were swept). Attempts to neutralise shore batteries by indirect fire across the Gallipoli Peninsula failed, despite valuable assistance from spotter aircraft.

On 13 March the British cruiser HMS *Amethyst* was badly damaged by enemy gunfire. This caused the Admiralty to first seriously consider the landing of troops to silence the shore batteries. However, a major naval effort was planned for 18 March. This would involve all the naval resources on station and supposedly muster enough firepower to obliterate Turkish defences while sweeping took place simultaneously. The planning memorandum for the 18 March operation stated:

> The general idea is to silence the defences of the narrows and of the minefield simultaneously, so as to enable the sweepers to clear a passage through the Kephez minefield; if this is successful the attack will be at once continued on the remaining defences until the fleet has passed through the Dardanelles.10

At 11.00 the formidable Anglo-French Task Force went into action against the thinly spread Turkish mine and coastal defences. A witness at the time said of the Allied naval force:

> It was an unforgettable picture of aloof grandeur and made an immense impression on all who saw it, it looked as if no human power could withstand such an array of might and power.11

The first mine casualty took place at 13.45, when the French Dreadnought *Bouvet* struck a mine and sank within three minutes. Of a ship's company totalling 709 officers and men only 71 survived. At 16.11 the British Dreadnought *Inflexible* was seriously damaged when it

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9 See ibid., pp. 60-64. See also J. Meacham, "Four Mining Campaigns: An Historical Analysis of the Decisions of the Commanders", *Naval War College Review*, June 1967, pp. 77-86.
11 James, *Gallipoli*, p. 60.
struck a mine and just managed to clear the strait and beach on the island of Tenedos. Three minutes after *Inflexible* was mined the Dreadnought *Irresistible* was mined and quickly sank. A few hours later, at 19.00, the Dreadnought HMS *Ocean* met the same fate.

Shortly after the sinking of HMS *Ocean* a meeting was conducted aboard HMS *Queen Elizabeth* to assess the situation. Vice-Admiral De Roebuck, Naval Commander-in-Chief of the force '... was brooding over the events of March 18th. To [Commodores] Keyes and Wemyss he spoke mournfully of disaster and could not be lifted out of his gloom'. The meeting concluded that:

... the battleships could not force the straits until the minefield had been cleared ... the minefield could not be cleared until the concealed guns which defended them could be destroyed, and they could not be destroyed until the [Gallipoli] Peninsula was in our hands, hence we should have to seize it with the Army.

The fleet would no longer try to force the Dardanelles and De Roebuck sent what proved to be a fateful telegram to the Admiralty stating:

Mine menace will continue until Marmora is reached, being much greater than anticipated ... I think it will be necessary to take and occupy Gallipoli Peninsula before it is possible to force the straits with first rate ships.

The Admiralty accepted De Roebucks' recommendation and:

... the drama moved on into one of the most miserable land campaigns in history, resulting in enormous casualties for the Allies, and accomplishing nothing.

**Case 2 — Counter-Amphibious: Wonsan, Korea, 1950**

In September 1950, General MacArthur facilitated the UN breakout from the Pusan perimeter by making a major amphibious landing at Inchon. To shorten supply lines for his follow-up attacks against the North

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12 ibid., p. 65.
15 Meacham, ‘Four Mining Campaigns’, p. 82.
Koreans, he decided that a Korean east coast port would be required. The port selected was Wonsan. Mines of the moored and bottom variety were expected at Wonsan and a minesweeping force of a dozen sweepers began on 10 October to clear the way for the UN invasion force, which was due to land on 20 October. The area to be swept was about 50 square miles and the assault force would consist of some 250 ships conveying the X US Army Corps (approximately 70,000 troops).

On 12 October two US sweepers were mined and sunk by Soviet-made moored contact mines. Sweeping continued until 18 October, when a sweeper was obliterated by a bottom mine detonating below its keel in very shallow water.

The landing was delayed until 25 October, during which time the invasion force steamed in circles for five days and Wonsan was eventually captured by South Korean Army units. Of the 3,500 Soviet mines laid by peasants, fishermen and North Korean troops — from junks and sampans — only 91 moored and 6 magnetic mines were actually swept by 25 October. Most of the moored mines were of World War One and pre-World War Two vintage. Many dated back to the Russo-Japanese War of 1905.

Vice-Admiral A.E. Smith, Commander of the US Advance Force, assessed the situation at Wonsan as follows:

At Wonsan with 10 days allowed for mine-sweeping, it required 16 days to get ... into the beaches. Probably more risk could have been accepted, if necessary and one or two days cut off the extra six. As it was there had been some talk of the delay in the landing being the cause of the Chinese divisions gaining positions in North Korea. At any rate, if the Korean Campaign had depended on the time factor in landing at Wonsan, a failure might have resulted.

A signal sent by Smith to the US Chief of Naval Operations (CNO) in Washington went to the extent of stating that 'The US Navy

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16 See C. Cagle and F. Manson, *The Sea War in Korea* (US Naval Institute, Annapolis, 1957), pp. 118-121, for a discussion of the background to the decision to land at Wonsan.
17 Meacham, 'Four Mining Campaigns', p. 106.
18 Discussed in Chapter 3, above.
Mine Warfare in Australia’s First Line of Defence

has lost command of the sea in Korea waters...'.20 The US CNO, Admiral P. Sherman, supported Smith at a press conference when commenting:

Let’s admit it ... They caught us with our pants down. Those damn mines cost us eight days’ delay in getting the troops ashore and more than two hundred casualties. That’s bad enough. But I can all-too-easy think of circumstances when eight days delay offshore could mean losing a war ... Hoke’s [Smith’s] right; when you can’t go where you want to, you haven’t got command of the sea. And command of the sea is a rock bottom foundation of all our war plans. We’ve been plenty submarine conscious and air-conscious. Now we’re going to start getting mine conscious — beginning last week.21

Case 3 — Strategic Blockade: Eastern Baltic, 1941-45

In 1941 the Soviet Navy had the largest submarine force in the world.22 This submarine force was supported by a fairly large surface fleet and was based in and around the major Baltic port of Leningrad. On the eve of Germany declaring war against the USSR, German aircraft laid a dense mine blockade off Leningrad and other Baltic ports. These fields were later reinforced with large submarine nets. As the Germans started to occupy other Russian ports, Soviet vessels had to run the mine blockade to enter Leningrad. Heavy Russian losses were experienced. For example, one flotilla steaming for Leningrad from Tallin in August 1941 lost 53 vessels of the 197 ships that originally set sail.23 Also, heavy losses of Russian submarines trying to break out of the port blockades were experienced and, until the end of the war, the Russian submarine service, and fleet in general, ceased to be a force to be reckoned with. Practically all German submarines were able to concentrate on the naval

20 Cagle and Manson, The Sea War in Korea, p. 142.
21 Cited in ibid., pp. 142-143.
22 S. Gorshkov, ‘Navies in War and in Peace’, translation published in US Naval Institute Proceedings, June 1974, p. 47. By 1 September 1939, the Soviet Navy had 165 submarines on inventory (p. 50). Germany and Japan had 57 and 58 submarines respectively at this time.
war against Britain (and later the United States), thus fighting the maritime war on one front only.

Case 4 — Tactical Harbour Blockade: Pelau, 1944

On the evening of 30 March 1944, US carrier-borne aircraft laid 78 bottom influence mines in the harbour approaches to the Pelau Atoll anchorages used by the Japanese. Thirty Japanese warships and auxiliary vessels were at anchor in the atoll. The Japanese force remained in harbour, rather than challenge the mines without an intensive minesweeping effort. A US bombing attack soon followed in which all Japanese ships were destroyed. A few days later the Japanese lost a further three ships, mined and sunk on trying to enter harbour. Additional minefields were then planted, including some mines with long arming delays. These mines posed a persistent threat that forced the Japanese to abandon Pelau as a naval base for the duration of the war.24

Case 5 — Economic Warfare: Operation Starvation, 1945

The mine can be an effective weapon of economic warfare. Commenting on requests to use mines in this capacity, the World War Two Director of British Minelaying stated:

Frequently, however, they [requests] come from other ministries, and in particular from the Ministry of Economic Warfare, to whose strangulatory processes the laying of mines was well attuned.25

An example of the devastating effect minefields can have on an economy is provided by the US aerial minelaying campaign against the Japanese Inner Sea Zone in 1945, designated Operation Starvation. The aim of the campaign was to complete the destruction of Japanese sea lines of communication, thus:

- preventing the importation of raw materials and food into Japan;
- preventing the supply and deployment of her military forces; and

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- disrupting marine transportation within the inland sea.26

It was considered that a dedicated mining effort would essentially stop all imports into Japan; first of raw materials and then of food. Japanese industry would be incapacitated and starvation of the population would ensue. Economic blockade could only be achieved using air power at this stage of the war, since submarines and surface craft were susceptible to heavy shore battery fire and ASW defence forces in the Inner Zone.

Prior to the aerial minelaying campaign, 2,000,000 gross tons of shipping was available to Japan in vessels displacing over 1,000 tons. This total tonnage was deemed to be the minimum which Japan would have to sustain in order to maintain an adequate wartime industrial output.27

In late 1944, most Japanese shipping passed the Shimonoseki Strait between the Sea of Japan, the Inland Sea and the coasts of Korea and China. During 1944, 80% of oil supplies, 88% of iron ore, 24% of coal and 20% of Japanese food was bought by sea traffic through the inner zone. By early 1945, Japan had withdrawn most of its shipping to this zone, from which the economy of the Japanese islands could be maintained.28

During Operation Starvation, B-29 aircraft planted 12,135 mines (4,900 magnetic, 3,500 acoustic, 2,900 pressure and 700 low-frequency acoustic). Each plane was capable of carrying 12,000-14,000 lbs of ordnance in a combat radius of 1,500 miles. The mines were dropped from altitudes between 5,000 and 8,000 feet and ordnance comprised 1,000 and 2,000 lb mines.29

Japanese records indicate the loss, by sinking or severe damage, of 670 vessels totalling 1.4 million tons. The casualty list is detailed below:

- Warships sunk — 65
- Merchantmen sunk — 294
- Damaged beyond repair — 137

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28 Duncan, America’s Use of Seaminses, p. 145.
29 See ibid., pp. 145-157, for a concise technical account of the campaign.
Damaged and repaired — 23930

Thus by the end of the campaign, in May-June 1945, mines had accounted for three-quarters of the tonnage available to Japan at the commencement of the campaign (March 1945). Japanese reaction to the campaign is highlighted by the following comments made by Japanese officers and industrialists who were interrogated after the war:

The result of the B-29 mining was so effective against the shipping that it eventually starved the country. I think you probably could have shortened the war by beginning earlier.31

... in the war’s last months the proportion of shipping sunk was only one by submarines, six by bombs, twelve by mines.32

The aerial sinking of Japanese vessels and the B-29 aerial mining campaign was equally effective in the closing stages of the war as the B-29 attacks on Japanese industry. [The USAF estimated that only 5.7% of the XXI Bomber Command’s effort was dedicated to the mining campaign].33

Around June and July this year [1945] conditions were so bad that regardless of losses we pushed the ships through.34

Figures 5:2 and 5:3 demonstrate just how bad things were.

There is little doubt that Operation Starvation was largely responsible for reducing the inflow of Japanese raw materials and food to below its critical point. The US Strategic Bombing Survey concluded, in its Summary Report, that the economic paralysis of the Japanese empire could have been accelerated if changes had been made to Allied strategy, including ‘... an earlier commencement of the aerial mining program’.35 Nevertheless, the result of the mining campaign was not

30 ibid., p. 156.
31 Cited in ibid., p. 157.
32 ibid.
33 ibid.
34 ibid.
35 Sallager, Lessons from an Aerial Mining Campaign, pp. 58-59.
FIGURE 5:2
JAPANESE SHIP TONNAGE THROUGH SHIMONOSEKI STRAIT, MARCH-AUGUST 1945

FIGURE 5:3
TONNAGE ENTERING JAPANESE PORTS, MARCH-AUGUST 1945

Note: Ports include Tokyo, Yokohama, Nagoya, Osaka, Kobe, Shimonoseki, Moji, Wakamatsu and Hakata. Only vessels over 600 tons are included in the statistics.

lost on official World War Two British naval historian S.W. Roskill, who concluded that:

... The Blockade [of Japan] had, in fact, been far more successful than we realized at the time. Though the submarines had been the first and main instrument for its enforcement, it was the air laid mines which finally strangled Japan.36

Case 6 — Forced Re-Routing Operations: The Inner Leads, 1940

During 1940, the British laid mines in the Inner Leads of the Norwegian coast between Starvanger and Narvik, a distance of some 500 miles. The Inner Leads are a sheltered series of channels running inside an almost continuous chain of islands. Early in World War Two Germany’s vital iron ore traffic progressed through the Leads and was effectively covered from enemy interdiction by the island chain and Norwegian neutrality. The Admiralty reasoned that, if this protected zone were mined, enemy shipping would be forced further seaward and would become more vulnerable to search, capture or attack outside Norwegian territorial waters. This operation proved a success and Germany experienced far greater difficulty in gaining the Scandinavian iron ore which was so vital to the sustenance of its war effort.37

Case 7 — Ambush Operations: The Solomons, 1943

Thousands of small tactical minefields have been laid during this century, mainly by submarines, surface raiders and other small vessels. An example of this type of operation is provided by the mining of Blackett Strait in the Solomons during 1943. The operation involved fouling parts of the strait with moored mines and it was carried out by three small, ageing US minelayers. On the same night that laying took place, these mines destroyed an entire Japanese destroyer squadron (comprised of the Kagero, Oyashio and Kuroshio) which was making a night transit of the strait.38

During World War One, the Germans took the laying of tactical minefields to the extreme of preserving the right to jettison free drifting

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mines over ships' sterns to discourage British ships from following them. This measure or, more precisely, the threat of this tactic proved very beneficial to all forms of German craft in both wars. In fact, it was this German tactical habit which was given by Admiral of the Grand Fleet Jellicoe as a major reason for not pressing the German High Seas Fleet during and after the Battle of Jutland.39 Thus, the psychological aspect of the tactic proved of great value.

Submarines have often been very successful in setting ambush minefields in both world wars. In fact a minefield was once specifically set to interdict one man. In June 1915 Lord Kitchener, the British Minister of War, was making a secret trip to Russia on board HMS Hampshire when it was mined and sunk off the Orkney Islands. The field was laid by a German U-boat for the specific purpose of killing Kitchener, who did not survive.40

Australia's Use of the Sea Mine in World War Two

Australian naval and air forces were engaged in a variety of minelaying operations in World War Two. Surface minelaying of protective (harbour defence) minefields was undertaken by HMAS Bungaree during 1941-43. Bungaree operated in the waters of New Guinea, New Zealand and the Great Barrier Reef. She deployed a total of 9,284 UK MK XIV Hertz Horn moored mines in numerous fields containing from 50 to 250 mines.41 These mines were produced in Australia by the Ford Manufacturing Company, Geelong, Victoria where annual production peaked at 5,000 units in 1942.42 Bungaree's operations received a high degree of praise from British Minelaying authorities:

The operations were carried out with a high degree of accuracy, while mine clearance operations after the war showed [by] the number of effective mines remaining in many of the fields that the standard of material and workmanship had been of the best.43

39 Hartmann, Weapons That Wait, p. 43.
41 Donohue, 'Maritime Mining', p. 15.
42 ibid.
43 Cowie, Mines, Minelayers and Minelaying, p. 138. HMAS Warrnambool, a Bathurst Class corvette, was sunk in 1947 on the Great Barrier Reef while sweeping Bungaree's mines.
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About the time Bungaree was scaling down her surface protective minelaying operations, the RAAF began its own scaled-down version of an Operation Starvation-type offensive aerial mining campaign against the Japanese. Many RAAF officers had experienced the impressive results of aerial minelaying against the Germans while serving with Coastal Command, RAF, early in the war. They believed that:

... Minelaying had proved to be a most profitable and economical form of attack against sea communications ... The closing of harbours is equivalent to an over-all reduction of the merchant shipping tonnage available to the enemy. There were, in the islands north of Australia, a number of harbours in the hands of the enemy which might be blockaded by mining.44

These officers were not disappointed with the results of Australian minelaying operations. Operating from bases at Cairns, Darwin and Yampi Sound, RAAF PBY-5 Catalina flying boats made 1128 sorties and deployed a total of 2498 mines.45 Eleven aircraft were lost during these operations, which were primarily conducted in the waters of the South-West Pacific and the Netherlands East Indies (see Figure 5:4). The operations yielded a very low casualty rate of only one aircraft loss per 100 sorties.

Damage to enemy vessels alone resulted in the sinking and damage beyond repair of 39,384 tons of shipping.46 A total of 90 vessels was successfully attacked by mines (9 ships over 2,000 tons, 14 ships of 500-2,000 tons, 50 vessels under 500 tons and 27 vessels were damaged to varying extents).47 Bearing in mind that, in the first year of operations, an effective strength of only half a squadron of Catalinas (6 aircraft) was devoted to minelaying efforts the results were impressive, as described

45 Lott, Most Dangerous Sea, p. 215.
46 Ibid. Lott has made the mistake of giving 39,384 tons as the total mine attack tonnage in the port of Surabuya alone. In reality this figure represents the total tonnage successfully attacked by RAAF-laid mines in the Pacific Theatre.
47 The RAAF claimed the sinking of 23 ships and 27 vessels damaged by Catalina-laid mine attacks. Ship casualties to vessels under 500 tons were not taken into account by the Joint Army and Navy Assessment Committee, which assessed all claims of Japanese shipping sunk in the Pacific War (see Odgers, Air War against Japan, 1943-1945, p. 372).
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by the following extract from a contemporary report by the Operational Research Section of RAAF Command:

When the substantial indirect returns [of minelaying in the Southwest Pacific] are taken into account, these sea mining operations have been in the order of 100 times as destructive to the enemy as an equal number of bombing missions against air targets.48

The first minelaying operation was against Kavieng, New Ireland, in the Bismark Island group. Besides mining the harbour at Kavieng the operation also involved the mining of Silver Sound and Santa Ysabel Passage. Kavieng was a major Japanese anchorage between the Combined Japanese Fleet Base at Truk (600 miles due north) and the major southern forward assault base at Rabaul. The aims of the RAAF missions against Kavieng were to:

1. Sink and damage enemy ships in Silver Sound.
2. Deny the enemy the use of Silver Sound as a Fleet anchorage or base, thus forcing him to use unprotected anchorages exposed to submarine attack, or alternatively to hinder the enemy’s effort by making him divert men, equipment and ships from other employment to special minesweeping operations.49

Post-war interrogation of a staff officer of the South-East Area Fleet, based at Rabaul, indicated that:

At that time [mid-1943] Kavieng was very important because it was used as a supply base: and after mine attacks it was necessary to take ships directly from Truk to Rabaul where they were then subjected to air attack.50

To further isolate Rabaul, by also dislocating its supply line from the east, surface resupply of ports along the air route from Surabaya to Rabaul was seriously affected by mining the harbours of Kendari, Ceram, Babo, Sarong, Manokwari and Wewak.51

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48 Cited in Duncan, America’s Use of Seamines, p. 164.
49 Cited in Odgers, Air War against Japan, 1943-1945, p. 356.
50 ibid., p. 363.
51 ibid., p. 359.
Although RAAF minelaying aircraft attacked a total of fifty targets between April 1943 and early 1945, certain targets were given high priority and were attacked frequently, with good results. These targets were:

(a) BALIKPAPAN: Located on the east coast of Borneo (see Figure 5:4). During 1942 this vital oil port was shipping ninety per cent of Japan’s petroleum product needs. Production and distribution averaged 67,000 barrels of oil daily. During 1943 and 1944 Balikpapan was often paralysed by RAAF-deployed mines. Over 10,000 tons of shipping was sunk by mines in the harbour and its approaches. Besides a number of tankers, the Japanese destroyer Amagiri (2000 tons) was sunk on 23 April 1943, during a nine-day period in which the harbour was completely closed. This operation alone denied Japan over half a million barrels of essential petroleum products.

(b) SURABAYA: Located in East Java. This target was a highly developed naval dockyard and commercial port that handled huge amounts of peacetime traffic and largely maintained its activity throughout the war until hampered by allied mining and bombing operations. It was also the main South-West Pacific anchorage for Japanese naval units and home of the Second Southern Expeditionary Fleet. A major function of Surabaya was to act as the supply base and convoy assembly area for troop ships transiting to islands that maintained military garrisons close to Australia. This harbour was difficult to mine for a number of reasons. It was heavily defended by searchlight and anti-aircraft defences. Also, it had natural protection from the large island of Madura, which straddled its entrance and was a base for much Anti-Aircraft (AA) defence. The Catalinas had little choice but to pass over, or close to, Madura in order to mine the two main channels into Surabaya. Nevertheless, aircraft losses were small and tactics were soon developed to overcome air defences. These tactics included dropping mines from 200-300 feet to avoid searchlights and using bombing raids as diversions.

53 Odgers, Air War against Japan, 1943-1945, pp. 219, 367.
54 Ibid., p. 359.
during mining operations. Sustained mine attacks between mid-1943 and late 1944 closed Surabaya 47 times with the use of 375 mines. These mines were reported to have sunk 7 vessels and damaged 11 more.

(c) POMELAA (now called Pallima): Located in Sulawasi (Celebes). This target area produced 300,000 tons of nickel ore per annum, which made up two-thirds of Japan’s annual wartime requirement of this strategic material.

(d) DUTCH NEW GUINEA: To aid the allied landings at Hollandia (Jayapura) and Aitape, efforts were made to isolate Japanese forces from the eastern resupply line coming from Surabaya via the western New Guinea harbours of Sarong, Manokewari, Kokas, Babo and Kaimana. All these harbours were mined successfully.

As the war progressed, bases for the Catalinas became available in the Philippines, from which they conducted minelaying offensives against China and Japan, with concentrated efforts being made against the ports of Amoy and Hong Kong.

The RAAF minelaying campaign was described by the Director of Minelaying Operations, British Admiralty as ‘... an outstanding success’. But a more precise estimate of its real effect upon the enemy was given by Rear-Admiral Matsuzaki, Chief-of-Staff of the Second Southern Expeditionary Fleet, Surabaya. Matsuzaki was tasked with mine countermeasures in Java, Borneo and the Celebes. He testified during post-war interrogations that mining had a considerable impact on the exploitation of resources from the Dutch East Indies and that mines sunk ships and delayed convoys. Off-loading of cargoes was jammed at Balikpapan and Surabaya until sweeping operations had been completed. He stated that the delays in oil shipments and destruction of tankers was particularly serious, and that over 1500 Japanese were maintained on 30 MCM vessels to provide a standing countermeasures force for the area. Matsuzaki also quoted Japanese

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55 ibid., p. 362.
56 Lott, Most Dangerous Sea, p. 215.
57 ibid.
59 See ibid., pp. 218, 359, 360, 363, for references to the mining of Dutch West New Guinean harbours.
60 ibid., pp. 370-371.
estimates that 40 per cent of all vessels under 1000 tons that sailed into the Surabaya and Balikpapan areas were sunk or damaged by mines.62

Additional Mine-Use Considerations

The Psychological Warhead

In history there have been many blockade runners but few minefield runners. Any question of closure of a harbour is inexorably tied up with the psychology of the adversary. Consequently, the 'psychological warhead' of the minefield will have wide application in modern conflict management and limitation.

The essence of the mine's psychological warhead is the increased stress placed on an opponent, who will develop an exaggerated fear of the unknown, invisible mine threat. The mine is a hidden, automatic device capable of infinite patience and instant attack. It cannot be fought like aircraft, submarines or surface combatants, since the minefield will lay quietly, only revealing itself occasionally. The psychological impact of mines is quite different to that of other weapons.

During the American Civil War, '... Sailors hardened to the smoke, noise and pandemonium of close range cannonading were stunned and demoralized by the sudden and unexpected mine blasts'.63 In World War One, testimony was given that '... German submarine crews were more afraid of mines than any other weapon'64 and in World War Two a Japanese officer stated that '... the crews — were very much worried and frightened by this mining'.65 The sinister aspect of mines in general was probably best summed up by a British officer in World War One, who said: '... I don't mind a fighting chance but I have a dread of mines'.66 Another officer, a veteran of the Falklands War, has stated that:

Mines have come to occupy an important place in the cannon of fear producing agents ... In part this is because they are an impersonal, inhuman threat ... not only are mines and booby traps impersonal but both can strike at any time, without any warning: they help to

62 Odgers, Air War against Japan, 1943-1945, p. 363.
63 Patterson, Mining: A Naval Strategy, p. 63.
64 Duncan, America's Use of Seamines, p. 157.
65 ibid.
extend danger from the firing line through to the lines of communication.67

Soldiers and sailors tend to feel naked against these automatic machines, which are implacable, untiring and incapable of mercy. The use of any weapon, especially one as unique as the mine, has to take into account human perceptions that will contribute to the value of that weapon.

Blockade and diversion of enemy naval and merchant shipping depends on the opponent's perception of the threat posed by a minefield or a system of minefields. If an enemy is prepared to accept massive losses then no minefield can stop him, but this situation is more the exception than the rule. Exaggerated fear of minefields has pervaded the decisions of commanders in most conflicts. This fear stems from the impossibility of knowing precisely, or even approximately in many cases, what one is up against in terms of the level of mine threat (which is based on numbers, type and position of mines deployed). Even when minesweeping is attempted, the psychological stress experienced by the commander is not decreased. If anything, it is likely that his perception of the danger of the situation will be reinforced by the confirmation of his fears (i.e., a mine being swept).68

Laboratory tests have shown that, given a choice under conditions of extreme uncertainty, combatants will exaggerate the likelihood of the more extreme consequences.69 Studies have also shown that feedback pertaining to the validity of decisions arrived at under conditions of extreme uncertainty is critical.70 Without feedback, 'all-or-none' behaviour is consistently manifested. This form of behaviour involves inflexible and subjective evaluation of the probability of the threat and a tendency to estimate risk at only two degrees of danger. Risk is deemed to be at an acceptably low level or an unacceptably high level.71 Historical examples indicate that minefields most often elicit the latter estimate, resulting in 'none' behaviour. During the naval attempt to force the Dardanelles in World War One, Commodore Roger Keyes stated '... there was never any question of

67 ibid.
69 See ibid., pp. 4-8.
70 ibid., pp. 6-7.
71 ibid., p. 7.
taking battleships through unswept minefields'. No attempt was made by the British to assess the effectiveness of the total minefield defence in depth or force the straits using obsolete vessels as 'bumpers'. No attempt was made to work out the probability of transiting the partially swept fields with sweepers leading battleships from a short distance.

A recent study of the psychological aspects of mine warfare states:

In summary, these psychological studies confirm the intuitive notion that decisions made with incomplete information, with no way to determine the accuracy of guesses, and with dire consequences for certain choices lead to a strongly exaggerated perception of the situation. The application of minefield psychology seems clear, at least qualitatively. Any minefield, regardless of how small a threat it actually poses, tends to be viewed as a serious danger not to be taken lightly.

The perceived threat posed by minefields is also increased because mines are 'invisible' and cannot be directly combatted. British studies on psychological stress experienced by anti-aircraft crews during German bombing raids in World War Two demonstrated that stress was reduced if the crew fired at the visible enemy, even if they did not hit a target. As when a man kicks his motor car that refuses to start, being able to do something — anything — tends to reduce personal stress. Put simply, minefields do not permit the rapid release of tension but, on the contrary, they cause a buildup of stress.

The 'demonstration effect' of a minefield is also of psychological value. It contributes to the conditions described above by lowering the morale and heightening the tension of the opposition in general and the enemy commander in particular. During the Wonsan operation, Admiral Smith had witnessed the instantaneous obliteration of a minesweeper and its crew when a bottom mine detonated in shallow water almost directly under it. While some subordinates advised that the landing proceed, Smith was adamant that sweeping operations must

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72 Keyes, Naval Memoirs, p. 246.
73 Greer and Bartholomew, Psychological Effects of Mine Warfare, p. 7.
74 ibid., p. 8.
75 See Meacham, 'Four Mining Campaigns', pp. 112-113.
continue, since the actual sight of the explosion had reinforced the commander's worst fears.

Similarly, during the Dardanelles operation Admiral De Roebuck was convinced that the straits could not be forced without a major land operation after having witnessed the destruction of his vanguard of Dreadnoughts. These instances graphically illustrate the extraordinary reluctance of naval commanders to expose their warships to mine attacks. During Operation Starvation, a Japanese Task Force led by the largest battleship in the world, *Yamato*, was ordered through the Bungo Strait in order to avoid mines in the Shimonoseki Strait, despite the fact that a Bungo transit would greatly increase the Task Force's vulnerability to aerial interdiction. *Yamato* was sunk by US carrier-based aircraft while passing through the Bungo Strait, a direct result of the Japanese Task Force commander's overwhelming reluctance to face the threat of mines.76

The reverse case can also apply. If minefields are challenged and serious demonstration effects do not take place, then the minefield's psychological effect is seriously compromised. During the 1984 mining of the Red Sea, no serious demonstration effects were observed.77 Ships may have been lightly damaged in general due to high sensitivity settings and low explosive charges in the mines deployed.78 The effectiveness of the mines was reduced to that of scare charges, and this failed to deter shipping that was already adapted to the high degree of risk inherent in sailing through Middle Eastern waters.79

A few shipping groups considered using the Cape of Good Hope route if insurance rates had risen as a result of casualties, since the net differential cost between routes was estimated to be as little as five per cent.80 The General Council of British Shipping (GCBS) indicated that the Red Sea situation did not warrant declaring any part of the Red Sea a War Zone, but advice was given on how best to transit the area in the light of continuing minor mine casualties.81 Consequently, British,

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76 ibid., p. 99.
78 ibid., p. 109.
79 Transit risk for ships making passage through Middle Eastern waters increased when the Iran-Iraq conflict commenced. Numerous missile attacks have been made against neutral shipping in this area since 1980.
81 ibid.
Swedish and Danish crews traversing the Red Sea were refused payment of war rates of pay, while Norwegian crewmen were in receipt of a 100 per cent war bonus after having observed a mine explosion detonated by the vessel *Bastion* on 6 August 1984.82

The demonstration effect of a minefield depends on the damage potential of the mines themselves. If a mine can be loaded and set to sink or severely damage a ship, then the psychological warhead remains intact and very effective. Otherwise, business will go on as usual.

The Suez Canal Authority reinforced the importance of lack of demonstration effect when it stated that ‘... some of the ships hesitated to come to the Suez Canal but these were very few ships’.83 After a brief decrease in traffic flow following the first explosions, traffic went back to normal after successful transits had been made. This is an example of the other extreme of the ‘all-or-nothing’ syndrome. In fact, the only ship believed to have avoided a transit of the Red Sea was the Turkish merchantman *Meroc*, and this was only after having monitored damage reports from the mined vessel *Morgul*.84

A more subtle consideration than damage effect involves the question of the ‘saving of face’. While it may be deemed a disgrace to withdraw or avoid combat against such overt enemy combat forces such as fighter aircraft and destroyers, it is generally viewed as no disgrace to avoid a minefield.85 No ‘face’ is lost, and this can have many advantages in limiting the amount of escalation and violence in modern conflict. Indeed, it will be argued later in this chapter that minefields offer modern conflict management advantages possessed by no other weapons system: the minefield’s psychological warhead can be used to political advantage where a form of passive coercion could stabilise a situation.

82 ibid.
83 ibid.
84 ibid., p. 101.
85 Greer and Bartholomew, *Psychological Effects of Mine Warfare*, p. 7. The authors state that ‘none’ behaviour (i.e., refusal to challenge a minefield) is historically more prevalent that ‘all’ behaviour (i.e., willingness to challenge a minefield.)
CHAPTER SIX
LEGAL ASPECTS OF MINE-USE

International Law

International law has served the historic function of placing limitations on violence. Civilisation has attempted to evolve humanitarian rules calling for conflict to be conducted in a way designed to reduce unnecessary suffering and to provide maximum protection for non-belligerents. Any mining campaign approved by Australian planners must be seen to be consistent with the provisions of international law. The following represent the main body of international law relating to mine warfare:

(a) Convention Relative to the Laying of Automatic Submarine Contact Mines (No. VIII), signed at the Hague in 1907 (known as Hague VIII).
(b) 1958 Geneva Conventions on (I) The High Seas (TIAS 5200) and (II) The Territorial Sea and Contiguous Zone (TIAS 5639).
(c) 1971 Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in the Subsoil thereof.
(d) The United Nations Charter: Articles 2(4) and 51.
(e) 1856 Treaty of Paris and the customary international law of blockade.

Hague Convention VIII, 1907

After the Russo-Japanese War (1905), many nations were plagued by mines which had broken loose from their moorings and were still in a fully armed state. Considerable damage was done to non-belligerent shipping, particularly that of China. The 1907 Hague Convention produced several articles imposing limits on mine-use, which still form the basic criteria for international legal assessment of mine-use.1

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1 See Cowie, Mines, Minelayers and Minelaying, pp. 168-180, for a practical discussion of the mine in the context of international law.
Article I:
(1) It is forbidden to lay anchored automatic contact mines unless they are so constructed as to become harmless one hour at most after those that laid them have lost control of them.
(2) It is forbidden to lay anchored automatic contact mines which do not become harmless as soon as they have broken loose from their moorings.

Though the text refers to automatic contact mines specifically, it is accepted that modern mines, whatever their nature in terms of target detection, should have an inbuilt facility to be rendered safe after breaking loose from their moorings. This minimises long-term threat to non-belligerents. Many modern moored influence mines are on inventory throughout the world. For example, the US Mk 56 and 57 moored ASW mines have an automatic scuttling device that operates if the mine rises to too shallow an operating depth or exceeds its sterilisation time. Drifting or unanchored mines are seldom used in maritime operations, as they are frequently more an embarrassment to the user than to the opponent. Riverine versions of the drifting mine were, however, widely used by the Viet Cong in the rivers of South Vietnam. The ex-Australian minelayer Bungaree, which was decommissioned in 1946 and sold overseas in 1957, was sunk in 1966 after striking a drifting mine in the Saigon River.

Article II:
It is forbidden to lay automatic contact mines off the coasts and ports of the enemy with the sole object of intercepting commercial navigation.

The difficulty with this article is that it is impossible in many instances to demonstrate that mines have been laid with the ‘sole’ purpose of intercepting commercial navigation. Offensive mining of commercial routes took place in both world wars and was undertaken by practically all parties, since convoys were escorted by naval forces. In early 1940 the then neutral state of Norway was

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2 See Navsea Mine Familiarizer, pp. 20-21, for a brief technical description of these mines, of which large stockpiles exist.
3 Donohue, ‘Maritime Mining’, p. 16.
badly affected by both British and German minelaying operations in its territorial waters. The Norwegian Foreign Minister at the time stated that ‘... it is practically impossible to prove that mines have no military objective’\(^4\) (see discussion on Article III below).

**Article III:**

When anchored automatic contact mines are employed every possible precaution must be taken for the security of peaceful navigation.

The belligerents undertake to provide, as far as possible, for these mines becoming harmless after a limited time has elapsed, and where the mines cease to be under observation, to notify the danger zones as soon as military exigencies permit, by a notice to mariners, which must be communicated to the governments through the diplomatic channel.

The critical term in this article was ‘military exigencies’, which obviously gives scope for broad interpretation. During the British mining of the Norwegian Inner Leads the British justified their theoretically unlawful action by stating that:

International law has always recognised the right of a belligerent when its enemy has systematically resorted to illegal practises, to take action appropriate to the situation created by the illegalities of the enemy. Such action, even though not lawful in ordinary circumstances becomes, and is generally recognised to become, lawful in view of the other belligerent’s violation of law.

The Allied Governments therefore hold themselves entitled to take such action as they deem proper in the present circumstances.\(^5\)

The reasons for British mining of the territorial waters of neutral Norway were specified as: ‘... Germany obtains resources vital to her

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prosecution of the war, and obtains from Norway facilities which place
the Allies at a dangerous disadvantage. A detailed statement was
issued by the British Foreign Office detailing the 'extenuating
circumstances' of the operation and the document specified all mined
areas and fully explained the rationale behind the action. It is a classic
example of how a technically illegal mining operation can be justified in
terms of the 'spirit' of international law and military exigency. It should
be noted that definite steps were taken to maximise free access of
Norwegian nationals and ships to their ports and coastal villages.

Article IV:
Neutral powers which lay automatic contact mines off
their coasts must observe the same rules and take the
same precautions as are imposed on belligerents.

The neutral power must give notice to mariners in
advance of the places where automatic contact mines
will be laid. This notice must be communicated at once
to the governments through the diplomatic channel.

This Article is a version of Article III for neutrals, with the
omission of the military exigencies component.

Article IV:
At the close of the war, the Contracting Powers
undertake to do their utmost to remove the mines which
they have laid, each power removing its own mines.

As regards anchored automatic contact mines laid by
one of the belligerents off the coast of the other, their
positions must be notified to the other party by the
power which laid them, and each power must proceed
with the least possible delay to remove the mines in its
own waters.

Modern, reliable sterilisation and self-destruct devices make this
requirement far easier to fulfil than in the past. However the
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maintenance of a quantity of exploratory sweep gear is a minimum prerequisite for those who plan to use mines in future conflict.

Articles VI to XIII mainly deal with the ratification of the treaty. The fact that the Convention was not signed by all parties (Russia and China were not signatories) does not invalidate it. Multilateral conventions to which the majority of states are parties wield considerable weight and remain a formal testimony of world opinion on what the law should be.7 Unfortunately the primary aim of the Convention, that is, preserving neutral interests and safety, was largely defeated by the ‘military exigencies’ provision of Article IV.

Minelaying in the open seas was by no means prohibited by the Convention and it is generally considered a flawed document in that it was a compromise between two extreme mine-use policies. The British policy was initially the outlawing of all mines, while the German policy was one of minimum limitation on the weapons’ employment.8 Nevertheless, some important principles did emerge as the generally accepted international rules of mine-use. These are:

(1) The minelayer should adequately warn neutral shipping of mine danger.

(2) Moored mines should be set to neutralise on release from their moorings. (This can be extended to bottom mines, which should have a self-destruct or scuttling mechanism installed so as to be rendered safe after an adjustable period.)

(3) The minelayer must be able to sweep and dispose of his own mines wherever they are deployed.9

The Geneva Conventions, 1958, were to some extent able to expand on these conditions and set more rigid rules pertaining to the deployment areas of mines.

The 1958 Geneva Conventions

(1) The 1958 Geneva Convention on the High Seas (TIAS 5200) recognises that the high seas are open to vessels of all nations. Freedom of navigation of the high seas as implied here allows non-belligerent states to employ the

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7 ibid.
8 ibid., p. 38.
9 See Cowie, Mines, Minelayers and Minelaying, pp. 168-180, for a practical discussion on the legalities and obligations of mine-use.
seas for peaceful purposes, presumably free from the menace of mines.

(2) The 1958 Geneva Convention on the Territorial Sea and Contiguous Zone (TIAS 5639) grants ships of all nations the right of innocent passage through territorial waters of a littoral state, so long as the passage is not prejudicial to the peace, good order or security of the coastal state. The implications of this provision are that mines should not be used to close an international strait which is vital to the transit of neutral shipping and that innocent passage should not be interfered with. A nation may, however, place mines within its territorial seas for reasons of self-defence and temporarily suspend, without discrimination, the right of passage if it is seemed essential to national security. Thus, we again see the spectre of the ‘military exigencies’ clause of Hague VIII.

1971 Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and the Ocean Floor and in the Subsoil Thereof

This agreement proscribes the emplacement on the seabed, beyond a 12 mile seabed control zone, of any nuclear weapon or other weapon of mass destruction as well as structures used for storing, testing or launching such weapons. Conventional mines are not categorised as weapons of mass destruction for the purposes of this treaty and are consequently exempt from its provisions.10

The United Nations Charter

Article 2(4) of the UN Charter provides that:

All members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, or in

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10 For an interesting argument against the use of nuclear mines see Cowie, Mines, Minelayers and Minelaying, pp. 196-197.
any other manner inconsistent with the purposes of the United Nations.\textsuperscript{11}

A major purpose of the UN is to ensure that the use of armed force is minimised and Article 51 of the Charter prescribes conditions for the use of force in self-defence. It states that:

Nothing in the present Charter shall impair the inherent right of individual or collective self-defence if an armed attack occurs against a member of the United Nations until the Security Council has taken measures necessary to maintain international peace and security. Measures taken by the members in the exercise of this right of self-defence shall be immediately reported to the Security Council and shall not in any way affect the authority and responsibility of the Security Council under the present Charter to take at any time such action as it deems necessary in order to maintain or restore international peace security.\textsuperscript{12}

The narrow limits set by the UN on unilateral use of force by states have been reinforced by the 1970 UN Special Committee Report on Principles of International Law Concerning Friendly Relations and Co-operation Among States. This report commented that the use or threat of force '... constitutes a violation of international law and the Charter of the United Nations and shall never be used as a means of settling international issues'. The report goes on to say that:

No state or group of states has the right to intervene directly or indirectly for any reason whatever in the internal or external affairs of any other state. Consequently, armed intervention and all other forms of interference or attempted threats against the personality of the state or against its political, economic and cultural elements are in violation of international law.\textsuperscript{13}

\textsuperscript{11} Yearbook of the United Nations 1968, Office of Public Information, United Nations, New York, Vol. XXII, Appendix II.
\textsuperscript{12} ibid.
However, history testifies to the fact that this is less than satisfactory practical legislation, despite its philosophical merit. In numerous situations since 1948 states have unilaterally resorted to force to preserve what were perceived to be their national interests and this has increasingly become the case as the UN has been seen to generally act with very limited effectiveness. Application and enforcement of Charter provisions has left much to be desired and the provisions remain what the community of nations believe the ‘law’ should be, rather than what it is in practice. To look past the form of UN proscription of the use of any type of force we must look at the substance of what is accepted by the community of nations as customary international law. An acceptable and practical framework may then be constructed which accommodates UN provisions with international realities since, in asking for everything, the UN seems to have got very little back in terms of peace.

The Treaty of Paris, 1856, and the Customary International Law of Blockade

To determine under what circumstances a state can reasonably resort to mine-use to blockade involves a consideration of customary international law. A state’s right of self-defence was deemed paramount under this type of law as a necessary prerequisite to the natural right of self-preservation. Customary law has developed through history, under the influences of necessity and the concept of reasonable proportionality. The law concerning blockade has developed as a process of customary decision over many centuries.

First, it is necessary to define blockade: ‘A blockade is a naval-air operation "... directed at the enemy and a method of curtailing neutral seaborne commerce with the enemy.”'

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14 See J. McHugh, ‘Forcible Self-Help in International Law’, Naval War College Review, November-December 1972, pp. 75-81 for a practical discussion of forcible self-help in the modern era. The UN approved the use of military force in enforcing the blockade of Iraq during the Gulf Crisis of 1990. However, approval was only given in the face of overwhelming support for the decision from most member nations and after much consideration. Some have argued that the UN was used merely as a ‘rubber stamp’ to legitimise inevitable US action.

15 ibid., p. 65.


17 ibid., p. 45.
Origins of the customary law of blockade can be traced from 1584, when the Dutch declared that all the Spanish-controlled ports in Flanders were blockaded. Blockades increased in frequency until 1856, when the Treaty of Paris codified the customary sea laws of the previous three centuries. It was agreed to by all major European powers including Russia. The Treaty, which is part of customary international law, specified that:

Blockades, in order to be binding, must be effective; that is to say, maintained by a force sufficient really to prevent access to the coast of the enemy.  

This article (No. 4) set out the existing customary law and implied that a blockade was legally valid if it could be made to be effective to a high degree and actually prevent access to harbours and coasts. Neutrals could only challenge the legality of a blockade if it did not meet the requirements of effectiveness.

More recently, legal experts have sought to develop a more specific basis for defining blockade. Traditional close-in blockades were replaced by long-distance blockades using the developments of technology, tactics and strategy. Blockades became a more advanced means of waging economic warfare and it was suggested by eminent legal experts that:

... measures regularly and uniformly repeated in successive wars in the form of reprisals and aiming at the economic isolation of the opposing belligerent must be regarded as a development of the latest principle of the law of blockade, namely, that the belligerent who possesses the effective command of the sea is entitled to deprive his opponent of the use thereof for the purpose either of navigation by his own vessel or of conveying on neutral vessels such goods as are destined to or originate from him.

Blockades are often initiated as reprisals for unacceptable foreign actions, acts of self-defence, or interventions on behalf of allies

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under threat. The following criteria have been suggested for exercising the customary right of self-defence generally:

(1) Its exercise must be in response to actual or threatened violence relative to an illegal act on the part of the target state (i.e., the state against which the right of self-defence is exercised).

(2) The actual or threatened violence must be of such a nature as to create an instant and overwhelming necessity to respond. And

(3) The response taken must not be excessive or unreasonable in relation to the violence being inflicted or threatened.\(^\text{20}\)

In addition to these broad considerations it is possible to postulate rational criteria under which the resort to force by states can be considered tolerable in the eyes of the international community. These criteria are:

(1) The burden of proof is accepted by the acting state, which will explain its conduct before the world community. The acting state will endeavour to demonstrate the following points (2-5).

(2) Provocative acts by the opponent have raised a considerable and imminent threat to the continued existence of the political independence/territorial integrity of a nation or its ally.

(3) A determined effort has been made to gain redress by pacific means and international organisations have been promptly informed and consulted. (Continued efforts to achieve a peaceful solution must be seen to be made.)

(4) The acting state cannot achieve its purpose by acting solely within its own territory.

(5) Response has been proportional and only directed against military and paramilitary targets. Every effort has been made to reduce risk to non-combatants and neutrals.\(^\text{21}\)

It is suggested that if the above points can be effectively put before the world community as reasonable, necessary and proportional criteria, and if they are in harmony with actions taken, then the actions


\(^{21}\) See ibid., p. 76.
may be seen as lawful and support may be obtained. All actions must, of course, be weighed carefully since certain restraints and prohibitions have been established in international law, many having their origin in custom. One of the most significant of these is the need for proportionality, since civilisation has always endeavoured to produce humanitarian rules calling for conflict to be conducted in a manner calculated to minimise unnecessary suffering and guarantee maximum protection to non-combatants. The state that violates the criterion of proportionality commits a serious error and loses the often tangible benefits derived from favourable world opinion, which is a factor of increasing importance in conflict management.

The real spirit of international law is probably best summed up in the preamble to the first general codification of the customary law of war, which took place at the Hague Conference in 1899. The preamble of the convention included a provision, known as de Marten’s clause, which indicated that apart from the codified rules of customary law being adopted ‘... populations and belligerents remain under the protection and empire of the principles of international law, as they result from the usages established between civilized nations, from the laws of humanity, and the requirements of the public conscience’. Public conscience involves a sense of right and wrong that governs a particular nation’s actions. It remains a vital consideration in the making of judgements relating to international legal issues. An act can be considered ‘reasonable’ by the world community despite being unlawful according to the letter of the law. The following is a relatively recent example of this phenomenon.

Case Study of the International Law of Blockade: The Quarantine of Cuba, 1962

The quarantine of Cuba in 1962 was technically described as a ‘special function blockade’ in that it:

(1) Was aimed at banning only certain contraband items (Soviet nuclear weapons) rather than all maritime trade.

(2) Employed moderate methods of enforcement such as visit, diversion and search, as opposed to destruction without warning.

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22 Preamble to Hague Convention concerning the Laws and Customs of War on Land of July 29, 1899 (with annexed Regulations).
(3) Was aimed at avoiding the consequences of a formal state of war.\textsuperscript{23}

The term quarantine, in its most general sense, involves imposed isolation for the prevention of the spread of disease. Maritime quarantine has its roots in the ancient customary laws relating to contraband, under which belligerents had the right to proscribe the influx of strategic material into enemy ports.\textsuperscript{24}

The US imposition of the quarantine was clearly an interference with the peacetime rights of both the USSR and Cuba to use the high seas for free and willing trade. However, the US felt justified in taking this action since it was threatened with the establishment of nuclear missile bases less than 100 miles from its shores.

Consequently, the US had three legal bases for its action:
- Customary law involving the inherent right of self-preservation through self-defence, either individually or collectively.
- A ‘realistic’ interpretation of Article 51 of the UN Charter.
- The right of collective action to maintain regional security.\textsuperscript{25}

The quarantine was presented as a low-level military response to national conduct which sought to destabilise the peace of the region. It remains a good example of a nation ‘illegally’ using force for coercion in a way basically acceptable to the community of nations. The act did not meet with UN condemnation and numerous states supported the quarantine. Steps taken by the US Administration to legitimise the act were:
- Evidence of unacceptable provocation was promptly advertised to the UN and the rest of the world. Proof of the development of Soviet offensive missile bases in Cuba was irrefutable and this was presented as a threat to the political independence and territorial integrity of the US. The threat was also presented as a major

\textsuperscript{24} ibid.
destabilising factor in terms of regional and global security.
• The quarantine was presented as a limited and appropriate coercive measure proportional to the current level of threat. The quarantine was personally proclaimed by the US President.
• Efforts were made to peacefully resolve the issue with the USSR. These efforts continued throughout the crisis.
• The support of the Organisation of American States (OAS) was courted and received by the US.
• The OAS resolution was promptly conveyed to the UN.
• The US promptly requested an urgent meeting of the UN Security Council, in which the backing of many world powers was obtained. World opinion generally ratified US actions.

In short, the US accepted the burden of proof to justify its actions as a reasonable response to unacceptable provocation. Since it did not receive UN condemnation, the quarantine of Cuba was effectively recognised as a customary and lawful action under Article 51 of the UN Charter.26

26 The Security Council refused to pass a Soviet Resolution condemning the US for imposition of the quarantine. For an interesting discussion on the implications of this refusal to condemn, see L. Meeker, ‘Defensive Quarantine and the Law’, American Journal of International Law, July 1968, p. 515.
Politics and Power

Politics is inevitably concerned with aspects of the exercise of power. In fact, politics has been described as simply a struggle for power. Power can be defined as ‘... the ability to influence the behaviour of others in accordance with one’s ends’.¹ This suggests that a measure of power is the degree to which an entity has the ability to make its will prevail. Relative power can then be defined in terms of the result of a power struggle being dependent on the relative strengths of the entities involved.

National power can be measured by the degree to which a nation is able to influence other nations. Measures of national power involve military, geographic, economic, demographic and other quantitative factors, but intangible psycho-social factors are also important and often crucial aspects in any assessment of national power. Politics, being the ‘art of the possible’, paradoxically derives its substance from the psycho-social elements of national power.

International politics and the relations which stem from political interaction are governed by power hierarchies which are in turn determined by perceptions of national power. The main psycho-social element of national power is the will of a nation’s political leadership, since the will-power or perceived resolve of a national leadership will to a large extent determine the amount of ‘respect’ it will get in the world community.

The greatest challenge to a political leadership comes during a period of crisis which may lead, or has led, to overt military action. How a political leadership will react to a particular crisis is impossible to accurately predict, due to the unspecifiable details of future crises and a host of other immeasurable elements which would undoubtedly enter the equation. A major psycho-social intangible in any nation’s political leadership is probably best described as political instinct. Politicians often place an overwhelming degree of trust in their instincts, because without political instinct, toughness, stubbornness and stamina they would not have made it to the top. Ex-US President Richard Nixon

¹ Spanier, World Politics in an Age of Revolution, p. 4.
probably best expressed this attitude when, under great pressure during the Vietnam War, he told his chief advisers: '... As far as I'm concerned the only real mistakes I've made are when I didn't follow my own instincts'.

The following case study will deal with the political aspects of a modern mining campaign by relating the behaviour and expressed attitudes of the main actors. Many aspects of the case study will be irrelevant to the Australian political context in terms of detail, but the following elements are integral components of the case study and would be common denominators in most higher level political-military crises faced by democratic peoples:

- Decisions are taking place in an extremely stressful and frustrating environment.
- A strong fear of escalation to a higher level of conflict exists.
- The political leadership is up against a strong-willed and quite formidable opponent who has taken the initiative.
- Actions are strictly limited by public opinion at the domestic and global level.
- Time is not on the democratic political leadership's side.
- Previous efforts to deal with the issue have met with little or no success.

The aim of the case study is to give the reader an appreciation of mine-use in a modern, highly constrained, political environment.

A Political Case Study: Analysis of Political Decision-Making in the US Mining Campaign Against North Vietnam (May-December, 1972)

The decision to mine the harbours and coastal areas of North Vietnam in May 1972 took place at the highest levels of US politics. This analysis is based on what the main actors and their critics have said about the circumstances of the campaign in their memoirs and other writings.3

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3 The memoirs of the main actors are heavily influenced by hindsight and self-interest. However, many of the relationships between participants were often not particularly cordial (e.g., Nixon-Kissinger, Kissinger-Zumwalt) and realistic assessments of aspects of the campaign can be gleaned from a comparison of accounts and analysis of what one party said about the actions and interests of the other. The account of the mining campaign in this study contains selected quotes, the intent of which can be confirmed by the writings of all actors and the operational and political actions taken.
The concept of mining North Vietnamese harbours had its origins in 1964, when the Seventh Fleet had developed plans for just such an operation. About 85 per cent of all war-sustaining material imported by the North Vietnamese came through the harbours of Haiphong, Hon Gai and Cam Pha. By far the most traffic passed in and out of Haiphong harbour, around which was based an extensive petroleum, oil and lubricant (POL) storage and distribution system and ordnance storage depots. Wartime POL requirements (all imported by sea) were estimated at 15,000-20,000 metric tons per month, equivalent to that carried by two small merchant tankers or 170 railway tank cars. Even if available, railway cars were able to be easily interdicted between the Chinese border and Haiphong, and Chinese resources were strained in conveying one-seventh (300,000 tons) of Hanoi’s total 2.1 million tons of imports by land transport. The North Vietnamese would have had enormous difficulty in attempting to shift a comprehensive seaborne logistics system based in Odessa, Vladivostok and Murmansk to a rail system across China, and the problems would have been exacerbated by the unfriendly relations between Russia and China at the time. In short, the often-quoted argument that sea carriage of imports could have been effectively substituted by a land transport system was nonsense.4

Several studies of the likely efficacy of a mining campaign against North Vietnamese ports were conducted between 1965 and 1970 by the CIA, Office of Systems Analysis and State Department.5 These studies invariably concluded that the mining of North Vietnamese

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4 See H. Kissinger, The White House Years (Little, Brown, Boston, 1979), pp. 1181, 1185. Kissinger’s assessment was confirmed by later events.

5 The first National Security Study Memorandum of the Vietnam War undertaken during the Nixon Administration was titled NSSM 1; parts of this were leaked to the press in April 1972. Like previous studies it determined that mining would exert no long-term disruptive effect on North Vietnamese ability to resupply the Vietcong in the South. The Joint Chiefs of Staff disagreed with this conclusion and Kissinger eventually ordered the compilation of a new study code named ‘Duckhook’, which was completed in mid-July 1969 by the Office of the Chief of Naval Operations (who was then Admiral Moorer). ‘Duckhook’ was essentially an ‘extensive war plan’. With regard to the issue of the legalities of mining, the CNO input stated ‘... The former simple dichotomy between a state of peace and a state of war no longer has legal or political validity ... Acts in self defence are lawful under international law. Therefore, mining of Haiphong harbour and its approaches, as described in this plan, is considered to be a lawful exercise of South Vietnam’s right of self defence against the aggression of North Vietnam’ (See S. Hersh, The Price of Power: Kissinger in the Nixon White House (Summit Books, New York, 1983), pp. 120, 520 for details of the 1969 planning development. Also, see M. Kalb and B. Kalb, Kissinger (Hutchinson, London, 1974), pp. 125, 129 for details of the NSSM 1 study.)
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harbours would not have a significant long-term effect on the resupply of the People’s Army of Vietnam (PAVN) and Viet Cong units in South Vietnam. It was suggested that the numerous waterways from China could not be closed to all traffic, and that they had ample potential for filling the gap of imports no longer arriving by sea from the Soviet Union. Similarly, it was said that bombing railways would not act as a very effective means of permanently disrupting the North Vietnamese war effort. A major factor brought out in these studies was that the North Vietnamese would find it easy to off-load cargoes into lighters, barges and smaller vessels. Consequently, to make sure the mining campaign was effective, US forces would have to contemplate attacking or stopping Soviet and other neutral vessels that challenged the minefields. This aspect had escalatory implications that mitigated against adoption of the mining option for years. It was only after the mining operation was carried out that its political and operational value could be accurately gauged.

Throughout 1965 Commander-in-Chief, Pacific (CINCPAC) and Commander-in-Chief, Pacific Fleet (CINCPACFLT) recommended a campaign involving the mining of North Vietnamese harbours and air strikes against Haiphong POL facilities. President Lyndon Johnson referred the question to Defense Secretary MacNamara, who made it clear that ‘... the expanded bombing, with the mining of Haiphong would endanger seriously the security of the nation’. McNamara saw mining as being seriously escalatory in terms of possible damage to Soviet or Chinese merchant ships, which could involve these countries in hostilities. Nevertheless, McNamara authorised limited bombing raids against outlying POL storage areas, which were to have equally limited effect on enemy war-making capability. US Navy pilots operated under severe constraints. Those attacking the POL storage area around Haiphong were ordered not to make attacks against any vessels in harbour unless fired on, and ‘... only if the craft is clearly of North Vietnamese registry’. Also, ‘... piers securing Haiphong POL storage depots are not to be attacked if a tanker is berthed off the end of the pier’.

In February 1967 the use of air-delivered mines, mainly of the recently invented DST (Destructor) variety, was approved for

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6 Hersh, _The Price of Power_, p. 520.
8 ibid., p. 85.
deployment in the rivers of North Vietnam. Photo reconnaissance indicated that half the enemy’s cargo moved on internal waterways toward front-line North Vietnamese combat units and the Viet Cong. By March 1967 five riverine minefields had been laid and in mid-1967 these rivers had ceased to be viable for transport. North Vietnamese forces apparently made little, if any, effort to sweep the fields. Nevertheless, the main port of Haiphong remained unaffected by mines and the US forces were handcuffed to the uneconomic policy of attempting to destroy enemy materiel once it had been dispersed.9

The perceived risks of heavily bombing and mining North Vietnamese ports was considered unacceptably high throughout the Johnson Administration.10 During a conversation with Lyndon Johnson in March 1966, future President Richard Nixon gave his view on the Vietnam War management and received Johnson’s reply:

He [Johnson] turned to my recommendation regarding a harder line in Vietnam. ‘China’s the problem there,’ he said. ‘We can bomb the hell out of Hanoi and the rest of that damned country, but they’ve got China right behind them, and that’s a different story.’11

Johnson was to an extent justified in hesitating to risk Chinese military reaction. In the early 1950s the US incurred heavy losses in Korea when it miscalculated Chinese reaction to US involvement. US forces were almost thrown back into the sea by the sudden entry of China into the Korean conflict. The US had completely misunderstood Chinese intent, and this precedent was largely responsible for excessive US caution in the years 1964-72, as far as launching a comprehensive mining campaign against Hanoi was concerned.

From 1967 to 1972, Admiral Thomas Moorer, as Chief of Naval Operations (CNO) 1967-70 and Chairman Joint Chiefs of Staff (CJCS)

9 ibid., p. 107. This article gives an excellent outline of the extreme, and usually civilian-dominated, target selectivity of the US air war in Vietnam.
10 Robert Strange McNamara, the US Defense Secretary from 1960 to 1968, was extremely reluctant to take the risk of mining North Vietnam (see above). In 1965 McNamara, at President Johnson’s behest, directed the Assistant Secretary of Defense (International Security Affairs) to investigate the legalities of mining Haiphong harbour. The recommendation to McNamara from his assistant appears to be to the affirmative regarding the mining option. Nevertheless, McNamara decided against it (see A. Rubin, ‘Rules of Thumb for Gut Decisions: International Law in Emergencies’, Naval War College Review, March/April 1982, p. 43).
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1970-74, had repeatedly recommended the mining option to policymakers. Prior to 1967 (1964-66) he had been CINCPAC and had also advocated the mining of Haiphong then. His enthusiasm for the mining was not entirely based on the relative military ease of the operation. Moorer had been a lieutenant commander in 1945 and had taken part in investigations involving the effectiveness of Operation Starvation against the Japanese. He was impressed with the extreme effectiveness of aerial mining and saw all the ingredients of success in a mining campaign against North Vietnam. During 1969, early in the first Nixon Administration, he participated in the first efforts at serious contingency planning for a mine blockade of North Vietnam. However, the same old constraints applied and it was not until the US had reached a critically desperate situation in 1972 that this strategy would be employed.

The Crisis

Crisis-point for the US President and his advisers came in what Nixon described as his 'week of disaster', 1-8 May 1972. By 1 May only 69,000 US troops remained in Vietnam, due to withdrawals under the Vietnamisation programme. A massive North Vietnamese offensive involving thirteen of the fourteen PAVN divisions and 150 independent regiments was threatening the old capital of Hue after having taken Quang Tri province. Reports from MACV Commander, General Abrams, and Ambassador Bunker were extraordinarily pessimistic. Late on the afternoon of Monday 1 May 1972, Henry Kissinger read a cable from Abrams that spelled out that '... it is quite possible that the South Vietnamese have lost their will to fight, or to hang together, and that the whole thing may well be lost'. Nixon's reaction was one of shock. He commented:

I could hardly believe what I heard. I took the cable and read it for myself. 'How could this have happened?' I asked ... And then I thought of the bleak possibility — it was conceivable that all South Vietnam would fall. We

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12 Kissinger, The White House Years, p. 1179.
13 Hersh, The Price of Power, p. 120.
15 ibid., p. 594.
would be left with no alternative but to impose a naval blockade and demand back our POWs.16

Theodore White suggests that during this crisis ‘...Nixon was now very lonely as a President. His architecture of peace had been neat, logistical, diligently pursued; its capstone was to be his journey to Moscow, two weeks hence, just as its cornerstone had been his mission to Peking. If he responded now in the diplomacy of kill against kill, he might risk both capstone and cornerstone — as well as his re-election.’17

A secret meeting between Kissinger and Le Duc Tho, the Chief North Vietnamese negotiator, on Tuesday 2 May went badly. Kissinger states that:

... in my experience the North Vietnamese were never more difficult than when they thought they had a strong military position — and never more conciliatory than when in trouble on the battlefield. Unfortunately for our emotional balance, Tuesday May 2 was a day on which Le Duc Tho was confident he had the upper hand... for all Le Duc Tho knew, a complete South Vietnamese collapse was imminent.18

Years after these events Kissinger, when praising Le Duc Tho’s ability, said of him ‘... Nor did he abandon his courtesy, except once in May 1972 when, carried away by the prospect of imminent victory, he was tempted into insolence’.19 This meeting turned out to be the briefest ever between the two delegates and Kissinger broke off talks after realising there was:

... no point in continuing the conversation ... Le Duc Tho was not even stalling. Our views had become irrelevant; he was laying down terms. He acted as if every passing day would make our position more untenable. Hanoi would not use the talks to try to

16 ibid., p. 595.
19 ibid., p. 24.
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forestall American retaliation because it wanted no inhibition on its freedom of action.\textsuperscript{20}

In summary of the meeting Kissinger said:

\ldots its significance was not that the North Vietnamese had been unyielding, that it was so close to victory that it no longer needed even the pretence of a negotiation ... Le Duc Tho’s disdain of any stratagem indicated that in Hanoi’s judgement the rout had begun, beyond our capacity to reverse by retaliation. Our action had to provoke a shock that would give the North pause and rally the South.\textsuperscript{21}

Kissinger claimed to have realised that ‘\ldots The point of decision had arrived’ as he flew back to the US for a meeting with Nixon.\textsuperscript{22}

On arrival in Washington (Wednesday 3 May), Kissinger and his deputy, Major General Alexander Haig, met with Nixon aboard the Presidential yacht Sequoia. All agreed that a ‘major move was called for’ and that a firm decision must be made by Friday 5 May. Kissinger says of his own attitude at the time:

My preferred strategy was the plan first developed by my staff in 1969 and resubmitted by Haig on April 6: the blockade of North Vietnam, to be accomplished by mining.

I favoured a blockade because it would force Hanoi to conserve its supplies and thus slow down its offensive at least until reliable new overland routes had been established through China. Since most of the supplies would be Soviet, this would not be an easy assignment. I preferred mining because after the initial decision it was automatic; it did not require the repeated confrontations of a blockade enforced by intercepting ships. Even though the brunt of stopping the offensive would still have to be borne by the forces of South Vietnam, once enemy supplies in the South were

\textsuperscript{20} Kissinger, \textit{The White House Years}, p. 1173.
\textsuperscript{21} ibid., p. 1175.
\textsuperscript{22} ibid., p. 1174.
exhausted, the mining would create strong pressures for negotiation.23

Haig had consulted Moorer in early April, less than a week after the 30 March commencement of the Communist spring offensive. Moorer was enthusiastic and probably thought the chances of approval were better than ever as the month of April wore on. As the military situation deteriorated Admiral McCain, Moorer's CINCPAC, sent a formal request for approval of blockade by mining Haiphong harbour. This dispatch was received by Moorer on 23 April. On 1 May Haig asked US CNO, Admiral Zumwalt, for an assessment of the likelihood of success using a mine blockade. Zumwalt was all in favour of the idea:

... We [USN command] all preferred mining to blockading [with ships]. Mining was tactically simpler and politically more decisive. Ships patrolling aggressively in front of harbour entrances would be both more provocative and more vulnerable than mines lying quietly in harbour waters ... As military operations go, in fact, mining is one of the most cost effective there is. It is relatively cheap and relatively safe and extremely threatening to an enemy.24

On 2 May CINCPAC followed up his 23 April mining recommendation and reminded Moorer of his request. The Wednesday 3 May meeting aboard Sequoia evidently proved decisive in terms of the possibility of a mining blockade since, on the afternoon of Thursday 4 May, Moorer met with Zumwalt and advised him that he (Moorer) had been instructed to immediately produce a Presidential brief concerning the mining of North Vietnamese harbours. Zumwalt and his advisers prepared the brief from 20.00 to midnight that evening and on the following day, Friday 5 May, Zumwalt and Moorer discussed ramifications of the plan before presenting it to the Joint Chiefs and then the President.25

While the military were involved in working out the details of a mine blockade of North Vietnam, there was much controversy over

23 ibid., p. 1178.
25 ibid., pp. 384-387.
adoption the option among White House staff. The period 3 to 5 May was a time of Presidential uncertainty regarding mining, and Nixon was not to make his final decision until the night of Friday 5 May or on the next morning at Camp David. Nixon was obviously concerned about the Russian and Chinese reactions to a blockade of any sort. With few exceptions, White House staff believed that the cancellation of the Moscow Summit would follow if mining were to take place. Strong arguments against the mining came from Defense Secretary Laird and CIA Director Helms.

On 3 May Nixon told Kissinger, Connally (Treasury Secretary), Haldeman (White House Chief of Staff) and Haig, with some degree of frustration:

... As far as I’m concerned, the only real mistakes I’ve made were the times when I didn’t follow my own instincts ... Now in this case my instinct is that one thing is clear: whatever else happens we cannot lose this war. The summit isn’t worth a damn if the price for it is losing in Vietnam. My instinct tells me that the country can take losing the Summit, but it can’t take losing a war.

Nixon later said of his attitude:

... I believed it was essential that we take decisive action to cripple the North Vietnamese invasion by interdicting the supplies of fuel and military equipment the enemy needed for its push into South Vietnam. I consequently directed that plans be prepared immediately for mining Haiphong harbour and bombing prime targets in Hanoi, particularly the railroad lines used for transporting military supplies.

Nevertheless, Nixon ‘... decided to take the risk of postponing a decision for at least a few days’ and set about making the Soviets aware of how seriously he took the situation. It was not until midday on
Saturday 6 May that Moorer alerted CINCPAC to prepare to initiate mining attacks at 20.00 (Washington time) on 8 May. Nixon planned to give his address to the nation at 21.00 on that evening and spent the weekend preparing his speech and preparing for the National Security Council (NSC) meeting, which was to take place at 09.00 on Monday morning.

At the three-hour NSC meeting on Monday morning there was considerable debate. The Defence Secretary and Director of the CIA maintained their stand against the mining and bombing attacks. Secretary of State Rodgers was 'ambiguous'. Connally, Vice-President Agnew and Kissinger were in favour of the measures Nixon had decided on. To exacerbate this lack of unity at the highest levels, State Department academic experts on Chinese and Soviet affairs came up with what turned out to be wrong and pessimistic predictions. The Soviet expert advised that the Soviets would definitely cancel the summit. The China expert advised that Peking would freeze relations. Nevertheless, an order for commencement of attack had to be relayed to CINCPACFLT by 14.00 Washington time if the operation was to be announced during the Presidential address that evening.

About midday, Nixon summed up his perception of the situation to the NSC. According to Kissinger, Nixon said:

The real question is whether the Americans give a damn anymore ... If you follow Time, The Washington Post, The New York Times and the three networks, you could say that the US has done enough. 'Let's get out; let's make a deal with the Russians and pull in our horns.' The US would cease to be a military and diplomatic power. If that happened then the US would look inward towards itself and would remove itself from the world. Every non-communist nation in the world would live in terror. If the US is strong enough and willing to use its strength, then the world will remain half communist rather than becoming entirely communist.

The meeting concluded at 12.20 and Nixon's 'Execute' order was relayed from Washington to CINCPACFLT at 13.40 Washington time.

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31 The fullest account of the 8 May NSC meeting is given in Kissinger, The White House Years, pp. 1183-1185.
32 See ibid., pp. 1182-1183.
33 ibid., p. 1185.
At 20.00 Washington time Navy and Marine A6 and A7 carrier aircraft took off from the decks of USS Coral Sea and commenced mining Haiphong, Hon Gai and Cam Pha harbours. By the time the President started his speech to the nation, 75 highly capable Mk 52 mines had been deployed along the 12-mile length of the narrow (200-250 feet) ship channel into Haiphong. In the following days over 700 DST-36 mines were laid in three other fields outside the Haiphong channel entrance. The Mk 52 mines were set with a 100-day sterilisation time while the destroyers had a 200-day setting.\(^{34}\) In later operations, involving reseeding and mining coastal areas where lightering could take place, a total of 11,000 DST-36 mines was deployed.\(^{35}\) No aircraft casualties occurred on 8 May and it was described by the US CNO as a ‘textbook operation’.\(^{36}\)

By the time the US aircraft involved in the mission were back on board, President Nixon had commenced his speech, which was not only aimed at justifying the mining to the American people. It was also used as a method of direct communication with the Soviet and Chinese leadership. Nixon’s 8 May speech made a critical, perhaps even decisive, contribution to the success of the US initiatives of 1972. Careful attention was paid to political and legal factors during the speech, and a close analysis of the text is informative and rewarding. The speech provides a political-legal precedent for launching a modern mining campaign.

During the speech, Nixon stressed that the US would not accept Hanoi’s terms but that a negotiated outcome was still his preference. He spoke of the disappointing 2 May meeting with the North Vietnamese, who ‘... arrogantly refuse to negotiate anything but an imposition’ and stated the objective of his military decisions clearly. He said: ‘I therefore conclude Hanoi must be denied the weapons and supplies it needs to continue this aggression’. The next stage of the speech dealt with how the objective would be achieved:

All entrances to North Vietnamese ports will be mined to prevent access to these ports. United States forces


\(^{35}\) Hartmann, Weapons That Wait, p. 188.

\(^{36}\) Zumwalt, On Watch, p. 387.
have been directed to take appropriate measures within the claimed and territorial waters of North Vietnam to interdict the delivery of any supplies ... Rail and all other communications will be cut off [to] the maximum extent possible.

Nixon then stated his terms to the North Vietnamese and went on to spell out the implications of his actions to the Soviet Union and to a lesser extent China. He said:

No Soviet soldiers are threatened in Vietnam. 60,000 Americans are threatened. We expected you to help your allies, and you cannot expect us to do other than continue to help our allies ...'. Our two nations have made significant progress in our negotiations in recent months. We are near major agreements on nuclear arms limitations, on trade, and a host of other issues. We do not ask you to sacrifice your principles, or your friends, but neither should you permit Hanoi's intransigence to blot out the prospects we together have so patiently prepared.37

There are many noteworthy aspects of the 8 May speech. The following points illustrate very well how a mining campaign can be justified to the world community on the basis of the criteria previously described:

- The US Government accepted the burden of proof for its actions and promptly explained its conduct before the world community. The explanation was televised at the time operations were carried out and it was given from the highest level of state, that is, from the President of the United States.

- Nixon explained that the acts of the North Vietnamese had raised an imminent threat to the lives of the 69,000 US servicemen remaining in South Vietnam. He also explained that the territorial integrity and political independence of a US ally (South Vietnam) was threatened. These points presented a 'realistic' interpretation of Article 51 of the UN Charter in terms

of the mining being a reasonable act of individual and collective self-defence. In doing this he also clearly defined the limited objectives of his actions.

- The President stated that, for months, reasonable and peaceful efforts to arrive at a settlement with the North Vietnamese had failed. He also emphasised his preference for a negotiated settlement and that he would continue these efforts, thus putting the US negotiating record beyond reproach. Nixon stated reasonable terms involving an internationally supervised ceasefire and the return of US prisoners of war. Following agreement to these terms by North Vietnamese leaders, he said that the US withdrawal in full would be completed within four months.

- The US military response, as detailed in the speech, was depicted as proportional and reasonable in the face of the threat posed by the North Vietnamese offensive. The mining effort minimised violence and limited the threat to non-combatants. The mining campaign was a major example of the principle of economy of force.38

- Detailed attention was also paid to the customary and conventional laws of blockade, even though the terms blockade or quarantine were not used. This is indicated by the following points:
  (i) Reference was made to the prevention, by mine interdiction, of access to and from North Vietnamese ports by commercial shipping and North Vietnamese naval units. This statement accorded with the Hague VIII precept that mines not be laid with the ‘sole purpose of intercepting commercial shipping’.
  (ii) It was emphasised that the mines were only to be laid in the territorial seas and internal waterways of North Vietnam. Freedom to navigate the high seas was not interfered with under TIAS 5200 of the 1958 Geneva Convention on the High Seas.

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38 To achieve economy of force or effort, a leader must correctly appreciate the situation so that he will be able to assign the minimum forces needed to achieve his aim. Such economy diminishes logistic support demands and in many instances is not unduly provocative. Economy of force is one of the 10 Principles of War.
(iii) Adequate measures were taken for the protection of neutrals. Nixon stated that three daylight periods were available for neutral vessels to leave North Vietnamese harbours and waters. This was arranged using a 72-hour arming delay on mines used during the initial operations. Neutral governments were notified promptly and a Notice to Mariners was issued. US and South Vietnamese naval vessels would also warn all vessels about to enter the mined areas that they would do so at their own risk.

In addition to these measures, the US Ambassador to the UN, George Bush, promptly informed the UN Security Council that ‘... these measures of collective self-defence [were being reported] as required by Article 51 of the UN Charter’. Bush went on to say that the operations were ‘... restricted in extent and purpose’. To further emphasise the limited objectives of the operations, Nixon only referred to them as ‘interdictions’. By doing this the President probably hoped to forestall legal challenges to his executive authority to order the mining campaign without a formal declaration of war.

Political Aftermath

The Presidential decision to mine Vietnamese waters was generally perceived as involving grave risk. The New York Times went so far as to describe it as a ‘desperate gamble’. White says that ‘... the mining of Haiphong harbour had been the greatest gamble of Mr. Nixon’s diplomacy’. Kissinger described the media’s rage as ‘nearly uniform’. The following newspaper excerpts, each printed within days of the speech, range from the basically anti-Nixon Administration New York Times to the decidedly right-wing Christian Science Monitor:

40 See Luckow, ‘Victory over Ignorance and Fear’, p. 22. A blockade is technically an act of war under international law.
41 Cited in Kissinger, The White House Years, p. 1191.
43 Cited in Kissinger, The White House Years, p. 1191.
New York Times: called for Congress to block government funding to ‘... save the President from himself and the nation from disaster’.44

Washington Post: commented that Nixon ‘... has lost touch with the real world ... The Moscow Summit is in the balance, if it has not yet toppled over ... The only relief in this grim scene is that Mr. Nixon is coming to the end of a term and the American people have the opportunity to render a direct judgement on his policy’.45

St. Louis Post-Dispatch: commented that the nation could not support its President because ‘... in this case the cause of war isn’t one of honour but of dis-honour’.46

Boston Globe: said of the challenge to Moscow that ‘... Somehow it all seems even more immoral than our involvement in the war itself’.47

Christian Science Monitor: commented that ‘... the wisdom of that decision [to mine] is clearly open to question’.48

The response from Nixon’s political rivals was equally unfavourable. George McGovern, Nixon’s challenger in the forthcoming November Presidential election, said:

The President must not have a free hand in Indochina any longer ... The nation cannot stand it. The Congress must not allow it ... the political regime in Saigon is not worth the loss of one more American life ... This new escalation is reckless, unnecessary and unworkable ... a flirtation with World War III.49

Similar thoughts regarding the decision to mine were expressed by the following prominent democrats:

44 ibid.
45 ibid.
48 ibid.
49 ibid.
Edward Kennedy: ‘... The decision is ominous and I think it is folly’.

William Proxmire: ‘[The decision is] reckless and wrong’.

Hubert Humphrey: ‘[The situation is] filled with unpredictable danger’.

Edmund Muskie: ‘[Nixon] is risking a major confrontation with the Soviet Union and with China and is jeopardizing the major security interests of the United States’.

Edward Koch: ‘The President is an international law breaker’.

Harold Hughes (Iowa): ‘[The decision is] a national tragedy’.

Kissinger summarised the response to Nixon’s 8 May speech thus ‘... Editorials, comment, commentators [were] overwhelmingly against [us] at home and abroad, [there were] riots on campuses, and demonstrations ...’.51

Communist response was pitched at a much lower key than the domestic fury of many elements in the United States. An emergency meeting of the Politburo was conducted in the Kremlin on the morning after the speech. TASS condemned the mining as ‘... fraught with serious consequences for international peace’ and ‘... A gross violation of the generally recognised principle of freedom of navigation’ as well as an ‘... inadmissible threat to Soviet and other shipping’.52 However Nixon was at no time personally denounced and the TASS bulletins specifically noted Nixon’s assurance that US efforts were not directed against any other country. Chinese response was even milder than that of the Soviets. Apart from complaining of attacks on Chinese ships during US operations they carried on with business as usual.53

On 11 May Kissinger met Soviet Ambassador to the US Dobrynin, and asked him why no mention had been made as yet of the Moscow Summit. Dobrynin is said to have replied: ‘We have not been

51 White, The Making of the President 1972, p. 236.
asked any questions about the summit and therefore my government sees no need to make a new decision’. Kissinger then asked Dobrynin ‘... should we have asked any questions about the Summit?’ Dobrynin replied: ‘No, you have handled a difficult situation uncommonly well’. Kissinger and Nixon now considered the crisis over. Both men proceeded to the Moscow Summit on 20 May.

Despite the extremely heavy criticism by the free-world media and rival politicians, US ‘grass roots’ domestic support appeared to be behind Nixon. The Committee working to re-elect Nixon received 20,000 telegrams of support the day after the speech, with a further 17,000 delivered later. On the morning after the speech a telephone poll conducted by the Opinion Research Corporation recorded 74 per cent support for the President. A survey conducted on 9 and 10 May reported 59 per cent approval for his actions, 24 per cent disapproval and 17 per cent unsure. Nevertheless, the real test of Nixon’s leadership and policies during the ‘week of disaster’ and throughout his first term was to occur in the 1972 Presidential elections, scheduled for early November.

On 22 August, at the 1972 Republican Convention, Nixon was renominated for a second term by a vote of 1,347 to 1. One week later Nixon received the largest post-convention point spread in favour of a Republican candidate in Gallup poll history. In early November Nixon won a landslide victory, in which he carried every state in the Union except one. No other President had ever taken so many states and he received the largest number of popular votes ever cast for a presidential candidate. A majority was won in every key group defined by Gallup polls, except democrats and blacks, although several of these groups had never before been seen as Republican backers. Nixon’s total share of the vote was 60.7 per cent, while McGovern’s was 37.5 per cent (this compares with his 47 per cent share of the vote in the closely contested 1968 election). The results of the 1972 election can be accepted as an overwhelming mandate of Nixon’s presidential performance, including the crisis management of May 1972.

White, The Making of the President 1972, p. 236.
ibid., pp. 716-717.
Military Aftermath

There is little question that the blunting of the 1972 Communist spring offensive was brought about by a strong combination of political and military pressure. The offensive lost momentum after initiation of the mining and bombing strikes during the period 8 to 12 May. The attack on Hue never eventuated and the besieged cities of Kontum and An Loc did not fall. Kissinger states in his memoirs that:

... Clearly, someone had blinked. Less than a week after the resumption of full-scale bombing and the blockade of North Vietnam efforts were being made to resume negotiations 'without preconditions' — a far cry from Hanoi’s previous smug insistence on the 'correctness' of its terms ... it had at last begun its retreat toward a more negotiable condition.58

After receiving a report of Kissinger’s 9 May press conference, Le Duc Tho sent word on 12 May that he was prepared to resume negotiations. On 15 May the US agreed in principle to reopen plenary sessions in Paris.

At this early stage after the initial mine deployments the real effect of the mining campaign was more in terms of political and psychological shock than direct US military advantage. US intelligence estimates indicated that the North Vietnamese had about four months’ war stocks in-country by the time of the mining attack,59 so it would obviously take time for the mines to have a long-term effect on the North Vietnamese war-making effort. But the blockade was entirely successful from the beginning. At the time of the first mining of Haiphong harbour 36 merchant vessels were in harbour. Nine of these ships left during the three-day arming delay period while the remaining 27 ships spent the next ten months confined to harbour.60 By September 1972 US analysts estimated that supplies to forward areas of North Vietnamese and Viet Cong activity had been reduced by 300-1500 tons per day.61 These figures represent a 20-90 per cent reduction in the flow of war materials from North Vietnam to forward areas in South

59 Ibid., p.1185.
Vietnam. This was an indirect result of the mining, because mines laid in coastal waters considerably reduced the quantity of goods sent to the south by lightering craft and a huge burden was placed on overland truck and rail routes which convoyed goods from China and went south. The flow of goods required in the south could no longer be maintained under cover of darkness or in bad weather. Consequently, the substantial reduction of supplies to the south arose from the increased susceptibility of overland lines of communication to surveillance and air strikes. This crucial indirect aspect was overlooked by the systems analysts and academic strategists of the 1960s. Sir Robert Thompson, a strategist of the Malayan Emergency and critic of the US conduct of the Vietnam War, highlights the fundamental political-military value of the mining campaign: ‘The mining was aimed at reducing Hanoi’s future capability to continue the war at the pace Hanoi itself had set’.

Even though Hanoi had several months’ war stocks, it was unlikely that North Vietnam would allow these stocks to dwindle significantly in the long term. Kissinger describes how he assessed the effects the mining would have when addressing the NSC on the morning before the mining operations:

I then answered the analyses that disparaged the effect of mining. The North Vietnamese would have to find alternative routes for 2.1 million tons of seaborne imports. Sihanoukville was closed. They could use railroads only by night for fear of our interdiction: ‘You can’t throw these figures around without better analysis. It is easy to say that they have four months’ [reserve] capacity and would go all out and end the war, but they would end up with zero capacity ... One thing is certain, they will not draw their supplies down to zero’.

Continued bombing of North Vietnam and supply lines to the south, together with the mine blockade and circumscribed support from its Soviet allies, seemed to have moderated Hanoi’s recalcitrance. Nixon stated in his memoirs:

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64 Kissinger, The White House Years, p. 1185.
After three years of disappointing and unproductive stalemate the US-North Vietnamese private channel suddenly became active in August. For the first time the Communists actually seemed to be interested in reaching a settlement. Kissinger and I assumed that they had come to the conclusion that McGovern did not stand a chance of becoming President and had therefore decided to explore the policy that they could get better terms from me before the election than after it. In addition they were undoubtedly concerned by our contacts with Moscow and Peking and with the success of Vietnamization; we knew also that the May 8 mining and bombing had taken a heavy military toll.65

Negotiations continued, with the North Vietnamese giving some ground under continued military pressure. Renewed North Vietnamese intransigence in early December lead Nixon to order the reseeding of the Haiphong minefields and B-52 strikes against military targets in the Hanoi-Haiphong areas. Bombing of North Vietnam continued until 29 December when the North Vietnamese proposed a meeting in Paris on 8 January. The result of the January negotiations was a settlement, made on 23 January, agreeing that the long-sought-after ceasefire would be put into effect at midnight on 27 January. The US continued the withdrawal of all remaining troops while simultaneously making massive injections of military equipment into South Vietnam under Operation Enhancement Plus.66 On 12 February the first US POWs were flown from Hanoi to the Philippines. Nixon had by no means ‘won the war’, as he would later claim, but he had achieved the crucial political-military objectives of his 8 May announcement: to prevent the imminent collapse of South Vietnam; to secure the safety of US forces in South Vietnam; to institute a ceasefire throughout Indochina; to secure the return of US POWs; and to demonstrate his resolve to the Soviets.

Conclusions

It is suggested that the personality of the national leader (Richard Nixon) was the dominant factor in the US management of the crisis

initiated by the Communist spring offensive of 1972. Evidence points to Nixon ‘becoming increasingly irate’ during the month of April, in which North Vietnamese forces made spectacular gains and implanted the vast majority of their regular forces in South Vietnam.67 A surprised President Nixon had obviously perceived the imminent collapse of South Vietnam as a distinct possibility by 1 May and his last hope of a negotiated settlement rested on the 2 May secret meeting with the North Vietnamese in Paris. The President’s delusion that Soviet leverage could moderate the hard North Vietnamese negotiating position during these talks was dashed when Kissinger closed off talks after being exposed to ‘... three hours of insult and invective’.68 The tentative decision to take unprecedented military action was made on 3 May. Though Kissinger basically agreed with strong military action he was surprised at the degree of Nixon’s response. The President personally insisted on massive air strikes and the bolstering of Seventh Fleet strength from 84 to 136 vessels. A Nixon critic suggests, with much justification, that:

Richard Nixon had become unnerved; he had concluded that he could not politically survive a defeat, or even the appearance of a defeat, in South Vietnam. He was convinced that his political future rested on the resolution of the Vietnam War, and not on a Moscow Summit ... The Vietnamese and Russians had conspired to humiliate him and he wanted to move boldly against Moscow.69

Nixon made a political judgement on his fundamental priorities and acted on that judgement with a vigour that surprised even the military. His ‘instincts’ told him that to lose in Vietnam would be more costly than to lose the Moscow Summit. Nixon’s diary of the time records that ‘... What really matters now is how it [the war] all comes out. Both Haldeman and Henry seem to have an idea — which I think is mistaken — that even if we fail in Vietnam we can survive politically’.70

The leader therefore concentrated his resources and energies on preventing the collapse of South Vietnam. However he was running out of options, since other than increased bombing against more targets he could do little else but blockade North Vietnam. Landing more US
troops in Vietnam was out of the question. Similarly, the use of tactical nuclear weapons against North Vietnamese lines of communication, which had been examined in the 'Duckhook' plans of 1969, was not politically viable.

The mining campaign of 1972 was the result of a decision made by a national leader exasperated by an enemy exhibiting no real desire for compromise and threatening to overrun a US ally. Nixon grew increasingly 'fed up' with North Vietnamese behaviour, both on the battlefield and at the negotiating table. By 3 May the negotiating and military position had become bleak enough for him to seriously take a decision to mine. This decision was taken, and acted upon, despite almost unanimous opinion throughout the highest levels of the administration that the Moscow Summit would be cancelled and relations with China would freeze up again. The leader's will and political judgement were the major factors in the decision, which was also heavily influenced by strong anger over perceived North Vietnamese duplicity. Both factors contributed to the decision to take unprecedented military action and ultimately set the scene for a favourable negotiating position in Paris and Moscow.

The short-term military effects of the mining campaign were recognised by the Nixon Administration from the outset as being minimal. But longer term military effects, after a few months, were very considerable. However, the important aspect of the campaign is that it yielded almost immediate political leverage for the US. The mining campaign was an act which clearly and tangibly demonstrated US resolve and preparedness to continue supporting its allies. The act also met with the apparent acceptance of the bulk of the US electorate, an electorate which, after seven years of active involvement in Vietnam, had developed a growing revulsion to any warlike US activity in the area. Similarly, Nixon's tough military approach to North Vietnam during early May almost certainly added to his prestige and standing with senior Soviet officials during the Moscow Summit.

In summary, the political utility of the minelaying campaign, as a signal to both Hanoi and Moscow, almost certainly surpassed even the considerable long-term military value of the blockade. The blockade was a decisive act that was accepted by the US electorate and the United

71 See Hersh, The Price of Power, pp. 505-513, 528.
72 See ibid., pp. 503-528, for a detailed and highly critical account of President Nixon's attitude during the period 30 March to 22 May 1972.
Nations because it was an act of collective self-defence set at the minimum level of conflict.

Approximately 1.5 million mines have been deployed during the twentieth century because they are inherently flexible, achieve excellent results in terms of ship sinkings and shipping control, and are useful in a wide variety of operational situations. The most impressive results of mine-use (Dardanelles, Baltic Sea and Wonsan) were achieved by the maritime underdog against overwhelming odds. A major reason for these spectacular successes was the unique psychological 'warhead' of the mine.

Modern mining operations can be co-ordinated in a manner compatible with customary international legal requirements and can provide a degree of political leverage out of all proportion to actual mine-use costs.
CHAPTER EIGHT
MINE-USE COST-EFFECTIVENESS

The ‘Numbers Game’

National defence decision-making is complex. Selection of weapons systems and specific policy development is not facilitated in an environment where most choices are interdependent and many elements do not remain constant. Consequently, it comes as no surprise that quantitative analysis, in terms of determining cost-effectiveness, has enjoyed widespread acceptance as a basis of resolving many issues of force structure decision-making.

Quantitative analysis to prove the high cost-effectiveness of the mine can be based on the following factors:

(1) Mines have been very cost-effective in the past.
(2) Mines have a relatively low initial cost.
(3) Mines are easy to maintain and have low upkeep costs.
(4) Mines have an indefinite shelf-life.
(5) Mines draw an extremely disproportionate response when deployed in critical areas.
(6) Mines offer a permanent threat to the rival force.
(7) Mines enhance the value of other weapons systems.
(8) Mines can be produced in large quantities and so facilitate economies of scale.
(9) Mines can be deployed by almost any naval/air force/civilian platform.
(10) Mines are reliable.

All of these factors contribute to making the mine an affordable force multiplier which is easily manufactured, easily maintained and readily deployed. Such characteristics make the mine an effective sea denial ‘ready round’ for the Australian Defence Force to use when carrying out its extensive maritime defence responsibilities.

This chapter will first consider the overall record of mines in the Western/South-Western Pacific Theatre during World War Two, then assess the modern situation. It can be argued that advances in mine countermeasures and surveillance technologies make the minelaying mission far more difficult today than was the case in World War Two.
and that we cannot expect as high a level of cost-effectiveness from the mine as was achieved in the past. However:

- Though considerable advances have been made in MCMs in the post-war period, advances in mine technology have far outstripped these. This is true to the extent that most nations have elected to practically give up attempts to minesweep and now concentrate on minehunting. But this is extremely costly and only possible under very favourable circumstances, so the modern bottom mine is often unsweepable and the mine designer maintains the initiative.

- Shipping is even more susceptible to damage from mines today than in World War Two. Firstly, there is much more shipping traffic now than during the war.1 Second, the ships themselves are less sturdy than their ‘rivetted’ wartime counterparts and relative ship costs are much higher today. Third, the control and communication systems in modern vessels are very susceptible to shock damage.

- While major technological advances have been made in developing the Anti-Submarine Warfare (ASW) and Anti-Aircraft (AA) effectiveness of systems which can acquire and target minelaying platforms, similar advances in Electronic Countermeasures (ECMs) have been incorporated in the minelaying platforms themselves. Losses incurred by US minelaying aircraft during the mining of North Vietnam were negligible. This was the case even against a highly practised and well-equipped opponent.2 The other capabilities of submarines, apart from ECMs, have also been expanded since World War Two. Finally, the element of surprise is always a factor which even the best ASW and AA

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1 See Hartmann, Weapons That Wait, Appendix B, pp. 278-279.

2 The North Vietnamese had been combating US tactical air strikes since 1964 with considerable success. This was particularly the case in the late sixties and early seventies, when large quantities of Soviet-made surface-to-air missiles were available to North Vietnamese air defence regiments. However, only one A7 aircraft was lost during operations involving the laying of approximately 11,000 mines. Intercepting aircraft flying low over the ocean is a much more difficult task for air defence missiles than intercepting higher altitude aircraft.
forces will find difficult to counter. Surprise is the

The costs of ships and of their cargoes have risen

A World War Two US frigate cost approximately $US6 million while a modern

A reasonably sophisticated bottom mine costs approximately $US80,000, while its wartime predecessor cost between $US6,000 and $US8,000 (a 10-fold increase). Damage costing $US96 million was done to the US FFG Samuel B. Roberts in 1987 by an Iranian contact mine costing no more than $US5,000 to produce. The total number of mines used in Iranian offensive fields was of the order of 50; for the cost of approximately $US0.25 million in producing the threat, the Iranians did exceedingly well. This is especially the case given that the FFG was not the only casualty of the few small offensive fields.

The reasons for this relative mine price stability are obvious: the bottom mine is immune to price rises in guidance, life support and propulsion systems. What this means is that a mine attack yields far more relative damage in terms of dollars lost by the opponent today than was the case in World War Two.

These points suggest that, if anything, post-war trends in technology and costings have dramatically reinforced the advantages of mine-use. It is not unreasonable to assume that a future mining campaign in the Western and South-Western Pacific could give results at least comparable to those achieved by mines during World War Two (see Table 8:1 and Figure 5:4).

On average 23 mines were required to attack a vessel, with each attack having a 64 per cent ship 'kill' probability. However the highest ship attack rate for mines was achieved in the waters of the South-West Pacific, with 8 mines per ship attack and a ship 'kill' rate of 75 per cent. Table 8:2 gives a comparison, in terms of cost-effectiveness, between mine performance and submarine (torpedo) performance in World War Two. The mining figures, from the Japanese Inner Zone mining campaign, represent a 'worst case' scenario, in that elsewhere in the Pacific mining achieved even better cost-effectiveness. For example, Fremantle-based US submarines achieved a cost per enemy ton casualty of between two and three dollars! While modern torpedoes, such as the RAN's Mk48, are greatly superior to World War Two models, modern mines are superior to their World War Two ancestors by at least the same margin.
### TABLE 8:2
**US COST PER ENEMY TON CASUALTY, WESTERN AND SOUTHWESTERN PACIFIC, WWII**

<table>
<thead>
<tr>
<th></th>
<th>Inner Zone Mining</th>
<th>Submarine Campaign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of Campaign in Months</td>
<td>4.5</td>
<td>44.5</td>
</tr>
<tr>
<td>Number of Craft Employed</td>
<td>40 (B-29)</td>
<td>100 (SS)</td>
</tr>
<tr>
<td>Number of Crew per Craft</td>
<td>11</td>
<td>85</td>
</tr>
<tr>
<td>Total Craft Lost</td>
<td>15</td>
<td>52</td>
</tr>
<tr>
<td>Total Crew Lost</td>
<td>103</td>
<td>4,000</td>
</tr>
<tr>
<td>Cost of One Craft in dollars</td>
<td>500,000</td>
<td>5,000,000</td>
</tr>
<tr>
<td>Ship Casualties to Enemy in Tons</td>
<td>1,250,000</td>
<td>4,780,000</td>
</tr>
<tr>
<td>Enemy Casualty Rate in Tons per Month</td>
<td>280,000</td>
<td>110,000</td>
</tr>
<tr>
<td>US Ship Investment Per Enemy Ton Casualty, Dollars</td>
<td>16</td>
<td>100</td>
</tr>
<tr>
<td>Tons of Enemy Casualty per Crew Member Required</td>
<td>3,500</td>
<td>560</td>
</tr>
<tr>
<td>Tons of Enemy Casualty per Crew Member Lost</td>
<td>12,000</td>
<td>1,200</td>
</tr>
<tr>
<td>Cost of US Loss per Enemy Ton Casualty, Dollars</td>
<td>6</td>
<td>55</td>
</tr>
</tbody>
</table>


A further comparison can be made between results achieved by submarines laying mines and results achieved by submarines firing torpedoes in the Pacific Theatre during World War One. Submarines achieved a cost-effectiveness ratio ranging between 0.36 and 1.1 sinking per million dollars cost. (The figure of 0.36 applies if submarine losses associated with torpedo firings are taken into account.) This figure compares most unfavourably with the 4.7 sinkings per million dollars cost achieved by submarine-laid mines in the same theatre. Based on these figures, the mine was at least four times more effective than the torpedo in cost-effectiveness. If submarine losses during torpedo attacks are taken into account, the mine was 13 times more effective than the
torpedo, since no submarines at all were lost during Pacific Theatre minelaying sorties.\textsuperscript{4}

How far can these impressive results be related to the modern combat situation? As mentioned, the modern mine has benefited from post-war technological development at least as much as the torpedo. Indeed, events in the Red Sea during 1985 strongly indicate that a 10:1 mine:ship attack ratio was achieved, in an area which is not a choke-point in the strict sense of the word.\textsuperscript{5} Submarine command and fire control systems have greatly improved since World War Two, but these can contribute to the use of mines as much as to the use of torpedoes.

These figures, variables and assumptions suggest that the mine is at least as cost-effective as ever, but cost-effectiveness is seldom decisive during crisis management. The tools of systematic quantitative analysis only take us so far. These methods may work well enough in business and management, but the environment of war and political-military decision-making is less ordered. This chapter thus far has treated only the measurables of the cost-effectiveness equation. The immeasurables of mine-use must now be considered.

The Immeasurables

Article 3 of the German Army Field Manual of 1936 succinctly outlines the importance of the immeasurables or intangibles of war:

The situations arising out of war are infinitely varied. They change often and unexpectedly and can rarely be foreseen in advance. Often it is precisely those factors that cannot be recognised that are of the greatest importance. One's own will is confronted by the enemies' independent one. Friction and errors are everyday occurrences ...\textsuperscript{6}

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\textsuperscript{4} See Patterson, 'Mining: A Naval Strategy', p. 62. Professor Patterson was Chairman of the Mine Advisory Committee, National Academy of Sciences of the National Research Council, from 1958-1962. During 1967-70 he was involved in the Project Nimrod study. (The figures cited by Patterson are from Frey, The Offensive Mine Laying Campaign against Japan.)


\textsuperscript{6} Cited in Van Creveld, Fighting Power, p. 29.
If sound political-military judgement is overly influenced by peacetime quantitative cost-effectiveness calculations, then disaster can result. In the 1960s, systematic quantitative analysis was extensively applied to the Vietnam conflict, with abysmal results. An academic approach to maximising that particular war’s cost-effectiveness and developing an appropriate military strategy led to the least cost-effective war in the history of the United States. Systems analysis was seen by some to be the key to the future of American strategic thought during the early 1960s, but it simply did not work.7

More than any other weapon, the mine takes its user beyond the realm of measurables, for it is the immeasurable element of mine-use that can yield results not attainable by directed weapons. The authors of a comprehensive US Navy analysis of the psychological aspects of mine warfare have commented:

Stress and uncertainty are at the heart of minewarfare. Minefields are like twilight zones — they work more on human minds than on ships themselves. We can use our knowledge — of exaggerated forms of the unknown — to our advantage, by exploring minewarfare’s full psychological potential.8

These words are not the words of mystics or philosophers. They are the words of researchers who are well acquainted with the mine’s record and who recognise the advantages of mine-use in crisis management.

The psychological immeasurables which contribute to the effectiveness of mine warfare have been considered in some detail in Chapter 5. They include the unique forms of fear, shock, surprise and apprehension developed by the presence of a minefield. These immeasurables derive from the invisible presence and automatic, impersonal nature of the mine itself. Because of these characteristics, the mine is said to have a unique psychological ‘warhead’.

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The mine’s psychological warhead is an effective political tool of crisis management. This warhead is separate from the physical warhead, which the mine has in common with directed weapons. The psychological warhead of the mine is used when it is deployed as a means of coercion without violence. It enables the mine to be used as a weapon without killing people and sinking ships. Also, the psychological warhead of the mine is a subtle, but firm, ambassador of national resolve, which can be used with relatively small risk by a government seeking to make its point of view clear.

Thus, the unique psychological warhead of the mine equates to a ‘political’ warhead in many situations. It is in the stressful ‘twilight zone’ of political uncertainty, of deciding what to do next, that the mine’s real utility comes to the fore. It is then that the mine is really recognised for what it is — a weapon that can do things no other weapon can do, that provides options no other weapon can provide. In a crisis the value of such options is immeasurable.

Conclusion

Using recognised methods of quantitative and comparative analysis, it can be concluded that mine-use today maintains at least the same high level of relative cost-effectiveness that it exhibited during World War Two. Indeed, mine-use cost-effectiveness has increased during the post-war period. However, quantitative cost-effectiveness analysis is one thing, while political-military utility is quite another. This difference leads to a consideration of mine-use ‘immeasurables’ in order to complete the cost-effectiveness equation. The immeasurable factors of mine-use are associated with the weapon’s ‘psychological warhead’. Because conflict in general, and war in particular, is basically a contest between ‘wills’, the psychological aspects of mine-use have important, sometimes decisive, political implications in terms of the unique options mines can provide.

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9 Some examples are detailed in Chapter 9.
CHAPTER NINE
THE SEA MINE AS A TOOL OF CONFLICT LIMITATION FOR AUSTRALIA

Government and National Security

The maintenance of national security involves the recognition and countering of threats as they develop and the effective signalling of national will and resolve. The Australian government generally signals its resolve through diplomatic channels, but resort to force may be seriously considered in some future crises. In Chapter 1 it was suggested that, during what may be perceived by Australian planners as the initial stages of tension and threat development, the unilateral application of traditional forms of power projection (such as combat aircraft and warships) may be considered too provocative and escalatory. However, Australian decision-makers may face a political requirement to display a tangible indication of national resolve, to extract concessions from an opponent without escalating conflict. A search would then be made for a minimum-risk strategy involving the following principles:

(1) Minimising of the level of violence and potential for escalation.

(2) Signalling political resolve to the rival in an unambiguous manner. (Such ‘communication’ may force the opponent into a less ambitious position by raising the cost aspect of his cost/benefit considerations.)

(3) Acting in a firm and timely manner which will be recognisable to the electorate, allies and the community of nations as a reasonable and proportional response to the threat. (In short, the action must not violate the ‘public conscience’ either domestically or internationally.)

The Australian military leadership must therefore provide political leaders with a system of graduated response, providing an array of options to give a proportional and appropriate responses to threats. Minefields can be used at the lowest, and hence least escalatory,
levels of graduated response. The lower levels of graduated response involve less overt means of conflict and coercion, while higher levels of graduated response would almost certainly involve direct confrontation between major military units. Because it is more difficult to minimise the potential for escalation at higher levels of graduated response, efforts should first be made to use methods of conflict management appropriate to the lower levels. Minefields can dampen the escalatory process by virtue of the following characteristics, which are of particular value in strategic minefields used for political purposes:

(a) Escalatory ‘eyeball-to-eyeball’ confrontation is eliminated. No direct combat between rival naval forces occurs.

(b) Violence is minimised and strictly limited. Only maritime targets are attacked and they are usually warned of a field’s presence. Populations are attacked with shortages rather than with bombs and missiles. Thus, the mine is a relatively ‘humane’ weapon.

(c) The opponent does not ‘lose face’ in refusing to challenge minefields, because of the field’s automatic, ‘impersonal’ nature. Face is lost in refusing to challenge manned, active weapons platforms such as combat aircraft, submarines and destroyers.

(d) Minefields are low-profile, low-visibility weapons and have traditionally been seen as the weapon of the maritime underdog and not of an aggressive maritime nation.

(e) Minefields have worked before to defuse a crisis involving a high potential for escalation (the mining of Haiphong harbour by the US in 1972).

(f) Minefields are the only form of weapon system that can be used without necessarily killing or injuring people or damaging property. They can perform their sea denial mission without ever firing.

Minefields can be seen as mild means of ‘gunboat diplomacy’ that, in many circumstances, will satisfy all three political imperatives listed above. But a caveat does exist with regard to Australian mine-use in the future. The use of the mine, and any other weapon for that

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1 Discusses above, Chapter 5.
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matter, must take place within a unified and specific framework that will facilitate rational political judgement by not committing political leaders to an 'all or nothing' response. Politicians must be given a specific framework of options allowing them a choice between doing all (over-reacting militarily to the threat and escalating) or nothing (using rhetoric in a situation which might be stabilised by a mild, though firm, military response). This chapter offers a framework of options for mine-use in the Australian political-military context, termed the Australian Mine-Use Model (AMUM).

The Australian Mine-Use Model (AMUM)

Overview

Eighteen contingencies have been identified in the AMUM (see Figure 9:1). These are listed under what is termed the threat spectrum and range in ascending order of seriousness from level 1 (economic/political competition) to level 18 (full-scale invasion of continental Australia). Most of the threats listed are derived from the low-, intermediate- and high-level scenarios established by the Parliamentary Joint Committee on Foreign Affairs and Defence.2

A weapons-use framework such as the AMUM should not be too scenario-sensitive. It should remain a general framework only and be flexible enough to be applied in situations not envisaged during peacetime contingency planning since, if history is any guide, the crisis actually faced could be quite different to that which has been anticipated. The purpose of the threat spectrum of the AMUM is to signpost various degrees of threat, ranging from a minimal threat to national security (level 1) to a maximum threat to national survival (level 18). The ordering of levels and contingencies in between these extremes is debatable in terms of specific threat placement, however crises which may eventuate can be fitted, in terms of perceived level of seriousness, into a level equivalent to or between levels set on the chart. Once this judgement has been made a process of lateral interpolation can begin, in which the type of threat can be classified and mine-use applications appropriate to conflict management can be selected.

Mine Warfare in Australia’s First Line of Defence

Threat Classifications

Threat levels 1 to 18 are categorised in terms of their objectives and resultant potential for escalation. Two major types of warfare are considered in the AMUM. General warfare characterises threats 17 and 18, which involve the mobilisation of at least a major segment of Australian civil and military resources in order to counter them. The nation’s territorial integrity and survival are threatened. In the case of invasion (threat 18), Australia would gear all its military and civil strength to countering the threat. Limited warfare (threats 7 to 16) implies some foreign intimidation with the potential for quickly escalating violence. Limited wars are fought for limited objectives and fall short of general war in that survival of a belligerent is not immediately under threat. However, a substantial potential for escalation to general war exists. Potential for escalation tends to increase as threat level increases.³

Limited Warfare Contingencies (Threat Levels 7-16)

Threat level 7: Harassment of shipping, fishing, offshore exploration and exploitation. This situation could involve the presence of hostile naval forces within or in close proximity to the Australian EEZ. It might involve indirect interference with Australian activities for the purpose of exerting political pressure on the Australian government or making a claim to a resource-rich area.

Threat level 8: Injection of large numbers of illegal immigrants under the sanction of a rival government might be associated with a policy of creating a precedent for subsequent immigration, or it might simply be a relatively safe way of pressing a resource claim using the old precept that ‘possession is nine-tenths of the law’. In any case, the landing of large numbers of illegal immigrants on Australian territory would be a threat to Australian sovereignty and an act of defiance against the authority of the Australian government.

Threat level 9: Military support of offshore resource exploitation would involve the presence of rival naval and perhaps air units in Australia’s

³ As threat level increases is increased pressure to take and maintain the initiative. Larger forces are likely to be held at higher levels of readiness. This contributes to an initial momentum that becomes progressively difficult to restrain once hostilities eventuate.
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FIGURE 9.1
THE AUSTRALIAN MINE-USE MODEL (AMUM)
EEZ. Such an unwelcome presence could lead to contests over fishing, oil, mineral and gas fields. This mission could be in support of a long-term ‘resource grab’.

Threat level 10: Sporadic attacks against isolated military establishments would pose a direct military challenge to the Australian government. Motives for such attacks could be to embarrass the Australian political leadership by exposing a degree of impotence or simply to affect the government’s capacity to make an independent judgement on certain issues.

Threat level 11: Sporadic attacks against vital civilian and military targets would be a clear attempt to intimidate the Australian government and its citizens through violence. While these acts would be essentially demonstrative in nature, casualties to Australian military and civilian personnel would be almost certain. Acts of this nature could be classed as little more than terrorism. The variety and importance of targets would be significantly greater than at threat level 10.

Threat level 12: Disruption of SLOCs may involve anything from seizure of Australian flag shipping at sea to deterring neutral shipping from approaching Australia. Once again this could be undertaken as a means of obtaining political leverage in dealing with the Australian government over an issue. It also involves a strong element of economic coercion. The presently limited maritime range, in terms of force projection capability, of the ADF could make this option very attractive to a rival endeavouring to extract political or economic concessions. Any opponent with a few submarines and a little imagination could sink or harass enough shipping to draw an extremely disproportionate response from Australia.

Threat level 13: Aggression against friendly neighbours would be a serious threat to Australia’s security because of the possibility of requests for ADF assistance. Strong historical, political and moral ties to the governments of New Zealand, Papua New Guinea and several other nations within the South Pacific could involve Australian forces in acts of collective self-defence within the region.
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Threat level 14: Blockade of Australian ports could be attempted with submarines, mines or a combination of both. Only a superpower would be capable of a sustained, widespread surface blockade against Australia.\(^4\) Once again this type of threat could be used to intimidate the Australian government and cause economic damage.

Threat level 15: Sustained major raids against Australia would take the situation into a 'hot' or declared war environment, involving large-scale damage to property together with substantial civilian and military casualties. Regular and Reserve Australian military units would be given the job of neutralising the raiders and large-scale overt combat would take place. Unlike the scenarios considered at threat levels 10 and 11, the objectives of major raids are predominantly punitive rather than demonstrative. This change in the nature of the objective and level of force engagement represents a serious escalation.

Threat level 16: Temporary lodgement of enemy forces on Australian soil would be a potent form of applying political pressure against the Australian government, possibly in order to gain concessions, e.g. resource rights.

The Tension Zone (Threat Levels 1 to 6)

Besides the 'general war' and 'limited war' threat groupings, a number of minor contingencies exist at the lower levels of the threat spectrum. Threat levels 1 to 3 are listed as threats to security by virtue of their potential for escalation.

Threat level 1 (economic/political competition) is a very low-level state of tension but nevertheless the seeds of international disputation exist. Economic sanctions (threat level 2) represent an escalation from competition. Sanctions can range from the banning of certain types of commodities to complete embargoes. However, it is unlikely that a complete embargo would be enforced at this low level of threat. This level of threat could simply involve manipulating currency,

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\(^4\) A sustained blockade could only be imposed by a nation capable of achieving widespread surface naval superiority. This could only be assured by enemy air superiority sufficient to neutralise Australian air defences. US Carrier Battle Groups and some Soviet Surface Action Groups are the only forces likely to have this capability.
import quotas or tariffs, thus bringing pressure to bear on Australian decision-makers to make some concession.

Threat level 3 involves hostile political propaganda and harassment of Australian nationals overseas. An example of this situation occurred in April 1986, when Indonesia exhibited a surprisingly sharp reaction to an Australian press report concerning the Indonesian leader, President Suharto, and members of his family. The Indonesian President was accused of nepotism, leading to the amassing of huge sums of family wealth. Indonesian reaction to the article may be summarised as follows:

(a) The employment of a blanket ban on Australian press access to Indonesia.
(b) Cancellation of the two-month visa-free period for Australian tourists in Bali. This affected 71 Australian nationals in Bali, as they were forced to return to Australia.
(c) Cancellation of an Indonesian ministerial visit.
(d) Refusal to refuel RAAF aircraft in transit to military exercise areas.
(e) Implied scaling down or even shelving of the Defence Co-operation Programme (DCP) between Indonesia and Australia. This threat was made by the Chief of the Armed Forces of Indonesia.
(f) Widespread hostile propaganda throughout the Indonesian press. This included an article about Australians which appeared in the 22 April 1986 issue of the official Indonesian armed forces newspaper, Angkatan Bersejata. The generally unflattering article stated:

... As a nation descended from the white race, Australians have a certain social attitude towards South-East Asian peoples which we

take as arrogance, conceit and delusion in their ability to lead ... The [Australian] desire to be recognised as a leader in South-East Asia and the Pacific is also motivated by the bitter fact that it is a white nation living among coloured races.9

All this took place just weeks before important talks between Australia and Indonesia were to occur in Jakarta. The maritime delimitation talks, which were scheduled for early May, related to the Timor Gap seabed boundary and joint exploitation of seabed resources. The Indonesian government did not proceed with the talks at that time and it was not until mid-June that it showed willingness to negotiate.10

The Australian reaction to Indonesian retaliatory measures was essentially one of surprise. The Indonesian government actions were widely perceived as overreactions. Undoubtedly, the overreaction — from the Australian point of view — stemmed from a basic divergence of attitude regarding freedom of the press. This led to open disagreement between the two nations on the role of a basic institution (the press) and, even more fundamentally, the relationship between government and the people.

In early May 1986 the Australian Prime Minister said: ‘... no government led by me is going to have a grovelling relationship — one in which if there is a capricious action on the part of Indonesia, that we accept that without comment’.11 That such a major rift in relations could arise in so short a time frame is sobering testimony to the difficulty in assessing another culture’s perceptions and calculating its reactions. It also indicates that levels of international tension can escalate quickly and without real warning to a surprisingly antagonistic degree.

Three more types of threat exist in the tension zone. Threat levels 4 (support of subversive groups) and 5 (seizure of ships, cargo, embassy, nationals, etc.) indicate rising tension which may generally be dealt with using purely diplomatic means, international legal methods or collective military action, as was the case in the initial stages of the

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1990 Gulf crisis. Threat level 6 (large-scale non-violent intrusion into Australia's EEZ) would presumably take place with a rival government's sanction and perhaps active encouragement. Police methods, with the aid of military surveillance forces, could be used to deal with this contingency. But an extremely disproportionate cost might be exacted from the Australian government because intrusions could be of a sufficiently large scale to make it impossible for the government to be seen as effectively regulating its own EEZ, and this could have been the motive behind the intrusions.

Finally, it must be noted that an overlap of 'hot' war and 'cold' war conditions takes place at threat level 14 (blockade of Australian ports). 'Cold' war can involve very limited confrontation between rival military or paramilitary units and may include small-scale sporadic harassment attacks such as those indicated at threat levels 10 and 11. Overlap occurs because, if blockade were attempted against Australia only using mines, the prime ingredient of armed conflict (overt combat between forces) would be absent and the war would remain 'cold'. If surface and/or submarine units were used during the blockade the conflict would become 'hot', in terms of a high potential for overt combat between forces.

Response Zones

The Limited Response Zone (LRZ) indicated in the centre of Figure 9:1 encompasses threat levels 4 to 14. These threats demand a judiciously selected limited response in terms of possible military action, while threat levels 15-18 require a strong, direct and maximum military response from the Australian government. Argument over the best means of resolution, the fear of escalation and general uncertainty seriously affect prompt government decision-making in the LRZ.

Application of a proportional and appropriate military response, supported by discreet diplomacy, is a major factor for success when decision-makers operate within the LRZ. This remains the case whether dealing with the particular threats specified or with unspecified future threats which political judgement renders equally serious.

Threat levels 4 to 8 of the LRZ may often, as discussed, be met with diplomatic and economic means. However, levels 9 to 14 embrace what is termed the Critical Response Zone (CRZ). This section of the LRZ is indeed critical in terms of Australian government response. Australian decision-makers would seriously consider the use of unilateral military force in order to gain a favourable resolution of the
crisis, but fear of escalation to a 'hot' war would be a major constraint upon overt Australian military action on a large scale. Political leaders would be faced with a major national security problem and could ask the military, in effect, 'What can be done about this problem? If we attack using F-18s or FFGs the whole thing could blow up in our faces and escalate into a major conflict. If we don't do something then we lose face in front of the opponent, the public, our allies and the international community. What are our options?'

Appropriate options during the early stages of a crisis at the CRZ level depend on the unique and often completely unpredictable circumstances of the crisis. However, minefield deployments can form part of a national security solution consisting of actions capable of satisfying the fundamental political-military objective of delivering a firm military response while minimising the chances of escalation to the 'hot' war level. The seven types of minefields depicted on the AMUM (Figure 9:1), which can be used throughout the threat spectrum, are described below.

AMUM Minefield Applications

Denial Fields (Threat Levels 6 to 9)

Australians have a disproportionate share of the earth's resource wealth. By the year 2000 less than one-third of one per cent (0.3 per cent) of the world's population will be living on the Australian continent, but the Australian population lays claim to one-quarter of the earth's known uranium reserves together with tremendous mineral, oil, gas and fishing reserves. All these resources exist within continental Australia or within the 200-mile Australian EEZ (which has an area roughly equivalent to that of continental Australia). It is clear that the Australian government may be increasingly challenged by the problem of effectively regulating a vast EEZ.

The Australian Antarctic Territory (AAT) is also an area with as yet unexplored deposits of resource reserves, although reports of the existence of quantities of oil and natural gas have been made.

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12 J. Hutcheson, 'Australia: The Undefended Source of Energy', Defence Force Journal, No. 29, July/August 1981, p. 6. The figure of 0.3% is likely to significantly decrease since by the end of the century Australia's population will be about 17 million.

13 ibid.

14 E. Luard, 'Who Owns the Antarctic?', Foreign Affairs, Summer 1984, p. 1182. See also, 'Envious Eyes on Antarctic Oil and Minerals Threaten Treaty', Australian, 1-2
1933, Australia has laid claim to almost half (43 per cent) of Antarctica on the ground that it is important to Australian security.\(^\text{15}\) Besides Australia, six of the twelve Antarctic Treaty signatories have territorial claims. None of the treaty claims on Antarctic territory are widely accepted and the treaty is due for review in 1991. Critics of the Antarctic claims are numerous. Malaysia, for example, has been most vocal in its opposition to treaty claims and describes the Antarctic Treaty as ‘restrictive and exclusive [arguing that] the present arrangement regarding Antarctica has created inequities which cannot be allowed to continue ... Inevitably these inequities will lead to instability’.\(^\text{16}\)

To Australia’s north are many developing nations with growing demands for energy and mineral resources by which to sustain economic and social progress. As essential oil fields, fishing grounds and mineral deposits are depleted during the first decades of next century, Australia’s disproportionate share of the planet’s wealth may be increasingly questioned and perhaps ultimately challenged. The EEZ, AAT and perhaps the continent itself may become attractive targets for still developing, energy-deficient nations.\(^\text{17}\)

If a challenge does come, Australia, as the coastal state, is entitled to deny exploitative entry to the EEZ. Minefields can be used to assist in the management and regulation of the EEZ, as in the following examples:

(1) **FISHERY DENIAL** (threat level 6): A certain amount of ‘petty pilfering’ in terms of fishing within the EEZ can be tolerated and expected. However, large-scale illegal intrusions by foreign national fleets create a dangerous precedent and should be deterred.

The Australian government could dispatch warships and fighter aircraft to demonstrate its determination to maintain sovereignty. But if the threat presented by active, manned Australian units was ignored they would be forced to attack or back down. And in some cases it might be impossible to arrest most of the intruders. Attacking unarmed, non-violent craft...
would be seen as inappropriate by the international community, but something tangible would need to be done for the Australian government to maintain its credibility in this 'battle of nerves' scenario.

The main area of challenge could be the vast, poorly regulated area in Australia's north and north-western waters, from Cape York to Dampier. Fortunately, about 80 per cent of the EEZ in these areas is under 200 metres in depth, and hence mineable. Large-scale fishing operations involve rigs of nets that cover considerable areas of ocean, and there are types of Obstructor mines designed to physically wreck fishing nets by use of shape (to sever nets) or with small explosive charges. These mines could be deployed to good effect in the operating areas of the rival's fishing fleets. Relatively few of these cheap, moored mines would be needed for the job and they could be delivered by air once information on rival activities had been acquired. The obstructors would effectively be performing a 'robot-policeman' role.18

(2) OIL/GAS/MINERAL DENIAL (threat level 6): Rival exploitation of these under-seabed resources would involve the use of substantial rigs. Rig construction areas could be cordoned off with mines deployed by Australian aircraft, surface vessels or submarines.

To counter the mine threat a rival would have to send mine countermeasure vessels into the Australian EEZ. As such vessels are naval ships of war, the onus would be placed on the rival to either back down or make the escalatory move of deploying a warship into Australian waters. Any effort to sweep 'our mines' in 'our waters' could be justifiably countered using Australian combat ships and aircraft: a reasonable and proportionate response to an intrusion, albeit non-violent, into the Australian EEZ.

(3) IMMIGRATION DENIAL (threat level 8): The Australian government would need to counter any large-scale illegal immigration backed by a rival government, possibly for the

18 Also discussed in A. Hinge, 'Australia's Use of the Seamine in the 1990s', Journal of the Australian Naval Institute, November 1984, pp. 48-49.
purpose of claiming resource wealth. Again, active combat platforms would be faced with the 'shoot or back down' problem; the minefield is a more subtle means of deterrence and one which is more acceptable to the international community. Planting minefields in likely landing zones could be presented as a justified and low-key response, somewhat akin to setting up anti-burglar defences. Mines required for this purpose would be the DST variety, and could be rapidly deployed by air in shallow water, on beaches and in the vicinity of airstrips. A decision to back these mines up with other weapons systems would depend on the seriousness and scale of the threat and would ultimately be a question for political judgement. Once again, to reduce the mine threat, the rival government would have to employ countermeasures forces which the Australian government would have a right to attack. Orchestrating the deployment of rival countermeasures forces would take the 'non-violent card' out of a rival's strategy. The onus for escalation would again be placed on the rival.

(4) RIVAL MILITARY FORCE INVOLVEMENT (threat level 9): The presence of rival naval and air forces within the Australian EEZ would inject a high degree of escalation into a conflict situation. These forces might harass the workers on Australian resource exploration and exploitation assets or merely support rival exploitation enterprises by virtue of their coercive presence. Minefields could be used to constrain the operations of rival vessels in the vicinity of exploitation assets. Further, if harassment were a rival's objective, his units might be lured into mined areas by various means. Small submarine-laid fields might even be placed in the courses of these vessels as a form of non-torpedo ambush. It would be necessary to avoid the use of torpedoes, at least initially, since they might be perceived as being too escalatory early in a dispute, particularly if no loss of life had occurred.

Mining could be a first-echelon deterrent against a foreign naval presence in certain waters, particularly in resource-rich or disputed zones in shallow depths. If rival military support for resource grabs became more widespread, making mining of disputed areas prohibitively expensive, the Australian political leadership might elect
to cause the rival a proportionate inconvenience in his own waters. Australian leaders could then choose the assertive option of deploying countervalue reprisal minefields in the rival’s waters, rather than overtly engaging rival targets in Australian waters.19

Countervalue Reprisal Fields

Countervalue reprisal minefields are a means of assertive economic warfare that can be applied in threat situations ranging from threat level 7 to threat level 13, but particularly at threat levels 9 to 13.

In the cases of sporadic attacks (threat levels 10 and 11) and disruption of SLOCs (threat level 12), Australian forces would find themselves very thinly spread against raiders with high mobility. It will be impossible to effectively guard all civil and military targets and SLOCs with the limited Australian interdiction and escort forces likely to be available in the future, and the Australian government could be put in the embarrassing position of simply not being able to ‘lay hands’ on elusive groups of raiding and disruption forces determined to elicit a disproportionate response from Australia, and bring coercive pressure to bear on government decision-making.

Australian response in kind might be operationally difficult and unacceptably escalatory in the initial stages of dealing with this type of sporadic attack problem. Minefields could prove to be a subtle and more expeditious means of inflicting damage on the rival’s ‘value’ assets.20 Countervalue reprisal fields, using mines to close rival ports for specific periods, could be used to exact a proportionate price for the rival’s unacceptable activities against Australia. Such fields differ from strictly offensive blockade minefields in that they are declared prior to becoming dangerous and have strictly limited lifespans. Also, they are usually only applied against two or three ports, since full blockade of a country is not the objective.

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19 Mines are ‘persistent pests’ and the Australian government, by deploying them in the opponent’s waters, would be reciprocating the inconvenience posed by the rival presence in Australian waters or on Australian land. Australians would not be placed at permanent risk and pressure for the opponent to negotiate would mount.

20 See M. McDougal and F. Feliciano, Law and Minimum World Public Order: The Legal Regulation of International Coercion (Yale University Press, New Haven Connecticut, 1961), pp. 59-96, for a discussion on the importance of minimising damage to ‘value’ assets, such as personnel and non-military shipping. The mine can inflict selective damage upon these assets at the minimum level of conflict. Most importantly, the civilian ‘value’ asset is attacked with shortages rather than with bombs or missiles.
Holding up essential cargoes and shipping and interrupting important supplies is of great importance in economic warfare. Every ship delayed represents a net cargo loss since, at the conclusion of the crisis, the rival is left with a negative balance of ship days that cannot be recovered. Every day of delay dislocates a rival’s basic industry to a measurable extent, since industry relies on the steady flow of materials. Other indirect effects of countervalue reprisal fields include the raising of marine insurance rates, refusal of neutral crews to sail and even the withdrawal of neutral tonnage from trade with a nation whose main ports are effectively mined.  

If the rival attempts to challenge the minefields he does so at his own risk and must accept a probability of ship sinkage. The repair of damaged merchantmen and countermeasures vessels would have a disturbing and cumulative effect on a rival’s shipyards. Sinking and salvage of vessels would also significantly contribute to the costs incurred.

The advantages of countervalue reprisal minefields and their potential use by the Australian government, in response to threats at levels 9 to 12 of the AMUM, can therefore be briefly summarised as follows:

1. They would satisfy a political requirement for a tangible, proportionate and effective action against an elusive rival bent on embarrassing the Australian government or unlawfully gaining a degree of political leverage by coercion.

2. The Australian government could justify the deployment of this type of field to the electorate, the United Nations and even the rival as a clearly appropriate and reasonable use of force in terms of being a low-key reprisal for unacceptable and provocative activity against Australia.

3. This type of field could draw a precisely measured and specifiable price from the rival. For example, the following hypothetical declaration might be made by...

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21 Cowie, Mines, Minelayers and Minelaying, p. 190. See also Taylor, ‘Mining: A Well Reasoned and Circumspect Defense’, p. 42, which indicates that the confinement of shipping to Haiphong harbour during the Vietnam War caused a loss of $US18,000 per ship per day over the 300-day period. This totals $146,000,000 in 1972 (or approximately $1,000,000,000 in 1990).
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The Australian government after a number of countervalue reprisal fields had been deployed:

'The Australian government is concerned at recent provocative acts perpetrated by the government of 'Kamaria'. This situation is unacceptable and intolerable. Australian forces have delivered countervalue reprisal minefields to affect harbours X, Y and Z as part of a reasonable and proportional response to provocation. The minefields have an active life of up to 100 days and a Notice to Mariners has been issued so as to ensure the safety of neutral shipping in accordance with the Hague Convention of 1907. Closure of harbours X, Y and Z for this period of time is calculated to draw an economic penalty commensurate with the economic damage and costs incurred by the Australian government in addressing belligerent acts by 'Kamaria' thus far. Any attempt to challenge the fields will bring about sinkings and damage exceeding this cost.

The delivery of these minefields is an assertive act of self-defence in accordance with Article 51 of the UN Charter and customary international law and is an effort to minimise violence and resolve the conflict in the most expeditious manner. The UN Security Council has been informed of the Commonwealth's actions and the Australian government wishes to express its desire to accord with the decisions of the Council and its allies. Negotiations for the neutralisation of the reprisal fields may commence when provocative acts have ceased and an undertaking is made that no further acts will be perpetrated against Australia.'

The minefields would be an effective form of retaliation within the rival's own backyard, yet they have the advantage of being a reprisal set at the minimum level

22 'Kamaria' was the name given to a fictitious country posing a threat to Australia during Exercise Kangaroo 83. It has been used in successive Kangaroo exercises. See K. Wolfe, 'K83: An Exercise with a Difference', Defence Force Journal, No. 42, September/October 1983, p. 7.
of conflict. This assertive act, using a passive weapon in the rival's territory, would unambiguously signal the government's determination while minimising the risk of escalation.

(5) The minefields could provide the Australian government with increased political leverage over the rival government. The incentive to neutralise the fields would place increased pressure to negotiate an agreement on the rival. Arrangements for mine clearance could therefore be a handy 'bargaining chip' for Australian negotiators.

(6) Countervalue reprisal minefields could buy time for Australian decision-makers. Third parties, including the UN and allies, could intervene on Australia's behalf if minefield deployments were shown to be legitimate responses to unlawful provocation.

(7) Minefields could, of course, be laid against Australia in response to the deployment of countervalue reprisal fields. However, being the first to deploy mines has substantial advantages: more mines can generally be laid with increased security and less loss. Enemy reprisals would be hampered by the increased vigilance of an Australian Defence Force expecting just such an attack.

Blockade (and Quarantine) Minefields (Threat Levels 13 to 18)

As discussed earlier, foreign aggression against friendly neighbours (threat level 13) is a potentially very escalatory threat because direct combat involvement by elements of the ADF could be hard to avoid in many instances. The level of Australian involvement would largely depend on the level of aggression and the importance of the friendly neighbour to Australia.

The Australian government could be placed in a situation of having to somehow demonstrate physical support for its friend without direct insertion of Australian ground forces, as there is a high threshold for such action. However logistic support, a naval presence involving surface units and an air presence providing surveillance might sufficiently demonstrate Australian resolve and deter further escalation in the region.
If the aggression continued to escalate and a 'hot' war situation developed, the Australian government might still be extremely reluctant to involve its ground, naval or air units in 'eyeball-to-eyeball' confrontation with the aggressor. A means of limiting conflict by constraining the aggressor's ability to project violence could be sought.

In such a situation, the mine could be of substantial and unique assistance in keeping two regional 'barking dogs' apart at the same time as limiting the prospects of escalation and direct Australian involvement in the conflict.

Ports belonging to the aggressor would be providing logistics support for any sustained attacks involving a force of credible size. These ports could be mined, with the declared aim of limiting the ability of the aggressor to apply violence by affecting his supply line. This act would also clearly demonstrate Australian resolve to support its friend by presenting the aggressor with a persistent, unambiguous, yet non-escalatory physical threat.

Using the mine in this way would not leave the Australian government open to charges of 'fence sitting' from the friendly state, the international community or large elements of the Australian electorate. Mining is a decisive military act and would be seen as such. After the mines were deployed the aggressor would be forced to consider taking the next step in the graduated response scale of conflict, and it is always possible that the physical demonstration of Australian resolve inherent in the minelaying could deter further escalation. Also, the minelays could be undertaken in such a way as to assist Australian military operations if the situation did escalate. For example, the combination of mines and submarines as the next step in an Australian response could hamstring any offensive acts of a substantial nature, since minefields 'covered' by submarines are a legitimate and extremely effective form of blockade, as was demonstrated in Operation Starvation (see Chapter 5).

After having mined 'Kamarian' ports the Australian government would be obliged under international law to explain its actions and intentions. A statement to the following effect, explaining Australia's rationale, could be made:

'Australian strategic interests have been adversely affected by the threatened destabilisation of the (friendly) government arising from Kamarian conflict with that government. The Australian government is unsure of Kamarian intentions and has taken assertive action by which to limit violence in the
The assertive actions taken by the Australian government involve:

(1) The mining of conflict-supporting Kamarian ports as a means of bringing about conflict termination and signalling the Australian government’s resolve that conflict limitation in (friendly state) is an important Australian strategic and national interest. The Australian conflict limitation policy involves inhibiting the flow of Kamarian conflict-sustaining supplies through ports, thus encouraging eventual disengagement of forces. The assertive act of mining Kamarian ports is not an act of war but an act of quarantine, whereby a level of logistical isolation and hence limitation of offensive power is applied to Kamarian forces. The purpose of the quarantine is the prevention of the ‘disease’ of war in our region. The quarantine has been implemented in the interests of regional security as a legitimate act of collective self-defence under Article 51 of the UN Charter.

(2) In addition to the quarantine of Kamarian conflict-sustaining ports a supportive Australian Naval-Air presence will assist (friendly state) to patrol its territorial waters and airspace.

Finally, it is stressed that Australia wishes to maintain a cordial relationship with the Kamarian government. The actions outlined above are seen as necessary in helping the government and people of (friendly state). The people of (friendly state) are a people to whom Australians have strong historical links and obligations. They are a people whose security and independence is of prime concern to the Australian people.’

The act of mining could be shown to be a relatively restrained military act aimed at stabilising or de-escalating the situation by limiting the aggressive state’s war-sustaining capability. An added bonus, in terms of international favour, would be having the mining endorsed by a major regional group, such as the South Pacific Forum or ASEAN.
Blockade of Australian Ports (Threat Level 14)

No regional navy has the capability to inflict a sustained blockade of Australian ports using surface, submarine and air means (see Chapter 3), but even if a sustained blockade could not be achieved, mines can draw an enormously disproportionate response and mine deployment could present itself as an attractive option to rivals intending to embarrass or intimidate the Australian government.

The economic impact of a port closure depends on the period it is closed, the value of cargo involved and the viability of alternative supply sources and transport modes. When a port is closed for an extended period, the production which is dependent on that port will, over time, cease.

In northern Australia the land-based transport infrastructure is not as fully developed as in the south. There are a few private rail lines in the Pilbara region connecting mines to ports but, apart from the national highways, good roads capable of greatly increased long-distance freight carriage are almost non-existent. Several of the major ports in the north are inaccessible by land: Groote Eylandt and Barrow Island are islands; Weipa and Gove are connected by dirt tracks which are impassable in the wet season and in the dry are practical options only for four-wheel-drive vehicles. Even Darwin and the iron ore ports in the Pilbara, which are served by good-quality sealed roads, are separated by hundreds of kilometres from other large ports.

In southern Australia, if a port is closed, options exist to transport at least some goods by rail or road to or from another port. As a substitute for coastal freight, it may also be possible to use land transport modes to carry the cargo from source to destination. Of course, such emergency measures would impose extra freight costs and would usually be only viable for the more valuable general cargo or where the land distances involved were short. They would also stretch scarce petroleum resources. Land transport would rarely be an economic option for bulk cargo currently moved by sea. But similar options do not generally exist in northern Australia.

When a port is closed for only a relatively short period, as occasionally happens through industrial strike action, production can continue to the limit of the available storage facilities. The costs incurred in this case are much less, although there are still very significant costs associated with the shipping delayed outside and trapped inside the port and the delay in moving cargo.
The results of closure of a large port, such as Sydney, would be exceptionally severe, although this prospect is extremely remote in contingencies considered credible in the short term. However, it is conceivable that an adversary could attempt to disrupt shipping using ports in northern Australia. A number of these load large quantities of minerals for export and domestic consumption. A significant part of the trade from northern mineral ports is in the form of exports and provides about a quarter of Australia’s export earnings. The loss of export earnings that would result from one month’s closure of each port are shown in Table 9:1.

In addition to directly countering enemy blockade minefields in Australian waters, the Australian government might consider the imposition of a reciprocal blockade, as a reasonable and proportional response. This would involve deployment of fields on a larger scale than countervalue reprisal or quarantine fields and is unquestionably an act of war.23

Blockade minefields can be laid outside and inside ports in the same way as countervalue fields. However, blockade fields can also be laid anywhere in territorial waters and rivers and need not be declared. Obligations to neutral shipping are broadly satisfied by a declaration that all territorial waters of the enemy are unsafe for the transit of shipping.

A blockade must be largely effective to be recognised as such (see Treaty of Paris, Chapter 6). Consequently, mining only a few ports might not be enough. The aim of blockade is not merely to impose economic penalty, as was the case with countervalue fields. The blockade must affect entry into all major harbours of a country if international legal requirements are to be adhered to.

While Australia has the capability to deploy countervalue fields anywhere within the radius of action of a patrol submarine, the ADF is limited in its ability to blockade in the full sense of the word. In addition to this limitation the legitimacy of blockade by mines alone is open to legal question. However, the presence of submarines to support the mines, and vice versa, is generally accepted as being a legitimate form of blockade if the bulk of shipping can be deterred from entering or

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leaving the rival’s main ports. Operation Starvation is the main precedent for this line of argument.24 Nevertheless, Australia has the potential capability to apply a largely effective blockade at least as well as any other nation in our region. Realising this potential, in terms of having ordnance and delivery platforms available, would deter blockade attempts against ourselves.

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Counter-Amphibious and Land Control Minefields (Threat Levels 15 to 18)

(1) Major Raids (threat level 15). Minefields can contribute to countering sustained major raids by being used in:

(a) Counter-amphibious fields. These fields, which would mainly be constituted of rapidly deployable Destructor (DST)-type devices, could be laid in likely landing zones and be set to trigger on detection of small assault landing craft.

(b) Land control fields. Once again, rapidly deployable DST-type fields could be deployed to foul likely landing strips, protect installations and disrupt lines of enemy advance at very short notice. Such fields can even be employed in the defence of Australian Antarctic territorial claims, since DST units can be aerily deployed into ice and snow (see Chapter 2).

(c) Blockade fields. These fields could be deployed as a punitive response against a nation responsible for a major raid. The role of these fields is to limit the delivery of war-sustaining material to the enemy's homeland and reduce capability to prosecute major raids against Australia.

(2) Lodgements (threat levels 16 and 17). The problems facing a lodgement force would only really begin after the lodgement had been made. Geography would work against the lodgement force which, in order to survive against Australian forces, would need to be of substantial size. Divisional to corps strength would not be an unreasonable requirement for the size of a lodgement force, whether the lodgement was expected to be temporary (threat level 16) or permanent (threat level 17). Australia's geographic depth in terms of ocean to be crossed and huge land areas of operations, combined with the difficulty of living off the land, would present the lodgement force with many

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25 The Australian Army works on an attack:defend ratio of 3:1. If a lodgement force comprising one Division were 'dug-in', an Australian Corps (3 Divisions) would theoretically be needed to dislodge it. Such an Australian commitment is clearly beyond the short-term of even intermediate-term surge capacity of the Australian Army.
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problems.26 Most, if not all, initial war-sustaining logistics would come from a home base or a forward support base of some sort. An enemy lodgement commander, after having gained a foothold on Australian territory, would be extremely concerned about his ‘back’. Being far from home, in a fairly desolate, low-support infrastructure region with tenuous logistics links, would pose severe constraints on his operational capability. Australian forces could aim at disorganising enemy dispositions, separating forces, threatening supplies and blocking escape routes.

The larger and more capable the enemy lodgement force, the more disproportionate would be the adverse effects of logistics deprivation. This would contribute to a general feeling within the lodgement force of being ‘trapped’. Developing this state of mind within a lodgement force could enhance the possibility of a favourable settlement — for Australia — in negotiations with the enemy government.27 In short, the objective of the Australian government would be to ensure that the lodgement forces ‘wither on the vine’, by deploying sufficient ADF units to fragment the enemy war effort and loosen the ‘lodgement grip’ to an extent where enemy strength could only deteriorate further and not recover. The aggressor would effectively becomes a hostage, and might become a bargaining asset in any peace negotiations.28

Mines can be of widespread value in disrupting the operations and support of a lodgement force. Mine blockade of forward bases, home ports and choke-points could hinder resupply to operational units. Counter-amphibious minefields can be delivered by air at short

26 Unless the lodgement force landed on the east coast of Australia, there is little likelihood that a force of divisional strength (12-15,000) could find a lodgement area with sufficient infrastructure to completely sustain it. Maintaining a secure line of resupply from the homeland or a major forward base would be an essential prerequisite to any sustained lodgement on Australian territory.

27 It can be argued that a trapped opponent will fight harder in order to escape or achieve an objective. Australia has the continental and maritime depth to ensure the confinement of the enemy without bringing major forces to bear. The enemy would become trapped, harassed and finally exhausted. Ultimately, this would lead to a state of despair in which the fighting power of the enemy would be eroded. See B. Liddell Hart, Strategy: The Indirect Approach (Praeger, New York, 1954), p. 340.

28 During the Vietnam War, the North Vietnamese employed US POWs as a valuable bargaining asset by which to influence US domestic politics and policies. The use of hostages to achieve a degree of leverage over an opponent is a customary practice in wartime: the physical treatment of POWs is the major point of disagreement amongst nations.
notice to foul landing places and harbours. Land control fields would adversely affect any enemy air operations and land movements of lodgement forces. Mines would generally assist in grinding down the lodgement force's operational capability, and in so doing would multiply the effectiveness of active ADF weapons systems such as combat aircraft, warships and army units.

In the lodgement scenarios and in the full invasion contingencies the mine would essentially fulfil its classic role as a weapon of attrition and harassment in support of other ADF forces.

**Harbour Defence and Deep Trap Minefields**

In a range of contingencies (AMUM threat levels 5 to 18) the mine could further support other weapons in terms of acting as a harbour defence and ASW measure.

(1) The Harbour Defence Ring (HDR). Australia has the right to deploy minefields in its territorial waters for the purposes of self-defence. Mine barriers, or protective minefields, have been used very effectively in a number of conflicts to keep intruders out. The main purpose in deploying protective harbour defence fields around critical points is to deter hostile submarine torpedo attacks and submarine mine deployments.

Submarine mine deployments involve the use of Submarine-Launched Mobile Mines (SLMMs) and other mine types launched directly from torpedo tubes. Standard mines despatched from torpedo tubes can be of the bottom or moored type. The bottom type is deployed from torpedo tubes, generally using compressed air as the propellant while the submarine travels at about 3 to 5 knots. The mine settles to the bottom immediately and activates at a pre-set time. This type of mine would be effective against surface targets down to a depth of 60 to 80 metres if it contained about 750 kilograms of high explosive. However, to find this amount of explosive contained in a standard submarine-laid mine is rare because of size constraints.

Moored submarine laid-mines are deployed in the same way as bottom mines except that after a pre-set time the case and anchor

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29 Hartmann, *Weapons That Wait*, p. 236, gives the total number of defensive mines laid by the US and Britain as 198,000. This was twice the total number of offensive mines laid by the Allies. See Cowie, *Mines, Minelayers and Minelaying*, pp. 130-138, for a description of the large defensive fields or barrages.
separate, allowing the case to rise to its pre-set depth. Many of these mines are equipped with mud-freeing devices to assist separation in muddy areas.\textsuperscript{30} The problem with moored submarine-laid mines is that positive buoyancy is achieved at the cost of an airspace within the mine. This space takes up room which could have been used to increase explosive charge weight. Also, the airspace must be increased when the mine sinker is at larger depths, since more cable weight is required to set the mine nearer the surface. Most moored mines today are of the magnetic influence type, since pressure change cannot be detected while the mine is suspended in a fluid. This limitation makes them much more susceptible to influence sweeping and they are, of course, already vulnerable to basic mechanical sweeping.

From these considerations it is evident that, if the hostile submarine can be physically kept out of waters shallower than 80 metres, it is hardly worth deploying bottom or moored mines from its torpedo tubes. Effectiveness of such mines at these depths against larger surface vessels would be seriously compromised. In addition, any mines deployed at these depths would have to be deployed in greater numbers to realise the same probability of detection and ignition as mines deployed at the 25 to 50-metre levels. This is because of the increased arc of mine deployment due to greater laying distance offshore at greater depths and the fact that ships would have more vectors for transit available to them if mine deployments were forced further out to sea.

The following measures could be taken to deter submarines from approaching closer than the 80-metre isobath:

(a) The deployment of a ‘ring’ of passive acoustic sensors around vital port entrances. Acoustic sensors could pick up enemy submarine contacts and relay information by cable or coded sonar signal to a shore signal-processing station. The station could vector shore-based air and fleet ASW units to the scene of activity.

(b) The acoustic sensors could be supported by a ring of controlled mine charges placed at or near the 80-metre

\textsuperscript{30} See Nausica Mine Familiarizer, p. 20, for a more complete description of this particular method. Also, see Project Hindsight: A Study of the Research and Exploratory- Development Origins of the Naval Mines Mark 56 and 57 (Naval Ordnance Laboratory, White Oak, 1 June 1966).
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isobath. These charges would be of large size and could be remotely triggered from a shore control station if acoustic ranging techniques determined that the suspected submarine was within damage radius.

The advantages of this system of harbour defence are:

- It is a relatively cheap form of ASW and is a concentrated method of ‘point defence’ of critical ports. This would serve as an effective deterrent to hostile submarine operations in focal areas and contribute to ASW defence in depth.

- The mine charges would only need to be large explosive charges using remote detonation. There would be no need to build in elaborate target discrimination and firing circuits. All command/control functions would be undertaken by a human controller ashore.

- The acoustic sensors (hydrophones) would be bigger than anything that could be built into a mine or a submarine. They would be more effective than sensors built into any ASW vessel, because the noise of the ship’s motion and turbulence seriously degrade hull-mounted and variable-depth sonar efficiency. The hydrophones could be periodically raised to ‘clean their ears’ and would be positioned outside the damage range of the explosive charges. They could also be switched off prior to remote mine detonation to avoid circuit damage arising from the sound of the blast. These simple sensors could pick up the quietest of submarines and would also benefit from being deployed relatively far away from harbour ‘noise’.

Keeping hostile submarines outside the 80-metre isobath would also compromise the effectiveness of SLMMs. SLMMs have a very limited warhead explosive charge weight. Charges generally range between 150 and 300 kilograms. Therefore they must travel to very

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31 The ‘noise’ level received by a surface vessel’s sonar receiver increases markedly with ship’s speed. Generally, a hull-mounted sonar is useless for effective submarine detection if the surface vessel is making way at a speed in excess of 20 knots.
shallow water, often well within the harbour itself. If the 80-metre isobath is three miles from a harbour entrance, an enemy submarine commander might elect to deploy SLMMs from four miles offshore when, under more favourable circumstances, he could have launched the weapon from shallower water only one mile from the main harbour entrance. An SLMM travelling four miles is subject to navigational or placement error in waters characterised by even moderate tidal streams. All mines — especially SLMMs — need to be deployed with a fairly high degree of accuracy. Sometimes high charge weight and a course influence sensitivity setting can make up for placement error, but this is not the case with SLMMs. Forcing submarines further out to sea would appreciably reduce the chances of accurate, shallow SLMM placement.

The acoustic sensors of the HDR would also have a high probability of detecting the passage of an SLMM through the ring and MCM measures could rapidly be instituted. ASW units could be given co-ordinates based on a possible acoustic 'fix' on the SLMM's final resting-place. If the SLMM threat ever became of major proportions a system of harbour defence nets might be contemplated as a low-technology, but extremely effective, measure against this weapon.

(2) ASW 'Deep Trap' Fields. HDRs could also be supported in the ASW role by 'deep trap' minefields deployed in deeper waters outside the hydrophone/charge ring. Deep traps proved successful in World War Two in deterring submarines from entering shipping focal areas. These fields could be made up of ordinary bottom mines in waters up to about 200 metres in depth. The mines would not need a huge charge weight, since they are not required to attack surface targets. For example, a charge weight of 500 kilograms at a depth of 200 metres would prove damaging to a conventional submarine transiting the vicinity at a depth of 100 metres. Fires and shock damage might also be experienced, even in double-hulled nuclear submarines, at this depth. Only relatively minor effects would be experienced at the surface. Charge weights would have to be scaled down as shallower deployment depths were encountered to ensure the safety of surface shipping.

Deep traps could be used in deeper waters if the situation warranted this step. However, the mines employed in waters deeper

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32 See Hartmann, Weapons That Wait, p. 134. Also, Johnson and Katcher, Mines against Japan, p. 289. This method of acoustic fix could be adapted to the SLMM localisation problem quite effectively.

than 200 metres would have to be of the moored variety in order to have a chance of damaging transiting submarines. In order to avoid the embarrassment of mines breaking loose from their mooring cables and becoming a danger to surface shipping, it would be necessary to incorporate a scuttling device in the mine design. This involves the mine scuttling automatically once it rises to a specified shallow depth after the mooring cable breaks.34

These deep trap fields of the bottom and moored variety could be deployed in the following locations (with the obvious requirement that their positions should be accurately known by Australian submarine commanders): shipping focal areas; obvious submarine transit paths; choke-points; and areas where a hostile submarine commander might go in order to get an accurate coastal fix.35

Deep Trap fields must be small and accurately placed. They would contribute to the effectiveness of HDRs by placing a further constraint on the operational freedom of hostile submarine commanders. Such fields may be considered an automatic means of 'surveillance by fire', but would have to be used sparingly around major ports for reasons of cost.

Both HDRs and Deep Traps can be of use throughout much of the threat spectrum. Deployment of these fields is a legitimate defensive act which could signal warning to a potential opponent that the Australian government is taking the likelihood of conflict seriously in the lower threat levels. In the higher threat levels these fields would form a practical means of mine countermeasure in terms of countering the mining of a few vital ports and could act as a viable contribution to Australia's overall ASW defence.

AMUM Logistical Considerations

Between 1967 and 1970 the US Navy funded a major mine warfare research study known as Project Nimrod.36 The published parts of the report found that military and civilian planners consistently:

34 *Navsea Mine Familiarizer*, p. 20.
35 Despite the technologically sophisticated navigational systems available to submarines today, the reassurance derived from a good three-point coastal fix, using a periscope, is significant. This is particularly the case when pinpoint minelaying accuracy is required.
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- Knew little about the use of mines and assumed that they can only be used in long strategic campaigns when the reverse is true.
- Failed to realise that mines are special weapons that require considerable training of support personnel if they are going to be used effectively.37

Australian military planners are no more immune to these faults than anyone else. The implication is clear. If Australian decision-makers want the options offered by the mine then a ‘family’ of mines should be developed in order to satisfy the requirements of the Australian Mine-Use Model. The appropriate mine types are: Submarine-Launched Mobile Mine (SLMM), Air-Deployed Combat Mine (ADCM), Destructor (DST), Short-Tethered Rising Mine (STRM), Obstructor Mine (OBSM), and Command Controlled Mine Charge (CCMC). The general features of each mine type in this family are as follows:

**SLMM**

This mine should be capable of being fired from standard (533 mm) torpedo tubes and have a range of 6 to 10 nautical miles.38 Charge weight should be in the order of 300 kilograms. The weapon should be quite selective and be smart enough to resist substantial countermeasures. Its major application would be in countervalue reprisal and blockade fields. The real significance of this weapon is that any harbour within mission range of an Australian patrol submarine (above 3,000 nm) is able to be mined at minimal risk to the deployment platform. Because of the utility of the SLMM in a wide range of situations and the difficulty of producing them rapidly, a minimum of 150 of these weapons should be maintained in peacetime as ready rounds.39

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38 This is a sufficient standoff range for most harbours in the South-West Pacific region. SLMMs deployed from ranges in excess of 5 nm would probably have to be wire-guided for at least part of their transit and it is unlikely that any submarine would deploy an SLMM from anywhere inside the 30-metre isobathic contour. The minimum minelaying operating depth for World War Two submarines was about 20 metres.
39 This quantity provides for 10 submarine sorties, each with a 15:8 mine:torpedo load (see Table 9.2).
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ADCM
This mine would be capable of deployment from any Australian air platform able to carry 1000-pound or 2000-pound bombs. The ADMC should combine the three major influence-type mechanisms: acoustic, pressure and magnetic. All influence-type sensors should be made quite selective when coupled with an efficient target detection device. Any desired mix of influence actuations should be achievable.

The ADMC should be designed on a modular basis, with removable instrument racks making it possible to assemble, test and store firing component assemblies apart from the loaded mine-charge case. Given the advances in modern materials technology, the ADMC should be capable of a 75 to 80 per cent charge fraction despite the requirement to use flight gear. Therefore the 2000-pound model of the ADMC could carry at least a 1500-pound charge weight.

The ADMC would be a bottom mine capable of effectively attacking surface and submarine targets. A moored version of the ADMC is also desirable, but not essential, especially in view of the considerable extra research and development costs involved in this type of modification. However, a facility for surface and submarine laying of the ADMC would add to its flexibility.

The 2000-pound model would be capable of seriously damaging large vessels, of 1000 tonnes or more, at depths up to 80 metres. It would also be effective against submarines at depths up to 200 metres, depending on the submarines' operating depths.

Since this type of mine would form the main deterrent backbone of minefields laid within reach of Australian air and surface units, several hundred ADMC ready rounds should be available for immediate use.

DST
This handy bomb-mine can and should be available in large numbers. Manufacture of bombs is not a problem, however the number of Bomb Conversion Kits (BCKs) available in-country obviously limits available mine numbers. Given their capability to increase the threat of any type of field and also their well-established utility as a land control weapon,

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40 The F-111 and P3-C aircraft are immediately capable of deploying these weapons (see Table 9:2). The Mk 82 and Mk 84 GPLD bombs are standard F-111 armament.

41 See Project Hindsight, Appendix 1, for a description of the research and exploratory development programme associated with producing highly capable, air-deployed, moored mines.
several thousand conversion kits should be available for immediate use. However, the inherent limitations of the DST should always be borne in mind (see Chapter 2).

**STRM**

This weapon would mainly be deployed in depths outside the effective range of bottom mines, that is, in the 80 to 200-metre depth range. The STRM would be equipped to detect a surface target, detach from its sinker unit and by virtue of its net positive buoyancy rise to the vicinity of a target. This mine type could be widely used in resource denial applications as a 'robot policeman' with a limited life. STRMs could be used to declare an Exclusion Zone, to cordon off various unwelcome installations within the EEZ and to deter intruders generally.

Several hundred of this particular mine type should be available in peacetime as a deterrent to large-scale intrusion into the Australian EEZ. The main area of research applicable to the STRM is sensor and signal processing technology, which is equally applicable to the other mine types considered thus far.

**OBSM**

The Obstructor mine is designed to harass enemy minesweeping efforts and to destroy fishing nets in the resource denial application. When the mine is engaged by a sweep wire or fishing net a relatively small one-kilogram high-explosive charge will cut the sweep wire or badly hole a net.

These moored mines should be capable of deployment from the air and surface. The ability to deploy them from civil aircraft would be an advantage in terms of the deployment operation being seen as a police action. The OBSM need only weigh a few hundred pounds and not many of them would be required in peacetime, since production would be relatively simple and parts are easily built if the tooling is already in existence.

**CCMC**

These undersea charges could be controlled from the shore and may be used in harbour defence of vital ports. Construction is simple, as they are merely command detonated units of explosive on the ocean floor. However prototypes and command procedures should be developed in peacetime if funding permits. Detailed contingency plans for their use can be made in peacetime at minimal cost.
Mine Delivery Considerations

The best mines and the best mine-use plans are useless if ordnance cannot be accurately delivered at the right time and in the right quantity. The essence of successful mine warfare is the delivery of many mines at the earliest possible time. This operational principle maximises the deterrent effect and operational value of the minefield while minimising risk to the delivery platforms.

Australia has a substantial mine delivery capability at present and this situation will persist. Table 9:2 summarises the mine delivery capability of ADF platforms in 1990.

The P-3 force is theoretically capable of carrying and deploying $20 \times 15,000 = 300,000$ pounds of mine ordnance in one lift, the F-111 force can carry $18 \times 12,000 = 216,000$ pounds and the C-130 force can, in theory, deploy $24 \times 40,000 = 960,000$ pounds of mine ordnance. The three platform groups together have a theoretical mine ordnance air-delivery capability of approximately one and one half million pounds per lift. However, during crises these aircraft would have other mission responsibilities (in fact aerial mining is not a mission of the P-3 or C-130 at all, even though both plane types are capable of it). Nevertheless, if only 12.5 per cent of this total ordnance delivery capacity could be applied, Australian aircraft currently in service would deliver about 200,000 pounds of mine ordnance per lift. This is impressive, as only one-third of this amount of mine ordnance was used to completely foul Haiphong harbour's main channel in 1972.42 However, deployment of aerially laid minefields can be very risky in the blockade, quarantine or countervalue reprisal applications. Surprise is the paramount element in these operations, which are known as Rapid Aerial Minelays (RAMs). After the first mining effort rival air defences are alerted and losses might increase. This is why initial large mine plantings should be made using as many available platforms as possible. Aircraft could then return to their primary missions, with the fields being replenished with SLMMs on an opportunity basis.

If mines have to be aerially deployed to areas further from Australia, mine loadings can be reduced. For example, the mission

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42 Lucknow, 'Victory over Ignorance and Fear', p. 24, states that 75 Mk 52 (1000 lb, air-laid, bottom influence) mines were laid along the main channel into Haiphong harbour.
radius quoted in Table 9:2 for the C-130 carrying 40,000 pounds of ordnance is 1000 nautical miles. (This includes a 5 per cent fuel reserve and half an hour's sea level delivery time, through far less time than this would be spent in actual mine deployment). If only 20,000 pounds of mine ordnance were carried, the mission radius would be increased to 2200 nautical miles with the same fuel reserve and deployment time.

**TABLE 9:2**

**MINE DELIVERY CAPABILITIES**

<table>
<thead>
<tr>
<th>PLATFORM</th>
<th>EFFECTIVE NUMBER ON INVENTORY</th>
<th>MAXIMUM MINELOAD</th>
<th>MISSION RADIUS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3-C</td>
<td>20</td>
<td>6 x 2000 lb ADCM and 3 x 1000 lb ADCM</td>
<td>over 2000 nm</td>
</tr>
<tr>
<td>F-111</td>
<td>18</td>
<td>4 x 2000 lb ADCM/Mk 84/DST</td>
<td>over 1500 nm</td>
</tr>
<tr>
<td>OBERON</td>
<td>6</td>
<td>24 SLMM (or 32 to 48 mines)</td>
<td>over 3000 nm</td>
</tr>
<tr>
<td>SUBMARINE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C-130</td>
<td>24</td>
<td>20 x 2000 lb ADCM</td>
<td>over 1000 nm</td>
</tr>
<tr>
<td>F-18</td>
<td>70</td>
<td>x 500 lb Mk 82 DST</td>
<td>over 550 nm</td>
</tr>
</tbody>
</table>

* Mission radius is maximum unrefuelled return-trip range.

**Note:** With the exception of the F-18, these figures are given for platforms carrying mineloads exclusively.

At present the C-130 aircraft used by the RAAF are not equipped to deploy mines. However, the viability of a Cargo Aircraft Minelaying (CAML) system has been examined in detail by the United States, Japan and Britain. The technology involved in constructing a mine-filled pallet which can be loaded into the C-130 and secured is not

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sophisticated. Mines would be placed in the pallet so that they could be gravity fed out of the aircraft during operations.44

Of course the Oberon submarine would not go to sea without torpedoes and carrying mines exclusively. However, on a specialised minelaying mission only a few torpedoes would be required for the purpose of self-defence. This is especially so considering the acquisition of the highly capable Mk 48 torpedo by the Royal Australian Navy. Indeed, the extremely high cost of the Mk 48 may make more room in torpedo racks for submarine deployed mines, since it is difficult to envisage all submarines going to sea with a full torpedo/missile loads of 24 extremely expensive Mk 48 torpedoes and Harpoon missiles.45

Submarine minelaying missions are extremely valuable in special operations such as blockade and the laying of countervalue reprisal fields. This is attributable to the accuracy with which mines can be laid as ambush devices. During World War Two submarine minelaying had no greater success world-wide than in the waters of South-East Asia. These results were achieved by Fremantle-based submarines, which started laying mines in October 1943, mainly because a shortage of torpedoes existed at that time in the Pacific. A combination load of 11 mines and 21 torpedoes was carried in each submarine.46 The first operations deployed a total of 160 bottom mines in the approaches to Bangkok, Haiphong, and Cape Padaran. The Hainan Strait was also mined. These mines threatened the heavily used route around Indo-China to Siam, as well as all traffic transiting the Hainan Strait. The fields immediately began to produce casualties, as six ships totalling 22,000 tons were sunk and six ships totalling 18,000 tons were damaged. Successes continued as a few Fremantle-based


45 Each Mk 48 torpedo was costed at over $A1.2 million at the time of writing.

46 Duncan, America’s Use of Seamounts, p. 135.
submarines continued to lay mines at points along the coasts of Malaya, Singapore, Borneo and the Celebes.47

As a result of these operations a total of 421 submarine-laid mines, deployed in twenty-one small fields, sunk twenty-seven vessels and damaged the same number again.48 Consequently, an outstanding success rate of one ship attacked per 8 mines deployed was achieved by Fremantle-based submarines. Also, no submarines were lost during mine-planting missions during the entire war in the Pacific. Finally, 421 mines (the number responsible for such phenomenal results in South-East Asian waters) could be laid by only eight submarines carrying full mineloads in one squadron sortie.

Surface minelaying does not require specialised platforms. Indeed, in operations outside the Australian EEZ the best surface layers would be the most inconspicuous of vessels. The less military their appearance the better. The main advantage of surface minelaying is, as with submarine laying, the accuracy with which fields can be deployed. Mines can be deployed from surface craft using chutes, quickly assembled mine rails, ramps or just be lifted over the side using ships' davits. Surface layers can also usually plant many more mines than other platform types. However surface minelayers, unless they are well disguised, are more easily interdicted than submarines or aircraft.

The Mine is an 'Orphan'

In view of the above it can readily be seen that Australia has the potential to deploy large numbers of mines at considerable distances from the continent using a variety of launch platforms. There is no requirement for the construction of any purpose-built minelaying platforms. Nevertheless, a minelaying mission should be allotted to all the platforms listed in Table 9:2; at present, however, there is little indication that mine preparation and minelaying are being practised to anything but a minimal degree in the Australian Defence Force.

Low mine readiness in the ADF is exacerbated by the pitifully small stocks of mines available for training in the preparation of highly capable live mines for operational use. Another reason for the general lack of Australian mine readiness is the traditionally low status accorded to the mine itself as a weapon of war among the military. Pilots and naval warfare officers who have not been educated in the use of the

47 ibid.
48 Hartmann, Weapons That Wait, p. 234.
mine have an understandable preference for the more visible, or more glamorous, weapons of warfare. These weapons move fast, create loud explosions and give the user quick feedback on results.49

A former US CNO (Admiral E. Zumwalt) pinpointed the core of this attitude problem when he suggested that his navy was made up of 'unions' consisting of the surface warfare, submarine and aviation arms. Members of these three unions were educated to be extremely platform-orientated and the mine had tended to become an 'orphan' because it did not seem to greatly enhance the value of the platform relative to other weapons.50 It is also less dependent on a particular vehicular delivery system than are most weapons. These factors are exacerbated by the mine's traditional image as the weapon of an inferior maritime nation. All this has led to a lack of mine awareness in Western navies and a general feeling that mine service does not enhance prospects for career advancement.

Lack of mine awareness within the military necessarily leads to a lack of appreciation by politicians of the utility of mine-use. Ironically, the mine suffers neglect because of the same 'unglamourous', low-key features which are the essence of its ultimate political value.

The Australian political leadership should be fully aware that efficient minelaying operations, designed to enhance Australian political leverage, will not be viable unless the right sorts of mines are able to be laid in adequate numbers and that personnel must be trained to ensure that the mines can be laid quickly, accurately and in good condition, with the proper settings. Such requirements have many implications regarding tactics, training and logistic support, but detailed consideration of these issues is beyond the scope of this work.

General Conclusions

The linkage between politics and war has seldom been stronger than in the post-World War Two era. This is largely due to unprecedented constraints imposed by international legal, economic and moral factors, as well as the tremendous destructive power of modern conventional and nuclear weapons. These factors have tended to lead to the waging of limited wars for limited objectives. Limited wars have been described as 'wars of risk' involving co-ordinated military-diplomatic manoeuvres


50 ibid.; also Hartmann, Weapons That Wait, p. 146.
that may not lead to overt military engagement, but often achieve results governed more by the political manipulation of risk than by actual military contest. Risk involves the possibility of incurring hazard, misfortune and loss — with the actual degree of risk intuitively measured by perceptions of the rival's likely reaction.

In the Australian political context an extremely high threshold of risk-taking exists with regard to engaging in any unilateral military act that might escalate a crisis and elicit a potentially heavy cost in terms of human life and national treasure. Though this high threshold of action may appear excellent in principle, democracies have found extreme disadvantages with it in practice, since they have often been 'pushed' so far that they have no option but to finally yield a maximum response at a high level of overt conflict. This, of course, leads to the massive costs which the democratic government tried to avoid for so long.

Rather than be committed to such 'all or nothing' behaviour democracies need low-risk political-military tools for the effective signalling of resolve at the lower levels of threat development. These tools should be capable of de-escalating or defusing a conflict situation by giving the rival less reason for confidence at an early stage. Consequently such tools must be 'sobering' but not unduly provocative. The naval minefield is one such tool of conflict management, and this work suggests that political decision-makers can use it in a firm and decisive manner while concurrently minimising the degree of risk in a wide variety of Australian defence contingencies. Minefields can be widely used at the lower echelons of conflict and threat management because they satisfy the fundamental requirements of graduated response; that is, appropriateness and proportionality. This is because a field's threat is politically adjustable in terms of area, intensity, timing, target and duration of effect.

Minefields are paradoxical. The mines themselves are passive weapons and the minefield is invisibly assertive. As such, the minefield is capable of de-escalation at the lower echelons of threat development, since it can be used as a subtle, though assertive, ambassador of national resolve. Mine-use lies in the 'grey area' at the critical interface between purely political manoeuvre and overt military action. Mine deployment can therefore sometimes be used as a minimum military response capable of contributing to the achievement of the objective of conventional de-escalation.
Through the development of a practical Australian Mine-Use Model (AMUM), this paper has endeavoured to demonstrate that mine-use is a suitable, acceptable and feasible option for Australian decision-makers in a wide range of political-military contingencies:

- Its use is in accord with the Australian government's policy of self-reliance.
- It acts as a framework for the development of an assertive Australian mine warfare deterrent which is, in itself, a potent form of mine countermeasure.
- It provides options capable of contributing to the resolution of most contingencies identified in 1981 by the Parliamentary Joint Committee on Foreign Affairs and Defence. In particular, the model provides unique options which can contribute to the formation of successful Australian security solutions relating to regulation of the EEZ; the defence of friendly neighbours; and the deterrence of low-level harassment operations.
- Properly handled mine-use operations can be acceptable to the domestic and international public conscience.
- The Australian Defence Force has in its current inventory a more than adequate number of platforms capable of satisfying missions involved in the AMUM.
- Production of the family of mines necessary to carry out AMUM missions is affordable and probably within the current industrial and technological capacities of the Australian defence infrastructure. Mine-use can give Australian decision-makers a degree of political-military leverage out of all proportion to mine costs.

51 See Parliament of the Commonwealth of Australia, Joint Committee on Foreign Affairs and Defence, *Threats to Australia's Security*. 
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This monograph presents an imaginative plan for the use of the sea mine in Australia's defence. It explores uses of the sea mine as a peacekeeper, capable of eliminating escalatory 'eyeball-to-eyeball' confrontation between forces. A role for the sea mine as a 'robot policeman' of Australia's EEZ is also considered, together with the sea mine's traditional role as a proxy warfighter, one which issues no communiques and never surrenders.