
National Effects-Based Operations: The Example of Fleet Air Defence

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The integrated air defence of maritime task forces is conventionally regarded as being of purely military concern. This article argues, however, that under the principles of operations research, the whole-of-government instruments applied during the Falklands War (1982), Tanker War (1987–88) and East Timor (1999) were significant air defence systems. Australia's expanding capacity to project military power through defended maritime/amphibious task forces must therefore be compatible and integrated with its regional/global engagement—a National Effects-Based Approaches question of force structure design, even if the systems concerned are grounded in psychology versus physics.¹

Q: What was the single most effective air defence system during the Falklands War?

A: The UK lobbying for economic sanctions by the European Economic Community on Argentina, resulting in an arms embargo.

The Falklands War remains as an instructive example of the challenges faced by a deployed amphibious force,² especially for air defence. The questions in 1982 about land- or carrier- based airpower (fighters, Airborne Early Warning & Control) in conjunction with organic maritime defence (area- and point-defence Surface-to-Air Missiles) remain pertinent in 2007. However, that the Falklands War (1982), Tanker War (1987-88) and East Timor (1999) constitute worked examples of whole-of-government operations yielding air defence effects appears to be less well known, inviting exploration.

The aim of this article is to illuminate the potential conduct and analysis of National Effects-Based Approaches (NEBA) to warfare. Through the Falklands War, Tanker War and East Timor case studies, the article shows that NEBA was critical to the integrated air defence of a maritime task force, a domain which is conventionally regarded as being of purely military concern. With this experience of unifying conventional military operations

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² Alexander Wooley, 'The Falklands: 20 years too soon', *Proceedings of the United States Naval Institute*, vol. 128, no. 3 (Mar 2002), p. 66.

under a whole-of-government umbrella, the article draws implications for future deployed operations led by Australian forces.

Background

This work was motivated by Defence Science and Technology Organisation (DSTO) responsibilities in technical risk assessment, notably in and around the Air Warfare Destroyer (AWD). Following the *2003 Defence Procurement Review*, DSTO was empowered with a mandate to scrutinise the technology feasibility, maturity, and overall technical risk of capability proposals.³ This dovetailed with pre-existing interest in studying the operational effectiveness of a number of Australian systems expected to become operational in the 2015 epoch, among them the upgraded missile defence systems on the ANZAC frigates, New Air Combat Capability, Amphibious Deployment and Sustainment and Australia's wide area surveillance systems of which the Jindalee Operational Radar Network is a major component. In assessing the risks of integrating these systems together, it is necessary to have a systems-of-systems understanding of how they would operate. The operations research of future maritime task force operations and Australian Defence Force (ADF) effectiveness thus needed an umbrella of operational and strategic concepts.

The second motivation is in improving the understanding and analysis of NEBA to warfare,⁴ where NEBA is defined thus⁵:

A national effects-based approach [NEBA] represents a basic idea for thinking about Australia's security in a new century. This approach involves taking a whole-of-nation view of security to find the most appropriate tool to achieve national objectives. These tools will be drawn from the elements of national power, and provide diplomatic, economic, information and military options. In deciding which tool to apply, the Government is likely to consider the interests involved and the preferred way to affect the adversary's will. We should also consider the goals and capabilities of our coalition partners in planning. Therefore Defence is not the only—and sometimes will not be the leading—agency for dealing with security problems.

The desirability of taking a NEBA approach to warfare has been repeatedly argued,⁶ particularly in the context of strategic strike⁷ and counterterrorism⁸

³ Department of Defence, *Defence Procurement Review* (Kinnaird Review), 2003, p. 17, <<http://www.defence.gov.au/publications/dpr180903.pdf>> [Accessed 18 April 2007].

⁴ Paul K Davis, *Effects-Based Operations-A Grand Challenge for the Analytical Community*, RAND MR-1477 (Santa Monica: RAND, 2001).

⁵ Department of Defence, *Force 2020*, 2002, <www.defence.gov.au/publications/f2020.pdf> [Accessed 8 May 2007].

⁶ Department of Defence, *Future Warfighting Concept*, 2003 <www.defence.gov.au/publications/fwc.pdf> [Accessed 8 May 2007]; Chris Michaelsen (ed), 'Special Edition: Effects-Based Strategy', *Security Challenges*, vol. 2, no. 1 (April 2006). NEBA is also referred to through "Effects-Based Operations", "Effects-Based Strategy", and similar.

⁷ Justin Kelly and David Kilcullen, 'Chaos Versus Predictability', *Security Challenges*, vol. 2, no. 1 (April 2006), pp. 63-73.

seeking mechanisms whereby immediate kinetic (military) effects can generate final cognitive (political) effects.⁹ Doubts about NEBA include questions of its being sufficiently robust and reliable to be operationally useful,¹⁰ or the novelty of NEBA versus the classical theory of Ends-Ways-Means.¹¹ At stake is whether NEBA has anything to say about the investment programme for the future ADF, from conceptualising the ADF within whole-of-nation security.

This article contributes to these efforts by arguing that the integrated air defence of maritime task forces, while conventionally regarded as being a purely military problem, has actually been an implementation of NEBA. The discussion is seated in operations research (OR), as its ultimate goals are to inform investment decisions regarding ADF systems, and to shape its doctrinal thinking. Conversely, by showing that OR can be unified with NEBA in the domain of maritime air defence—a key domain of historical, quantitative “hard OR”—the path is opened to similar analyses in other domains.

Framework

Operations research thinking is that the effectiveness of an air defence system is *not* measured just by counting the attacking systems that are destroyed, but by an assessment of the attacks that were thwarted. This was first raised in arguments for fitting anti-aircraft cannon to WWII merchant vessels,¹² and holds today for modern equipment.¹³

⁸ David B Lazarus, 'Effects-Based Operations and Counterterrorism', *Security Challenges*, vol. 2, no. 1 (April 2006), pp. 147-156.

⁹ Gary Waters, 'The Strategic Value of Information in Effects-Based Operations', *Security Challenges*, vol. 2, no. 1 (April 2006), pp. 113-131; Peter Nicholson, 'Effects-Based Strategy: Operations in the Cognitive Domain', *Security Challenges*, vol. 2, no. 1 (April 2006), pp. 133-146.

¹⁰ Zoltan Jobbagy, 'Effects-based Operations and the Problem of Causality-Simple and Complex', *Joint Forces Quarterly*, no. 46, (3rd Quarter 2007), pp. 90-95.

¹¹ M. H. Miller, 'Aspirational Concepts and Their Impact on Classical Maritime Theories', *Australian Defence Force Journal*, no. 171 (2006), pp. 96-107.

¹² Philip M. Morse and George E. Kimball, *Methods of Operations Research* (New York : The Technology Press of Massachusetts Institute of Technology and J. Wiley, 1951). Section 3.4.4 discusses the argument over equipping British merchant vessels with anti-aircraft guns and crews. Analysis showed that, while enemy aircraft were shot down in only 4 percent of attacks, the presence of anti-aircraft fire correlated with a reduction in bomb hits from 13 to 8 percent, and sunk ships from 25 to 10 percent. The conclusion was that, under the measure of enemy attacks being disrupted, “the anti-aircraft guns more than paid for themselves if they reduced the chance of the ship being sunk by a factor of more than 2”. This case is cited in operations research as illustrating the importance of identifying the right question, versus finding the right answer to the wrong question; see for example Roy E. Rice, 'Step #1 Of The Scientific Method: Defining The Problem', *MORS Tutorial "What Analysts Need to Know"*, MORS 2003 Education Colloquium, 2 April 2003, <http://www.mors.org/education_colloquium/EC2003/EC2003_presentations.htm> [Accessed 23 April 2007].

Given the metric of thwarting attacks, this article introduces the Defensive Zones framework of Table 1. The framework defines 8 zones, designated z0 through z7, functionally centred on the task force being defended. The *Functional Effect* column defines each zone in effects-based terms, while the *Common Term* column provides a description that might be used otherwise. Zones z0 ... z4 are designated as the *inner zone*, with z5 ... z7 as the *outer zone*, to contrast instruments that are conventionally regarded as being part of fleet air defence from those that are not.¹⁴

Table 1 thus highlights the challenge in unifying whole-of-government mechanisms with military ones: from centre out, defensive instruments merge into offensive, the level of war is lifted from tactical to strategic, the effect domains run from physical through cyber to cognitive, and the tempo decreases substantially from seconds-and-minutes to months-and-years. Moreover, within the *inner zones*, the means and effects are largely physical, while in the outer zones, the means and effects are more cyber and cognitive. These factors are difficult to model under contemporary operations research. However, as the next section shows, outer-zone instruments have been crucial to effective fleet air defence, and must be incorporated into analysis.

Table 1: Defensive Zones

Zone	Functional Effect	Common Term	
z7	Shape the context of the conflict.	Diplomacy	} Outer
z6	Undermine will to use.	Information operations	
z5	Deny at basing.	Strike	
z4	Deny acquisition by a sensor platform.	Outer Air Battle "Archers not arrows"	} Inner
z3	Deny weapons launch by a shooter platform.		
z2	Deny weapons hit on another.	Area defence	
z1	Deny weapons hit on self.	Point defence	
z0	Recover from a hit.	Damage Control	

Case Studies

In the case studies that follow, inner- and outer-zone defences were assembled around a maritime task force, in a NEBA implementation of air

¹³ Wayne P. Hughes, *Fleet Tactics and Coastal Combat*, Second Edition (Newport: US Naval Institute Press, 2000), p. 190. Hughes used the example of the Sea Dart contribution to the defence of the UK task force. He described it as "vital", in constricting the Argentine pilots' manoeuvring room (low level), with follow-on effects for close-in defence and bombing accuracy.

¹⁴ This article was originally entitled "The *REAL* Outer Air Battle". The term "Outer Air Battle" is from US Navy thinking on defending aircraft carrier battlegroups against air attack, particularly the interception of enemy aircraft before they could launch their antiship missiles. The thesis of this article is that this is not the true "outer" zone of fleet air defence.

defence. The tables summarise the systems and their alignment with the Defensive Zones, as described in the supporting text.

FALKLAND WAR (1982)

In April 1982, the United Kingdom dispatched a naval task force to retake the Falklands Islands, following their invasion by Argentina. Much has been written on the campaign and the defence of the task force,¹⁵ with conventional attention on the air-to-air engagements by Sea Harriers operating off the carriers *HMS Hermes* and *Invincible*,¹⁶ the surface-to-air engagements by the Sea Dart-equipped Type-42 destroyers in area air defence¹⁷ and the Sea Wolf-equipped Type-22 frigates deployed as goalkeepers.¹⁸ This is not the entirety, with other defences including the Rapiers surface-to-air missile batteries deployed to cover ships close inshore,¹⁹ the equipping of Nimrod MR.2 maritime patrol aircraft with Sidewinder missiles to handle a chance encounter with their Argentine 707 counterparts,²⁰ electronic countermeasures employed by the air defence ships,²¹ and damage control/recovery efforts aboard those ships that were hit.²² All of these defensive instruments fall into the inner zone.

This article will also only mention in passing strike operations on Argentine airbases. Such operations were at least contemplated,²³ as seen in the aborted SAS raids²⁴ and attacks by Vulcan bombers.²⁵ That such forays may or may not have precluded or deterred air raids on the naval or embarked units is not of prime importance, since the prevention of attacks by striking at bases is already an accepted part of defensive military wisdom.

¹⁵ Lawrence Freedman, *The Official History of the Falklands Campaign, Volume II: War and Diplomacy* (London: Routledge, 2005); James A. Haggart, 'The Falkland Islands Conflict: Air Defense of the Fleet', Marine Corps Command and Staff College, 1 May 1984 <<http://www.globalsecurity.org/military/library/report/1984/HJA.htm>> [Accessed 23 April 2007]; 'Falklands Air War' (3 parts), *Airplane*, vol. 1, no. 5 (1990), pp. 133-137; no. 6 (1990), pp. 160-164; no. 7 (1990), pp. 188-192; 'Super Entendard Exocet Attacks', *Airplane*, vol. 2, no. 18 (1990), pp. 496-499; 'A-4 Skyhawk in the Falklands', *Airplane*, vol. 5, no. 55 (1990), pp. 1530-1534; Nigel West, *The Secret War for the Falklands* (Boston: Little, Brown and Company, 1997).
¹⁶ 'Sea Harriers Draw First Blood', *Airplane*, vol. 5, no. 56 (1990), pp. 1558-1562; Andrea Ellner, 'Carrier Airpower in the Royal Navy during the Cold War: The International Strategic Context', *Defense & Security Analysis*, vol. 22, no. 1 (March 2006), pp. 23-44.

¹⁷ Hughes, pp. 152-154, 190.

¹⁸ 'Super Entendard Exocet Attacks'; Freedman, pp. 472-73, 477-78. Notably in the deployment of *HMS Coventry* and *HMS Broadsword* as a Type-42/22 air defence combination of Sea Dart with Sea Wolf.

¹⁹ Haggart, Chapter Eleven.

²⁰ 'NIMROD: The Might Hunter', *Airplane*, vol. 3, no. 33 (1990), pp. 905-915.

²¹ 'Super Entendard Exocet Attacks'.

²² Freedman, p. 300.

²³ *Ibid.*, pp. 432-34.

²⁴ Peter Ratcliffe, Noel Botham and Brian Hitchen, *Eye of the Storm: Twenty-Five Years In Action with the SAS* (London: Michael O'Mara Books, 2000), Chapter Ten, pp. 143-149; West, pp. 137, 139-152; Alastair Finlan, 'British Special Forces and the Falklands Conflict: Twenty Years On', *Defense & Security Analysis*, vol. 18, no. 4 (2002), pp. 319-332.

²⁵ 'Operation 'Black Buck'', *Airplane*, vol. 3, no. 32 (1990), pp. 888-892.

Similarly, the announced deployment of a nuclear submarine to the Falklands theatre²⁶ and the effects of torpedoing *ARA General Belgrano*²⁷ are also only of secondary concern, fitting as they do into conventional theories of deterrence and coercion.²⁸

Instead, this article recalls its opening assertion that the air defence of the British forces retaking the Falklands was a NEBA operation. The question then is about outer-zone instruments. Of interest are the diplomatic and information operations that sought to block Argentine maritime strike operations by interdicting capability, as characterised by then UK Prime Minister Margaret Thatcher's memoirs,²⁹ among them the sanctions and arms embargo of the European Community,³⁰ engagement with France to gain intelligence on the French-supplied weapons and aircraft,³¹ and the financial-industrial operations to thwart Argentine efforts to purchase further Exocet missiles.³²

The effectiveness of these engagements can be appreciated by considering the downstream effects of their absence, with specific attention to attacks using the Exocet missile.³³ At the start of the Falklands War, Argentina had taken delivery of five or six Super Étendard strike fighters, and ten Exocet anti-ship missiles of which five had been refitted with the inertial guidance systems necessary for their operation, prior to the withdrawal of technical support by the French contractor.³⁴ Combat effectiveness of the Super

²⁶ West, p. 36.

²⁷ Wooley, p. 66.

²⁸ Freedman, p. 468. Freedman cites Woodward describing the SSN as being a "trump card" that had "psychologically defeated" the Argentine Navy.

²⁹ West, p. xvii. "The Argentines had only a limited number of the devastating Exocet missiles.

They made desperate attempts to increase their arsenal ... We for our part were equally desperate to interdict this supply". Quoted by West from Margaret Thatcher, *The Downing Street Years*.

³⁰ Freedman, pp. 94-95, 100, 498; Lisa L. Martin, 'Institutions and Cooperation: Sanctions during the Falkland Islands Conflict', *International Security*, vol. 16, no. 4. (Spring, 1992), pp. 143-178; Inis L. Claude, 'UN Efforts at Settlement of the Falkland Islands Crisis', in Alberto R. Coll and Anthony C Arend (eds), *The Falklands War: Lessons for Strategy, Diplomacy and International Law* (Boston: George Allen & Unwin, 1985), Chapter 9.

³¹ John Nott, *Here Today Gone Tomorrow: Recollections of an Errant Politician* (London: Politico's Publishing, 2002), p. 305; Freedman, p. 71; John Follain, 'Falklands: 'The Sphinx and the curious case of the Iron Lady's H-bomb' (memoirs of Mitterrand's psychoanalyst)', *The Sunday Times*, 20 November 2005, <<http://www.margarethatcher.org/commentary/displaydocument.asp?docid=110663>> [Accessed 16 May 2007]. The engagement by Thatcher with French President Mitterrand for details on the Exocet radar ("codes") reportedly included the threat of nuclear attack on Argentina.

³² Freedman, pp. 385-89; West, Chapters 4 and 8 in particular; Nott *Here Today Gone Tomorrow: Recollections of an Errant Politician*, p. 305.

³³ 'Super Entendard Exocet Attacks'.

³⁴ Freedman, pp. 259, 297. "It appeared that the original American inertial guidance system fitted to the missiles had not worked properly but a new system developed by the French had been supplied for the Super Etendards. ... Of the ten Exocet delivered to Argentina only five had been handed over so far for fitting, and France had undertaken to stop supplying military equipment to Argentina from 15 April." Martin Middlebrook, *The Argentine Fight for the*

Étendard-Exocet combination was exhibited by the sinking of the Type 42 destroyer *HMS Sheffield* on 4 May 1982 and the resupply ship *MV Atlantic Conveyor* 25 May 1982, the loss of helicopters and supplies on the latter having a significant impact upon British land force mobility later during the campaign.³⁵

It is reasonable to postulate that further Super Étendard-Exocet attacks could have had similarly far-reaching effects. The considerations are that the 30 May raid was thwarted,³⁶ potentially due to improvements in passive defences (jamming, decoys) following the 4 May 1982 attack on *Sheffield*,³⁷ and that while the loss of *Atlantic Conveyor* was significant, this was acceptable when compared to the potential alternative of losing the aircraft carrier *Hermes*.³⁸ As a result, it is something of a bold statement to claim that the arms embargo was the “most effective” air defence system employed by the British, when placed in the entire air defence system of systems (Table 2). However, the numbers invite attention: the five missiles that were not upgraded to operational standard, and four missiles ordered by Peru were delayed in France;³⁹ commendable totals⁴⁰ when set against the effect of the five Exocets that were operational. Hence the central point holds—in thwarting the Argentine capability to make further attacks, the

Falklands (Yorkshire: Pen & Sword Military Classics, 2003), p. 121. “... a French team due to arrive in Argentina on 12 April for completion of the technicians’ [ground crew for the Super Étendard aircraft and Exocet missiles] had their visit cancelled because of the EEC embargo on help and trade for Argentina. ... There was also much work to be done on the aircraft’s vital Inertial Navigation System. The set intended for the Super Étendard had not arrived when the embargo came down, and an older model, designed for the Mirage fighter, had to be adapted”. The text from Freedman and Middlebrook are quoted to recognise the discrepancy on whether it was the Exocet missiles or the Super Étendard aircraft that were specifically interdicted, but this does not detract from the overall point about the arms embargo.

³⁵ ‘Chinook in the Falklands’, *Airplane*, vol. 3, no. 30 (1990), pp. 832-835.

³⁶ ‘Super Étendard Exocet Attacks’.

³⁷ The acquisition of improved information about the Exocet radar is best characterised as an enabler to improved Zone 1 defence. Freedman, pp. 299, 482. Note that *Sheffield* was equipped with jammers and chaff, but was not at action stations and did not attempt to engage either missile or aircraft. Moreover, Freedman writes, “It is important to note that even if the right assessment had been made and chaff released, it is still by no means clear whether this professionally executed Argentine attack could have been frustrated.”

³⁸ Hughes, p. 153. Hughes criticises *HMS Ambuscade* for defending itself at the expense of *Atlantic Conveyor*.

³⁹ Freedman, p. 386. The number of Exocet missiles may have been as high as eight. See ‘France Is Said to Deny 8 Exocets to Peru Ship’, *The New York Times*, 28 May 1982, <<http://query.nytimes.com/gst/fullpage.html?res=9E02E5D71038F93BA15756C0A964948260&sec=&spon=&pagewanted=print>> [Accessed 16 May 2007].

⁴⁰ See also Freedman, pp. 387-388, on missiles allegedly offered by Iran and Libya. Freedman writes that Iran had captured nine Exocet missiles from Iraqi stocks and that, “It could not be ruled out that this number was on its way to Argentina”. Similarly, there were concerns that Libyan supplies of ammunition and spares may have included Exocet missiles. Hence, taking a pessimistic view that all the Iranian missiles were delivered, and if a nominal guess is made of two missiles from Libya, this would indicate an interdiction rate of some 45 percent (9 intercepts out of a total of 20 possibles).

economic and industrial-information operations logically constituted outer-zone air defence of the British task force, under the operations research measures of air defence.

Table 2: Falklands (1982) Air Defence of the Task Force

z7	Economic sanctions (total ban on imports and arms sales).
z6	Thwarting of attempts to purchase further munitions (Exocet).
z5	(Attempted) strikes on mainland Argentine airbases.
z4	Maritime units held far east of Falklands; Nimrod MR.2 armed with AIM-9G.
z3	Sea Harriers armed with AIM-9L operating from carriers; Type-42 destroyers (Sea Dart) forcing attacks to low-level; Rapier batteries covering ships inshore.
z2	Type-22 frigates (Seawolf) deployed as goalkeepers.
z1	Chaff and electronic warfare defences.
z0	Damage control & recovery.

TANKER WAR (1987–88)

In 1987–88, in response to a Kuwaiti request and within an overall context of safeguarding the flow of oil, the United States deployed as the lead of a coalition for escorting reflagged oil tankers in the Persian Gulf.⁴¹ While there is significant attention on the tactical and operational actions of US forces,⁴² with the US Navy as the leading actor, an operations research approach must consider the Tanker War from a Kuwaiti perspective, in the protection of their vessels from attack.

The tactical nature of the air defence problem does require a summary, as it set the context for defence in the inner zones. The US Navy air defence concepts of the time were oriented against regiment-strength Backfire raids in deep water (North Atlantic),⁴³ yet the mission called for escort operations

⁴¹ Nadia El-Sayed El-Shazly, *The Gulf Tanker War: Iran and Iraq's Maritime Swordplay*, (Basingstoke: Macmillan Press, 1998).

⁴² Ted Hooton, 'The Tanker War in the Gulf 1984–88', *Jane's Intelligence Review*, May 1992, pp. 218-221; Michael A Palmer, 'Operation Praying Mantis', in Jack Sweetman (ed), *Great American Naval Battles* (Annapolis: US Naval Institute, 1998), Chapter 19; Craig L. Symonds, *Decision at Sea: Five Naval Battles that Shaped American History* (Oxford: Oxford University Press, 2005), part 5; Peter Huchthausen, *America's Splendid Little Wars: A Short History of U.S. Military Engagements: 1975-2000* (New York: Viking Penguin, 2003), Chapter 7.

⁴³ Richard Scott, 'Global developments in the ASCM threat', *Janes Intelligence Review*, 1 June 2000; Benjamin S. Lambeth, *American Carrier Air Power at the Dawn of a New Century*, MG-404 (Santa Monica: RAND, 2005), pp. 2-3. Lambeth describes the naval air capabilities at the time of Desert Storm 1991, that is some 3–4 years after the Tanker Wars. "... the naval air capabilities that had been fielded and fine-tuned for open-ocean engagements, such as the long-range AIM-54 Phoenix air-to-air missile carried by the F-14 fleet defense fighter, were of little relevance to the allied coalition's combat needs. Navy F-14s were not assigned to the choicest combat air patrol (CAP) stations in Desert Storm because, having been equipped for the less crowded outer air battle in defense of the carrier battle group, they lacked the redundant onboard target recognition systems that CENTCOM's rules of engagement required for the denser and more confused air operations environment over Iraq." A description of the then-extant concepts can be found for example in 'F-14 Tomcat Operational Profile', *Airplane*, vol. 6, no. 64 (1990), pp. 1784-1788; and *The New Face of War: Carrier Warfare* (London: Caxton Publishing Group, 2004), pp. 31-32, 34-37; Norman Friedman, *Seapower and Space*:

in constrained littoral waters (Persian Gulf), against potential missile attacks by aircraft, ships (including Boghammer patrol boats) and coastal launchers and maritime mines.⁴⁴ Indeed, antiship missiles were a poor weapon against oil tankers,⁴⁵ but achieved an operational effect of presenting the US Navy with a dilemma: orienting against the high-technology missile threat⁴⁶ and also low-technology mines and small boat attacks.⁴⁷ Hence, instead of reducing a high-quantity attack through layered application of carrier battlegroup defences,⁴⁸ the defensive problem was concerned with the interception of low-quantity late-notice attacks in conjunction with US Air Force and other assets, where every loss could be interpreted as a strategic failure.⁴⁹

Strategically, the Tanker War sat within the Iran-Iraq War (1980-88), under an Iraqi (Saddam Hussein) strategy of pressuring Iran into ending the war on terms favourable to Iraq.⁵⁰ The US had tried to stay detached from the Iran-Iraq War, but allowed itself to be drawn into the role of escorting Kuwaiti tankers against the perceived poorer alternative of increased Soviet presence in the region.⁵¹ This constituted a successful Kuwaiti government action in constructing point- and area- missile defences around their tankers, in the form of the US Navy-led escort operations,⁵² Hawk surface-to-air

From the Dawn of the Missile Age to Net-Centric Warfare (London: Chatham Publishing, 2000), Chapter Ten.

⁴⁴ Huchthausen, pp. 104-107; Hughes, pp. 150-151.

⁴⁵ Hooton, pp. 218-221.

⁴⁶ El-Shazly, pp. 292, 295. In describing the first convoy escorted under Operation Earnest Will, El-Shazly writes, "In Washington, officials expressed relief that the passage they had most dreaded [transit of the Strait of Hormuz, which was guarded by Iranian Silkworm missiles] was behind them—an indication that the Chinese-made land-based SSMs were their main concern." And "Official American pronouncements had revealed that the main threat the navy's commanders perceived was that of land-based SSMs mounted on al-Fao peninsula and the shores and islands on the Strait of Hormuz". The weakness of the US Navy in mine countermeasures, both in terms of capability and operational planning, is of significant discussion in writings about the Tanker War.

⁴⁷ Symonds, pp. 288-290.

⁴⁸ Norman Friedman, 'The Vincennes Incident', *Proceedings of the United States Naval Institute / Naval Review* (May 1989), pp. 72-74, 76, 78-80. The issue can be seen in detail with the experience of the USS Vincennes, and the review of the Aegis weapon system with the then SPY-1A radar system in the downing of the Iran Air Flight 655. Friedman wrote that "SPY-1A and the Aegis system were designed primarily for fleet air defense in a dense, high-speed environment" and "Although the radar performs surveillance well ... it is primarily a means of effective fire control, and the design is probably biased in that direction".

⁴⁹ Symonds, p. 288. Symonds quotes Michael Palmer's description of the convoys being "largely symbolic", but "historically significant" in demonstrating "America's willingness, and the Navy's ability, to turn the Persian Gulf into a kind of American lake."

⁵⁰ El-Shazly, Sections 5.5 and 7.4; Sreedhar Kapil Kaul, *Tanker War: Aspect of the Iraq-Iran War 1980-88* (New Delhi: ABC Publishing House, 1989), pp. 2-3.

⁵¹ Symonds, pp. 279-280.

⁵² *Ibid.*, pp. 283-288.

missile batteries,⁵³ and covert operations against minelaying vessels.⁵⁴ Arguably, this also constituted an Iraqi success, in seeking greater superpower involvement in the region as a step towards concluding the war.⁵⁵

Regarding the land-based Silkworm missiles as the core of the air threat, it has been asserted that their use was deterred by the threat of strikes on the launchers - "tit for tat".⁵⁶ This raises a significant point: when this deterrence had a "leaker" in the form of the Silkworm attack on the reflagged supertanker *Sea Isle City*, the US Navy did *not* respond with a tactical counterstrike on the launcher. As the launchers were permanently emplaced,⁵⁷ and hence within the technological-warfighting capability of the US military at the time,⁵⁸ the choice not to do so was deliberate. Instead, the selected response was to strike an oil rig, with the justification of disrupting the Iranian surveillance capability but with a deliberate goal of being a "proportionate" demonstration.⁵⁹ The US Navy's capacity to deal with the threats tactically was thus being controlled from the highest strategic levels. Whether it wanted to or not, the US Navy was forced to place its escort operations in a whole-of-government context, against the poorer alternative of defeat through attrition in the inner zone.

In the outer zone, the United States sought and was given assurances from China that no Silkworm missiles were being exported to Iran.⁶⁰ This action sat within the context of Operation Staunch, an ongoing diplomatic effort to

⁵³ Andres de Lionis, 'The Coastal Missile Threat in the Middle East', *Jane's Intelligence Review*, vol. 6, no. 1 (1 January 1994).

⁵⁴ Symonds, pp. 289-292.

⁵⁵ El-Shazly, pp. 271-273, 308-310.

⁵⁶ B. F. Jublou, 'An Essay on the use of naval power in crises: A comparison of two US naval efforts', *Journal of the Australian Naval Institute* (November 1992), pp. 29-37. See especially p. 33, where Jublou argues the success of naval presence as deterrence: "An example of a successful use of this deterrent was the lack of Silkworm missile attacks on convoys in the Strait of Hormuz. The US made it patently clear that such attacks would bring immediate retaliation against the Silkworm bases. With a CVBG operating just outside the Gulf, the threat was indeed credible."

⁵⁷ See de Lionis.

⁵⁸ As exhibited during the attacks on Libya during April 1986 under Operation El Dorado Canyon, against fixed targets in a denied-access environment of comparable intensity; see 'The Raid on Libya', *Airplane*, vol. 1, no. 4 (1990), pp. 106-109. The conclusions may be different if the threat was from mobile launchers, the difficulty of which can be calibrated by the experience during the 1991 Desert Storm "Scud Hunt"; see Tom Clancy and Chuck Horner, *Every Man a Tiger* (London: Sidgwick & Jackson, 1999).

⁵⁹ Symonds, pp. 292-94. Symonds notes that the *Sea Isle City* was in Kuwaiti waters and hence technically not under US protection, however the Reagan administration requested a "proportionate" strike. The language of "proportionate" recognises that there was the potential for the US to come into open conflict with Iran, and indeed there were protests to that effect from Iran.

⁶⁰ Edgar O'Ballance, *The Gulf War* (London: Brassey's Defence Publishers 1988), pp. 204-205. O'Ballance writes, "In March [1987] when on a visit to China, George Schultz, the American Secretary of State, tried to persuade that country [China] to stop sending arms to Iran; but the Chinese blandly denied that they were doing anything of the sort."

interdict Iranian arms resupply, however, Operation Staunch was severely compromised by the Iran-Contra Affair.⁶¹ Hence, the more significant outer-zone activities were in the diplomatic efforts to secure a ceasefire, starting with United Nations Security Council Resolution 598. Indeed, under the tenet of this article that the success of an air defence system rests on attacks that are thwarted, and from a Kuwaiti perspective of protecting their tankers, the US Navy deployment was not immediately successful,⁶² and only gained its eventual success in terms of drawing the United States and other powers into greater engagement in the conflict.⁶³ The Iranian acceptance of United Nations Security Council Resolution 598 and the subsequent ceasefire, are conventionally attributed to coercion by military means,⁶⁴ but this is a US-centric perspective.

Table 3: Tanker War (1987–88)

z7	US engagement with China over Silkworm missiles; Ceasefire under UN Security Council Resolution 598.
z6	
z5	Coercion through tit-for-tat strikes.
z4	
z3	US operations against minelayers.
z2	US Navy -led escort operations; Hawk batteries.
z1	Kuwaitis seeking US-reflagging of their tankers. → US + coalition escorts.
z0	

Taking the ostensible Kuwaiti goal of protecting their tankers, in the absence of a ceasefire the attacks on their shipping may well have continued indefinitely. The US Navy has been described as being in a “no win” peacekeeping role,⁶⁵ but the full picture is that it was only fighting the inner zone of the air defence problem. Hence, while it is somewhat crass to say that the Tanker Wars ended only with the Iran-Iraq ceasefire, the actions taken to attain this ceasefire logically constituted outer-zone defence of the

⁶¹ Harold Lee Wise, *Inside the danger zone: The U.S. Military in the Persian Gulf, 1987–1988* (Annapolis: Naval Institute Press, 2007), pp. 4-5.

⁶² El-Shazly, p. 308 and Kaul, p. 3. El-Shazly writes, “The re-flagging of Kuwait tankers, in the summer of 1987, and the increase in the number of foreign warships in the Gulf, neither safeguarded Kuwaiti shipping and its territory, nor reduced the intensity of the conflict in the short term. On the contrary, it accomplished the opposite of what was ostensibly intended, and while around 80 foreign vessels patrolled the Gulf, Iraq and Iran fought more vigorously over its waters than at any other time.” Similarly, Kaul writes, “The naval escorts to certain ships passing through the straits of Hormuz by the extra regional powers, remained cosmetic. In fact the attacks on ships passing through the straits of Hormuz increased since mid-1987.” These conclusions do admit further discussion, in questioning the goal of achieving perfect safeguarding versus a more modest goal of reduced shipping losses, and in whether the foreign vessels triggered the increased intensity versus merely being coincident. Nonetheless, the central point holds.

⁶³ El-Shazly, pp. 241-42, 308-09.

⁶⁴ *Ibdi.*, p. 309; and Symonds, p. 317.

⁶⁵ Jublou, p. 32. Jublou writes of a “potential no win role of peacekeeper in a violent region.”

Kuwait tankers (Table 3), under the operations research measures of air defence.

INTERNATIONAL FORCES IN EAST TIMOR (INTERFET 1999)

The interest in the East Timor (1999) case study stems from studying the utility of the Air Warfare Destroyer (AWD) in the future ADF. The point of departure is that the US Aegis cruiser *USS Mobile Bay* was described as “vital enabler”⁶⁶ to the operation, an experience subsequently cited in support of the AWD.⁶⁷ That such warships significantly contribute to maritime air defence is undisputed; the central question is about the entirety of the defences afforded to the task force, within its NEBA context.

In October 1999, under UN Security Council Resolution 1264, Australia led a multinational force into East Timor to restore peace and security, protect and support the UN Assistance Mission to East Timor in carrying out its tasks (within force capabilities) and to facilitate humanitarian assistance operations. The conventional view of East Timor (1999) is that an ADF-led coalition was raised *ad hoc* at short notice,⁶⁸ bringing to bear high-end military force and military professionalism to enable a diplomatic solution.⁶⁹ The September 1999 arms embargo that degraded Indonesian air force capability⁷⁰ fits this short-notice viewpoint.

The complementary view is that diplomacy and information operations were also used as force protection, and started well before the (supposedly short-notice) October 1999 deployment. The actions are best characterised by the explicit statements made by the then Australian Prime Minister John Howard,⁷¹ the meetings by Major General Peter Cosgrove with his

⁶⁶ James Goldrick, ‘East Timor Maritime Lessons’, *Navy News*, 18 September 2000, <http://www.defence.gov.au/news/NAVYNEWS/editions/2000/09_18_00/story17.htm> [Accessed 20 April 2007]. “Although Australia’s guided missile frigates (FFGs) and the British destroyer GLASGOW provided an important measure of air warfare surveillance and combat capability, AEGIS cruiser, the USS MOBILE BAY was a vital enabler in the opening stages of the operation. Her long range air warfare systems, both in sensors and weaponry, and her excellent battle management and command capability meant that the force could contemplate any situation with a high degree of confidence, even without the continuous presence of friendly fighter aircraft.”

⁶⁷ Richard McMillan, *Air Warfare Destroyers and Combat Operations from the Sea*, Papers in Australian Maritime Affairs, no. 16, <<http://www.navy.gov.au/spc/maritimepapers/piama16/air.html>> [Accessed 20 April 2007].

⁶⁸ Steve Ayling and Sarah Guise, ‘UNTAC and INTERFET - A Comparative Analysis’, *Australian Defence Force Journal*, no. 150 (September/October 2001), pp. 46-56.

⁶⁹ MAJGEN P J Cosgrove, ‘The ANZAC lecture at Georgetown University’, Tuesday 4 April 2000’, *Journal of the Australian Naval Institute*, vol. 26, no. 2 (April/June 2000), pp. 5-9; David Dickens, ‘The United Nations in East Timor: Intervention at the Military Operational Level’, *Contemporary Southeast Asia*, vol. 23, no. 2 (Aug 2001), pp. 213-233.

⁷⁰ Andrzej Jeziorski, ‘USA blocks Hawk components for Indonesia’, *Flight International*, 25 April 2000, <<http://www.flightglobal.com/Articles/Article.aspx?iiArticleID=64852&PrinterFriendly=true>> [Accessed 9 May 2007].

⁷¹ ‘Transcript of the Prime Minister, the Hon John Howard MP, Television Interview with John Laws, Foxtell’, 27 September 1999, <<http://www.pm.gov.au/media/interview/1999/>>

Indonesian counterpart Major General Kiki Syahnakri to prepare to an orderly transfer of responsibilities,⁷² and in changes made to the means of force entry to avoid provoking the Indonesian forces at Dili airport.⁷³ Other actions included engagement by the Australian Prime Minister and Foreign Minister with their foreign counterparts to gain support for an international peacekeeping force, by the then Chief of Army with his regional counterparts to secure local allies, and with the United States and UN to gain Indonesian assent to an intervention.⁷⁴ Such diplomatic actions contextualised INTERFET as an action against rogue militia, as opposed to being an Australian-led invasion of Indonesia.

That these actions were deliberate is confirmed by the March 1999 decision to raise the readiness of 1 Brigade,⁷⁵ the decision in April 1999 to commission an Incat catamaran as *HMAS Jervis Bay*,⁷⁶ and a review of the

foxtel2709.cfm > [Accessed 20 April 2007]. LAWS: Prime Minister, I know the question has been asked time and time again and is still being asked and probably unnecessarily but could you in the simplest of terms just tell us why Australia didn't intervene before? PRIME MINISTER: Well if we'd have intervened before, in other words before the United Nations sanctioned it, that would have represented an invasion of Indonesia and that would have been crazy. The reason that the United Nations finally sanctioned it was that Indonesia finally agreed to accept a peacekeeping operation. So people who are saying that we should have acted in advance of that were really advocating an invasion of Indonesia.

⁷² James Cotton, *East Timor, Australia and the Regional Order* (London: RoutledgeCurzon, 2004), p. 128 and P. J. Cosgrove, 'Complex questions--A commander's perspective', *RUSI Journal*, vol. 146, no. 1 (February 2001), pp. 31-36. Cosgrove does describe Syahnakri and his advisers as being, "taken aback at the size and rapidity of the initial deployments and my clear intention to embark immediately on security operations in Dili", but the central point remains—the INTERFET deployment was expected.

⁷³ Cotton, p. 128. The specific change was from using helicopters to inserting with C-130 aircraft, which left "them [the special forces] initially exposed, but this manoeuvre was successful in building an atmosphere of cooperation, at least at the landing zone."

⁷⁴ *Ibid.*, p. 121; William Shawcross, *Deliver us from evil: Warlords & peacekeepers in a world of endless conflict* (London: Bloomsbury, 2000), pp. 356-357.

⁷⁵ 'Howard ready for further action but forced to wait on UN', *7:30 Report*, Transcript 14 September 1999, <<http://www.abc.net.au/7.30/stories/s51876.htm>> [Accessed 1 August 2007]. JOHN HOWARD: We anticipated this months ago, when we decided to raise the extra brigade, and we are in a high state of readiness; 'Speech by the Minister for Defence (Matter of Public Importance)', House of Representatives, 23 September 1999, <<http://www.minister.defence.gov.au/1999/28699.html>> [Accessed 1 August 2007]. "Clearly the scale of our deployment to East Timor is posing major challenges for the ADF. However, because of the decision we took in February this year to raise the readiness of a second brigade, we have now available to us sufficient forces to deploy and maintain on East Timor a contingent of up to 4,500 personnel for about a year."; 'Defence Reform Program Delivers Increased Defence Preparedness', *Media Release* MIN 067/99, Thursday 11 March 1999, <<http://www.minister.defence.gov.au/1999/06799.html>> [Accessed 1 August 2007]. At the time of the announcement, the raising of readiness was put in terms of a "major, practical benefit" arising from the Defence Reform Program, with the goal of being at 28 days readiness by 30 June 1999.

⁷⁶ 'Defence Capability Boosted by new High Speed Catamaran', *Media Release* MIN 118/99, 25 April 1999, <<http://www.minister.defence.gov.au/1999/11899.html>> [Accessed 1 August 2007]; 'Acquisition Does Not Signal Threat', *Navy News*, 28 June 1999, <http://www.defence.gov.au/news/NAVYNEWS/EDITIONS/1999/06_28_99/story15.htm> [Accessed 1 August 2007].

intelligence briefings to the Australian Government in the months prior to the September 1999 violence. Moreover, 21 June 1999 saw a meeting by Air Vice Marshal Doug Riding (then Vice-Chief Defence Force) with senior officers of the Indonesian armed forces (TNI) to confront them with evidence of TNI complicity in organising the militia.⁷⁷ This meeting could be characterised as a diplomatic-information operation, seeking to decouple the Indonesian leadership from the militia under the contextualisation of INTERFET, appealing to themes of professionalism and respect for the rule of law.⁷⁸

Nonetheless, the conventional thinking is that East Timor (1999) was a military-led operation,⁷⁹ in the presence of a latent but non-trivial threat including that of air attack.⁸⁰ It is this viewpoint that takes interest in the *USS Mobile Bay*, and other systems used by the ADF to project combat power. The conventional viewpoint further argues that, in the absence of the UN mandate and Indonesian consent, Australia would not have deployed, from having insufficient capability.⁸¹ This is indeed the point—the actions to gain consent lowered the threat to a level that the task force was willing to engage, and thus constituted part of the overall force protection afforded to INTERFET by whole-of-government operations.

In a similar vein, the contextualisation of INTERFET focussed the use of military deterrence, for instance the raising of alert levels of the RAAF F/A-18 and F-111 forces,⁸² and RF-111 photoreconnaissance missions⁸³ that

⁷⁷ Desmond Ball, 'Silent witness: Australian intelligence and East Timor', *The Pacific Review*, vol. 14, no. 1 (March 2001), pp. 35-62.

⁷⁸ 'Minister Emphasises Australia's Role in Regional Security', *Media Release* MIN 042/99, 23 February 1999, <<http://www.minister.defence.gov.au/1999/04299.html>> [Accessed 1 August 2007]. The Minister said that "A key focus of the defence relationship is to secure a stable, long-term future for Indonesia in which the Indonesian armed forces play an appropriate role, characterised by professionalism and respect for the rule of law." See also John B. Haseman, 'National Interests and Mil-to-Mil Relations with Indonesia', *Joint Forces Quarterly* (Autumn 2002), pp. 20-26. Haseman points to the US-sponsored international military education and training (IMET) program as, "perhaps the most effective way to influence Indonesian officers on the role of the military in society, civilian control of the armed forces, and professionalism". The "heyday" of IMET was described as being 1975–1981; that is to say, the timeframe in which a 1990s senior officer will have received their junior officer training.

⁷⁹ Norman Friedman, *Seapower as Strategy: Navies and National Interest* (Annapolis: Naval Institute Press, 2001), p. 3.

⁸⁰ Dickens; "Some of the Indonesian military aircraft adopted aggressive probing tactics." David Spicer, 'Claims of Indonesian-Australian air skirmish', *AM Archive*, 13 May 2000, <<http://www.abc.net.au/am/stories/s126456.htm>> [Accessed 17 May 2007].

⁸¹ 'Strategic And Military Lessons From East Timor', *CSS Strategic Briefing Papers*, vol. 2, part 1 (February 2000), <http://www.vuw.ac.nz/css/docs/Strategic_Briefing_Papers/Vol.2%20Feb%202000/East%20Timor.pdf> [Accessed 20 April 2007]. See text under the title "Only balanced forces have the flexibility needed for peacekeeping". While the text focussed on the New Zealand defence force, the essence applied to the ADF.

⁸² Adam Cobb, 'East Timor and Australia's Security Role: Issues and Scenarios', *Current Issues Brief*, no. 3 (Canberra: Parliamentary Library, 1999), <<http://www.aph.gov.au/library/pubs/cib/1999-2000/2000cib03.htm>> [Accessed 17 May 2007]. "The F-18 squadrons based at Tindal have been issued with contingency plans to maintain air superiority in the event that the

implicitly demonstrated ADF reach. A conventional viewpoint would contend that these actions aimed at deterring military intervention by the Indonesians.⁸⁴ However, the F/A-18 and F-111 deployments are better characterised as being aimed at extremist element of the Indonesian government and army;⁸⁵ that is, INTERFET was not seeking to deter the entirety of Indonesian will, but merely rogue elements. The threat of counter-air and strike thus served as inner-zone protection to the deployed forces, within the context shaped in the outer zones.

This article does *not* argue that military force was superfluous to INTERFET. However, it does argue that diplomatic shaping reduced the threat to a level where military force became workable, as a layer of outer-zone protection to the deployed forces. In favourably shaping the intent of the Indonesian air force (and other forces), the contextualisation of INTERFET as a security action against rogue actors logically constituted outer-zone air defence of the ADF-led task force (Table 4), under the operations research measures of air defence.

Table 4: East Timor (1999) Air Defence of INTERFET

z7	INTERFET Contextualised as an action against rogue militia, not as an invasion of Indonesia; European Union / US arms embargo.
z6	Australia presenting intelligence on rogue TNI connections to the militia.
z5	ADF strike capability (F-111).
z4	
z3	ADF air combat capability (F/A-18 + cueing).
z2	US Aegis-equipped cruiser and other warships.
z1	
z0	

Implications

At this point, this article has introduced a Defensive Zones construct for defence, integrating physical, cyber and cognitive means & effects through

situation deteriorates. Temporarily grounded due to a mechanical problem last month, the F-111 fleet has been given a clean bill of health and is ready to undertake missions that might be tasked to the long range bombers." 'Battle Plans', *Lateline*, TV Program Transcript, 27 June 2000, <<http://www.abc.net.au/lateline/stories/s144809.htm>> [Accessed 17 May 2007]; Andrew Fowler, 'Flying Blind', *Four Corners*, Program Transcript, 29 October 2007 <<http://www.abc.net.au/4corners/content/2007/s2073943.htm>> [Accessed 30 Oct 2007].

⁸³ Lenn Bayliss, 'RAAF RF-111s Over East Timor', *Australian Aviation* (March 2000), p. 33.

⁸⁴ 'Embrace for impact', *The Age*, 25 June 2006, <<http://www.theage.com.au/news/in-depth/embrace-for-impact/2006/06/24/1150845417096.html?page=fullpage#contentSwap1>> [Accessed 17 May 2007]; Carlo Kopp, 'Three decades of the F-111', *Defence Today*, May 2003, pp. 2-16, <<http://www.airspacepower.net/DT-F111-MAY03.pdf>> [Accessed 17 May 2007].

⁸⁵ Alan Stephens and Nicola Baker, *Making Sense of War: Strategy for the 21st Century*, (Cambridge: Cambridge University Press, 2006), 'Strategic And Military Lessons From East Timor'; Alan Stephens, 'Strategy with Style: Effects-Based Planning', *Security Challenges*, vol. 2, no. 1 (April 2006), pp. 91-111.

the spectrum from tactical to strategic. The framework was then illustrated by application to three historical case studies. While the analytic framework and the interpretation of history are open to further revision and refinement, this article turns its attention to implications for the future.

AIR DEFENCE OF AUSTRALIAN-LED DEPLOYED OPERATIONS (2015 EPOCH)

The Australian *Defence Update 2005* articulated a clear intent to expand the ADF capability to project military power through defended maritime/amphibious task forces,⁸⁶ and this is reflected in the systems being acquired by Australia to protect such forces from air attack (Table 5).⁸⁷ In seeking an increased expeditionary capability through maritime means, Australia is hardly alone when compared for example with the United States,⁸⁸ the United Kingdom,⁸⁹ the Netherlands, France, Spain and Italy

⁸⁶ Greg Sheridan, 'PM puts on the armour', *The Australian*, 23 June 2007, <www.theaustralian.news.com.au/printpage/0,5942,21951450,00.html> [Accessed 12 July 2007]; *Australia's National Security: A Defence Update 2005* (Canberra: Department of Defence, 2005), p. 23. "The acquisition of new amphibious ships will extend the assured reach of the ADF and allow for the deployment of larger and heavier forces, as well as providing an additional capability for humanitarian assistance. New air warfare destroyers will help protect those forces during a deployment." And "This program to grow naval capability will increase the ADF's capacity to conduct operations in a wide range of possible regional or coalition contingencies." Gregory P. Gilbert, 'Australian Participation in Regional and Global Maritime Security Operations', *RUSI Defence Systems*, vol. 10, no. 1 (June 2007), pp. 78-81; 'Government Approves First Stage of Amphib Ships Project', *Media Release* MIN126/05, 11 August 2005, <<http://www.defence.gov.au/minister/Hilltpl.cfm?CurrentId=5039>> [Accessed 8 May 2007].

⁸⁷ Minister for Defence, The Hon Dr Brendan Nelson MP, 'Australia's Future Air Power', Speech to the Chief Of Air Force's Air Show Conference, 19 March 2007, <www.minister.defence.gov.au/NelsonMinSpeechtpl.cfm?CurrentId=6478> [Accessed 8 May 2007]; 'Super Hornet Acquisition Contract Signed', *Defence Media Release* CPA117/07, 2 May 2007, <www.defence.gov.au/media/DepartmentalTpl.cfm?CurrentId=6619> [Accessed 7 May 2007]; 'Australia - Weapons for F/A-18E/F Super Hornet Aircraft (correction)', *Defense Security Cooperation Agency News Release* 08-24, <www.dsca.osd.mil/PressReleases/36-b/2007/Australia_08-24.pdf> [Accessed 19 October 2007]; 'Defence Contract Signed With Lockheed Martin For New Missiles For F/A-18 Hornets', *Defence Media Release* CPA236/06, 8 September 2006, <www.defence.gov.au/media/DepartmentalTpl.cfm?CurrentId=5985> [Accessed 24 April 2007]; 'Australia to join Joint Strike Fighter Program', *Media Release* MIN311/02, 27 Jun 2002, <<http://www.defence.gov.au/minister/Hilltpl.cfm?CurrentId=1635>> [Accessed 8 May 2007]; 'Defence Minister rolls out Australia's first airborne early warning and control airframe', *Media Release* MIN615/02, 1 November 2002, <www.defence.gov.au/minister/Hilltpl.cfm?CurrentId=2038> [Accessed 9 May 2007]; 'EADS/QANTAS Wins \$2 Billion Air-To-Air Refuelling Competition', *Media Release* MIN73/04, 16 April 2004, <www.defence.gov.au/minister/Hilltpl.cfm?CurrentId=3747> [Accessed 9 May 2007]; 'Australia's Over The Horizon Radar to be Enhanced', *Media Release* MIN32/04, 24 February 2004, <www.defence.gov.au/minister/Hilltpl.cfm?CurrentId=3558> [Accessed 8 May 2007]; 'Australia's Next Generation Air Warfare Destroyer', *Media Release* MIN59/07, 20 June 2007, <www.minister.defence.gov.au/NelsonMintpl.cfm?CurrentId=6781> [Accessed 17 September 2007]; 'SEA 1390-FFG Upgrade Project (FFG UP)', Defence Material Organisation, 28 November 2005, <<http://www.defence.gov.au/dmo/msd/sea1390/sea1390.cfm>> [Accessed 15 January 2008]; 'Anti-Ship Missile Capability for ANZAC Ships', *Media Release* MIN147/05, 9 September 2005, <www.defence.gov.au/minister/Hilltpl.cfm?CurrentId=5096> [Accessed 8 May 2007].

⁸⁸ Friedman, *Seapower as Strategy: Navies and National Interest*, Chapter 11; Richard L. Kugler, 'Naval Overseas Presence in the New U.S. Defense Strategy', and George V. Galdorisi,

under the European Amphibious Initiative,⁹⁰ China, India or Singapore.⁹¹ However, while the *Defence Updates 2003* and *2005* foreshadowed an increase in capability to conduct deployed operations, they did so in the context of regional and global security relationships⁹² that are unique to Australia and its circumstances.

The central question, therefore, is where and how these relationships can influence force structure and design. For example, the *Defence 2000 White Paper* set as a fundamental priority that Australia must be able defend itself from attack without relying upon the combat forces of other countries. However, Australia is prepared to depend upon other-nation support in areas including intelligence, surveillance and logistics.⁹³ Hence there is discretion in force structure arising from regional and global security relationships, even

'Expeditionary and Amphibious Warfare', in Sam J. Tangredi (ed.), *Globalization and Maritime Power* (Washington DC: National Defense University, 2002), chapters 15 and 21.

⁸⁹ Ian Speller, 'Delayed Reaction: UK Maritime Expeditionary Capabilities and the Lessons of the Falklands Conflict', *Defense & Security Analysis*, vol. 18, no. 4 (2002), pp. 363-378.

⁹⁰ 'European Union - European Defence Agency - (Helsinki Headline Goal 2010)', <<http://www.armedforces.co.uk/mod/listings/l0023.html>> [Accessed 8 May 2007]; James H. Bergeron, 'Beyond Integration: Globalization and Maritime Power from a European Perspective', in Tangredi (ed.), chap. 13; Marc Brinkman, 'The Dutch Contribution to the UKNL Amphibious Force: Adapting to Changes in the Global Security Situation', *RUSI Defence Systems*, vol. 9, no. 1 (July 2006), pp. 70-71; Pierre-François Forissier, 'French Naval Operations Today', *RUSI Defence Systems*, vol. 9, no. 1 (July 2006), pp. 64-65.

⁹¹ Richard Fisher, 'Chinese Aspects of Singapore's IMDEX Naval Technology Show', Arms Show Reports, International Assessment and Strategy Center, 20 June 2007, <http://www.strategycenter.net/research/pubID.163/pub_detail.asp#> [Accessed 12 July 2007]; Ian Bostock, 'Asia's amphibious capability assessed', *Jane's Intelligence Review*, 1 October 2000; Raeeza Shams, 'Indian Navy Takes Big Strides Toward Blue Water Capability', *JINSA Online*, 24 July 2007, <<http://www.jinsa.org/articles/view.html?documentid=3864>> [Accessed 31 August 2007]; Robert Karniol, 'Singapore - Deconstruction forges ahead' ('DSTA in the news: In-depth feature on Singapore's defence in JDW'), *Jane's Defence Weekly*, vol. 35 no. 26-27 (22 June 2001), <<http://www.dsta.gov.sg/home/DisplayPage/sideContentPage10.asp?id=829>> [Accessed 12 July 2007].

⁹² *Australia's National Security: A Defence Update 2003* (Canberra: Department of Defence, 2003); *Australia's National Security: A Defence Update 2005* (Canberra: Department of Defence, 2005), esp. p. 12.

⁹³ *Defence 2000-Our Future Defence Force* (White Paper 2000) (Canberra: Commonwealth of Australia, 2000), Section 6.4, "Our armed forces need to be able to defend Australia without relying on the combat forces of other countries. This principle of self-reliance reflects, fundamentally, our sense of ourselves as a nation. As we made clear in discussing our US alliance in Chapter Five, the Government's commitment to self-reliance does not reflect any lack of confidence in our allies. Nor does it suggest that we would not seek and expect help from our allies and friends in time of need. It simply means that we should not rely on others having either the capacity or the willingness to defend our country, especially if we have not taken the effort to provide effectively for our own defence." and Section 6.5, "Moreover, self-reliance does not preclude us from planning on a significant degree of support in non-combat areas including intelligence and surveillance, re-supply and logistics."

in defence of the Australian homeland, let alone in designing the force for operations abroad.⁹⁴

Table 5: Air Defence in ADF Expeditionary-Littoral Operations (~2020)

z7	Regional and global security relationships.
z6	
z5	NACC / Super Hornet + JASSM / JSOW+ MRTT; Special Forces + Air/Submarine deployment
z4	NACC + AEW&C + MRTT + JORN; AEW&C + AWD.
z3	NACC + AEW&C + MRTT + JORN; AEW&C + AWD.
z2	AWD; FFGUP; Ground-Based Air Defence (LAND19); ANZAC Anti-Ship Missile Defence (SEA1448) – goalkeeper.
z1	LHD self-defence.
z0	LHD damage control & recovery.

AEW&C Airborne Early Warning & Control (AIR5077)
 AWD Air Warfare Destroyer (SEA4000)
 FFGUP Guided Missile Frigate Upgrade (SEA1390)
 JASSM Joint Air-to-Surface Standoff Missile (AIR5418)
 JORN Jindalee Operational Radar Network (JP2025, JP2096)
 LHD Landing Helicopter Dock (JP2048)
 NACC New Air Combat Capability (AIR6000)
 MRTT Multi-Role Tanker Transport (AIR5402)

Project numbers refer to the Australian *Defence Capability Plan*⁹⁵ and subsequent transition to Defence Material Organisation.

In choosing to intervene abroad, across the spectrum of conflict,⁹⁶ Australia has a multiplicity of relationships that it could activate, from the historical ANZUS Treaty⁹⁷ and Five Power Defence Agreement⁹⁸, to ASEAN⁹⁹ and

⁹⁴ Compare with John Nott, 'Inside the War Cabinet: Reflections by Britain's Defence Secretary during the Falklands War', *RUSI Journal*, vol. 152, no. 2 (April 2007), pp. 74-78. "We [the UK during the Falklands] were on our own; we needed to persuade our allies, but we hardly needed to consult them. Today, it is inconceivable that we could, or should, go it alone in what is sometimes called 'Expeditionary Warfare'. I fear that the Falklands campaign has distorted Defence Policy ever since. We would either be a subsidiary of the Pentagon, or a member of an EU committee of twenty-seven members."

⁹⁵ *Defence Capability Plan 2006–16*, Public Version (Canberra: Department of Defence, 2006) <<http://www.defence.gov.au/dmo/id/dcp/dcp.cfm>> [Accessed 24 April 2007].

⁹⁶ Eric Wester, 'Last Resort and Preemption: Using Armed Force as a Moral and Penultimate Choice', *Parameters*, vol. 37, no. 2 (Summer 2007), pp. 59-70; Derek McDougall, 'Australia's peacekeeping role in the post-Cold War era', *Contemporary Southeast Asia*, vol. 24, no. 3 (Dec 2002), pp. 590-609.

⁹⁷ 'Secretary's Speech: The United States Alliance and Australian Foreign Policy-Past, Present and Future', Speech by the Secretary of the Department of Foreign Affairs and Trade, Dr Ashton Calvert, to the University of Sydney conference, The United States Alliance and East Asian Security, Sydney, 29 June 2001, <http://www.dfat.gov.au/media/speeches/department/010629_deptsec.html> [Accessed 31 August 2007].

⁹⁸ Carlyle A. Thayer, 'The Five Power Defence Arrangements: The Quiet Achiever', *Security Challenges*, vol. 3, no. 1 (February 2007), pp. 79-96.

⁹⁹ David M. Jones, Mike L. Smith, 'The Changing Security Agenda in Southeast Asia: Globalization, New Terror, and the Delusions of Regionalism', *Studies in Conflict & Terrorism*, vol. 24 (2001), pp. 271-288.

recent arrangements with nations including Japan¹⁰⁰ and India,¹⁰¹ to the “1000 Ship Navy” concept postulated by the United States.¹⁰² The critical point is that these outer-zone relationships (shape the threat) complement inner-zone defences (hedge against leakers); that is, while Australia could seek to build an ADF capable of deploying and defending a force against all possible military attack, a more mature and resilient force design would have consistent and complementary approaches in the inner and outer zones.

For the air defence perspective in particular, the relationships in the strategic zone (z7) have a number of substantial consequences, among them:

- *Fixed-wing airpower and geography.* Australia does not have aircraft carriers, and this is seen to constrain the time-space envelope in which the ADF can provide fixed-wing air cover to a deployed force.¹⁰³ To put this alternately, for the recovery of Australian island territories against a land aggressor, fixed-wing air cover from Australian airbases is at least plausible, albeit likely to be stressful to sustain, and for operations further abroad the cover from Australian airbases is increasingly difficult. Inner-zone solutions hedge against host-nation support basing being unavailable¹⁰⁴ or susceptible to diplomatic interdiction.¹⁰⁵ Outer-zone solutions shape the circumstances of Australia’s deployment, going beyond the conduct of conventional operations against an occupying enemy to include being part of a greater alliance for liberation, or an armed peacekeeping force between parties at or near conflict. Hence, while a purely conventional military viewpoint puts an upper limit on the ADF capability to protect a deployed military force by its fixed-wing airpower, any proposals to raise the capability of inner-zone defences (aircraft carriers, theatre air defence systems, ...) need to be matched with defence through outer-zone engagement (diplomacy, information operations, ...).

¹⁰⁰ ‘Australia in Japan security deal’, *BBC News*, 13 March 2007, <<http://news.bbc.co.uk/2/hi/asia-pacific/6444207.stm>> [Accessed 17 September 2007].

¹⁰¹ ‘Australia and India Sign Defence Information Sharing Arrangement’, *Media Release* MIN70/07, 12 July 2007, <<http://www.minister.defence.gov.au/NelsonMintpl.cfm?CurrentId=6851>> [Accessed 17 September 2007].

¹⁰² John G. Morgan Jr and Charles W. Martoglio, ‘The 1,000-Ship Navy: Global Maritime Network’, *Proceedings of the United States Naval Institute*, vol. 131, no. 11 (November 2005), pp. 14-18.

¹⁰³ Friedman, *Seapower as Strategy: Navies and National Interest*, p. 3; Richard Temple Menhinick, *Sea Control & Maritime Power Projection for Australia: Maritime Air Power and Air Warfare*, Masters Thesis, University of Wollongong, 2003, <<http://www.library.uow.edu.au/adt-NWU/uploads/approved/adt-NWU20040730.161702/public/02Whole.pdf>> [Accessed 17 May 2007].

¹⁰⁴ Lee Willett, ‘To have or not to have—That is the question: Host nation support and British overseas force deployment options’, *RUSI Journal*, vol. 143, no. 1 (Feb 1998), pp. 36-42.

¹⁰⁵ Gordon S Magenheim, ‘Chinese Influence on U.S. Operational Access to African Seaports’, *Joint Forces Quarterly*, no. 45 (2nd Quarter 2007), pp. 22-27.

- *Shaping, Handoff and Warfighting Capacity.* The Defensive Zones construct sits well with concepts for shaping the battlespace prior to, or as an integral part of, force insertion. Indeed, the Tanker Wars, the Falklands and East Timor cases plot an increasing spectrum of success in shaping the air threat. Moreover, where contemporary thinking proposes that air and maritime power will reduce the threat faced by land forces making entry,¹⁰⁶ the same logic holds for outer-zone shaping around the military deployment as a whole. This drives the assumptions on threat level and concepts for handing off between air-, maritime- and land- based assets for air control, and hence the capacities expected from elements of the whole force. Further investigation along these lines could resolve the apparent paradox of “less than war” operations being supposedly less intense than “conventional” operations, but which stress the ADF into operating contrary to its force design.
- *Late-unmasking threats.* Following from the above, it can be observed that air defence for “less than war” has different kill chains to those for open conflict. Established tactical kill chains could be regarded as the “steady state” case of reducing an air threat, by defensive systems applied in the inner zones. Operations “less than war” introduce the possibility of rapid changes between states, arising from uncertainty in the outer zones; for instance, a peace enforcement or a freedom-of-navigation context, with a potential flip to open conflict triggering with the flight time of a weapon.¹⁰⁷ For Australia, this is of special interest as it contemplates the future of its strike capabilities, and concepts for protecting its trade lifelines through the archipelagic waters to its north.

OPERATIONALISING NEBA

This article has also shown that NEBA can be operationalised in a manner compatible with conventional OR. The measures of force protection were taken from work cited in the OR tradition, and the Defensive Zones and kill chain thinking are direct extrapolations of qualitative and quantitative OR methodologies. Furthermore, this article captured the impact of systems that were not previously regarded as “air defence” in nature; among them arms

¹⁰⁶ See, for example: ‘Air Force Experiment Headway-Some Insights’, *Pathfinder*, Air Power Development Centre Bulletin, no 28 (July 2005), <www.raaf.gov.au/airpower/html/publications/pathfinder/2005/Pathfinder_28_Jul05_hires.pdf> [Accessed 8 May 2007].

¹⁰⁷ See also Hughes, p. 162. Hughes observed (in 2000) that “the U.S. Navy’s current inventory is mainly in large warships that are potent offensively but depend almost entirely for survival on reducing susceptibility by a layered defense of combat air patrols, SAMs, and hard-kill and soft-kill point defenses. Even more importantly, American warships depend for survival on outscouting the enemy and attacking him not only effectively, but decisively first.” Hughes then concluded that “These are tactics suitable for a fleet in the open ocean. The tactics will lose their efficacy in littoral waters”. In parallel, it is observed that these are tactics suitable for a fleet at war, and will lose their efficacy in operations less than war but on the cusp of conflict.

embargoes (Falklands), UN diplomacy (Tanker Wars) and disclosure of intelligence to shape intent (East Timor). There are a number of results from doing so:

- *Basis of modelling.* Historically, modelling and simulation of air defence systems has derived from physics principles towards kinetic kill or electronic distraction,¹⁰⁸ but this is a difference in techniques and technology, not of OR intent. This article used *number of missiles interdicted* as the unifying metric for analysing the defensive systems (be they an embargo or an anti-aircraft cannon), but other metrics can be postulated: *time obtained for counter-action* or *attack axes available to the enemy* to name two. The case studies thus showed that systems of a non-physics nature made a substantial difference to the conduct and success of maritime air defence operations. The OR community could embrace this finding by continuing research on the modelling and simulation of cognitive and information systems.
- *Force Protection is easier than Force Purpose.* In integrated air defence, the whole-of-government instruments of diplomacy and information operations had effects measurable in conventional terms, namely the number of attacks that were prevented. This measure applies generally to force protection in general, be it attacks by Exocet missiles on ships or attacks by Improvised Explosive Devices on land forces.

The challenge for NEBA is in meaningful measures for force purpose, and using this to drive force structure and design. The Iraq Index indicators¹⁰⁹ point the way to the former, however these still largely centre on the physical domain versus the cyber and cognitive.¹¹⁰ On the latter, while the price of oil futures has been used to measure the benefit of forward-deployed US carrier battlegroups,¹¹¹ this was an example of analysis that put a rigorous

¹⁰⁸ See for example James E. Coolahan, 'Modeling and Simulation at APL' in 'Science and Technology in Service to the Nation' *John Hopkins APL Technical Digest*, vol. 24, no. 1 (January-March 2003), <<http://www.jhuapl.edu/techdigest/td2401/index.htm>> [Accessed 18 May 2007]; Stephen J. Chapman and Kurt K. Benke, 'Assessment of Ship Air Defence Performance by Modelling and Simulation', *SimTecT*, 2000, <http://www.siaa.asn.au/library_simtect_2000.html> [Accessed 18 May 2007].

¹⁰⁹ Michael E. O'Hanlon, Jason H. Campbell, 'Iraq Index-Tracking Variables of Reconstruction & Security in Post-Saddam Iraq', The Brookings Institution, <www.brookings.edu/iraqindex> [Accessed 25 October 2007].

¹¹⁰ So for example, the Iraq Index tracks the average amount of electricity produced, and the average availability during the day, but not the household perception of electricity quality of service.

¹¹¹ Robert E. Looney, David A. Schradly, and Ronald L. Brown, 'Estimating the economic benefits of forward-engaged naval forces', *Interfaces*, vol. 31, no. 4 (July/August 2001), pp. 74-86.

basis to anecdotal support to an existing structure, versus developing and driving to a future design.

In recent times, military forces have chosen to articulate force purpose measures of providing security and support to an overall civil operation,¹¹² as opposed to the direct generation of cognitive outcomes.¹¹³ The restriction to the provision of security support could well be an eminently suitable future for NEBA, but the aspiration has historically been greater.¹¹⁴

- *Command & Control (C2)*. Integrated air defence is regarded as being the most high-tempo and hence high-stress C2 problem, yet in NEBA terms has the relatively straightforward Defensive Zones framework introduced in Table 1. To be specific, government generates a cognitive zone of action for the military—a zone within which the military is free to think, as bounded by the social contract between the military force and government and interlacing with physical and cyber limits. This delegation of C2 in cognitive, cyber and physical terms works well in force protection, but does not seem to apply well in force application and purpose.

In the Falklands case, in the terminology of conventional C2, Thatcher and the UK Government as a whole understood the maritime task force commander Woodward's "command intent"—interdict the Exocet missiles through all available means. This intent was conveyed and acted upon through the extant mechanisms of the UK Government,¹¹⁵ and once articulated, did not require rapid revisiting. Conventional C2 sufficed in a NEBA context, albeit through inversion of the command hierarchy.

This situation stands in stark contrast to that for force application, and strike in particular. As discussed above in the *Sea Isle City* case, the decision to counterstrike at Iran required reference to the highest levels of the US Government. In military terms, the Silkworm missile batteries were tactical targets, and a conventional viewpoint would argue that the task force commander should have

¹¹² Joanne Wallis, 'A 'helpem fren' in need... Evaluating the Regional Assistance Mission to Solomon Islands', *Security Challenges*, vol. 2, no. 2 (July 2006), pp. 81-98. Wallis articulated tests for evaluating whether RAMSI dealt with the problems of state failure, arguing that a strong state is "one which fulfils its obligations under the social contract, and resembles a liberal democracy". One of the specific tests was "Has the intervention involved more than a military response", and the assessment against this test noted that RAMSI was primarily a police-led operation, the military being deployed for logistics and security support and quickly drawn down.

¹¹³ Ross Babbage, 'Next Generation Strategy: Is Effects-Based Strategy Worth Pursuing?', *Security Challenges*, vol. 2, no. 1 (April 2006), pp. 21-42; Nicholson, pp. 133-146.

¹¹⁴ Robert A Pape, *Bombing to Win: Air Power and Coercion in War* (Ithaca, NY: Cornell University Press, 1996).

¹¹⁵ Freedman, pp. 724-25.

been delegated the authority to remove them as a threat. That this did not occur sets a difficult precedent for strike capability under NEBA, as it pushes the military away from delegated execution of intent, towards centralised command under very-fast execution and control. The logical consequence is a C2 model of extremely fast targeting cycles from shooters in the field right up to the offices of government and back down again—the complete opposite of delegated intent.¹¹⁶

It is not enough to assert that the Silkworm missile launchers were “strategic” and hence subject to special provisions as compared to the missiles themselves being “tactical”—as observed, whole-of-government action was successfully used to interdict Exocet missiles. The need is for systems, processes and technology for mediating between Government and military on the use of force, at a granularity that supports specific targeting of arbitrary, individual systems, and compatible with tactical tempos. The result will not be the delegated execution model desired by the conventional military, but will avoid their poorer alternative of tight centralisation.

- *Defensive Zone “Leakers” = Offensive Zone ?*. The case studies in this article illustrate two intertwined concepts for the use of arms embargoes, with the interdiction of the antiship missiles intertwining with the goal of shaping of adversary intent. Both concepts are admissible under the Defensive Zones construct, as layers within an overall integrated defence. Hence, in the “tactical” sense the embargoes could fail,¹¹⁷ but this was no more a failure of that defence system than having “leakers” in other layers.

This point is of significance when considering a notional *Offensive Zones* construct that articulates how whole-of-government mechanisms assemble effects against an adversary, in the same manner as the kill chain for a missile launch can be plotted through the Defensive Zones and systems brought to bear to interdict. The idea of a corresponding *Offensive Zones* construct for NEBA is not new, with John Warden’s “Five Strategic Rings” cited as an example.¹¹⁸ The potential insight from the Defensive Zones construct is that it was very-deliberately set up as concentric rings

¹¹⁶ For comparison, see also Nick Cook, ‘Predator closes sensor-to-shooter gap for USAF’, *Jane’s Defense Weekly*, vol. 37, no. 7 (13 February 2002), pp. 28-29. In looking at the use of unmanned aerial vehicles (UAV) for strike on time-sensitive / fleeting targets, Cook quoted Frank Pace the then executive vice president of General Atomics Aeronautical Systems (manufacturer of the Predator UAV), “The limiting factor ... is not the technology, but the bureaucracy—getting the necessary permission to engage a target.”

¹¹⁷ James Mayall, ‘The sanctions problem in international economic relations: reflections in the light of recent experience’, *International Affairs*, vol. 60, no. 4 (Autumn 1984), pp. 631-642.

¹¹⁸ Babbage, pp. 26-29.

through which an inbound attacker must penetrate, and if an attacker can bypass a ring then that is an indicator to a significant change in operational-strategic context.

Conclusions

This article showed, through historical case studies, that the integrated air defence of maritime forces is not the pure military domain that it is conventionally regarded to be, but constitutes a worked example of NEBA to conflict. The NEBA instruments provided outer-zone force protection to a military force, the force then generating military effects in the field that were decisive for the whole-of-government campaign. That the NEBA instruments were grounded in psychology rather than physics is relevant only in their modelling, not in their impact.

While the future ADF may continue to focus on inner-zone (hedging) instruments, ADF design needs to retain consistency with outer-zone (shaping) as set up by Government. Moreover, this consideration extends from force protection (defensive) effects to force purpose (offensive). The case studies thus predict a command & control concept wherein the ADF and Government consult, in near real time and tactical tempos, on force application against specific targets. This is contrary to the delegated execution model desired by the conventional military, and resolution of this inconsistency invites further attention.

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