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THE NEW SUBMARINE COMBAT  
INFORMATION SYSTEM

AND

AUSTRALIA'S EMERGING INFORMATION  
WARFARE ARCHITECTURE

*Desmond Ball, PhD*



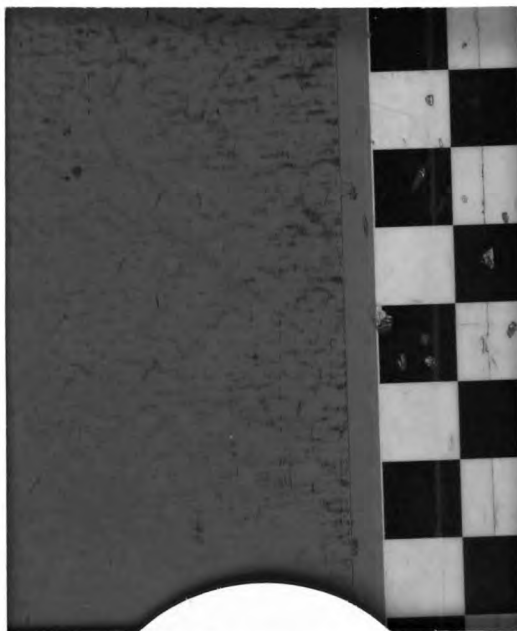
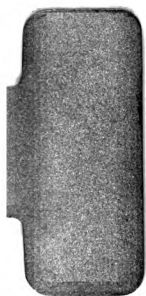
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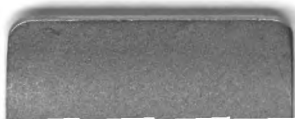
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## Author

Desmond Ball is a professor in the Strategic and Defence Studies Centre at the Australian National University, Canberra. Professor Ball is the author or editor of over 40 books or monographs on defence and security in the Asia-Pacific region. His recent publications include *The Transformation of Security in the Asia-Pacific Region* (Frank Cass & Co Ltd, London, 1996); *Presumptive Engagement: Australia's Asia-Pacific Security Policy in the 1990s* (Allen & Unwin, Sydney, 1996); *Burma's Military Secrets: Signals Intelligence (SIGINT) from the Second World War to Civil War and Cyber War* (White Lotus Press, Bangkok, 1998); *The Council for Security Cooperation in the Asia-Pacific: Its Record and its Prospects*, Canberra Paper No.139 (Strategic and Defence Studies Centre, ANU, 2000); (with Dr Hazel Lang) *Factionalism and the Ethnic Insurgent Organisations*, Working Paper No. 356 (SDSC, ANU, 2001); *Maintaining the Strategic Edge: The Defence of Australia in 2015*, Canberra Paper No. 133 (SDSC, ANU, 1999). Professor Ball is a Fellow of the Academy of Social Sciences of Australia (FASSA), a member of the Council of the International Institute for Strategic Studies (IISS), and co-chair of the Steering Committee of the Council for Security Cooperation in the Asia-Pacific (CSCAP).



## The New Submarine Combat Information System and Australia's Emerging Information Warfare Architecture\*

The Australian Defence Force (ADF) is about to acquire a \$400m Combat System for the Collins-class submarines which should be regarded as the initial building block of a multi-billion dollar Information Warfare (IW) architecture designed to guarantee the success of ADF operations in future decades.

Well within the lifetime of this Combat System, the ADF will move to a force posture and associated operational concepts that will be very different to the platform-based and Service-dominated posture that obtains today. Rather, there will be a complex system (or "system of systems") involving intelligence collection and surveillance systems, command and control centres, manned and unmanned combat vehicles, and the most advanced information technology available, providing broadband linkages for massive flows of communications, data and imagery. The Combat System in the submarines will be an important element of this information warfare architecture.

The Collins-class submarines are potentially the most capable conventional submarines in the world. The new Combat System should make them the best in the world.

But servicing the submarine fleet is only one function of the Combat System. Any prospective system must also be assessed on its ability to support joint and coalition operations, particularly with respect to Information Warfare or Network-enabled Warfare.

By about 2015, the ADF will include wholly new platforms. The Jindalee Over-the-Horizon Radar Network (JORN) will be operational and the Wedgetail AEW&C aircraft will have entered service. AIR 6000 will have resulted in new air defence, reconnaissance and strike capabilities, probably involving some combination of F-22, F-18E/F, Eurofighter or JSF aircraft. The ADF will undoubtedly possess UAV systems, both for broad-area surveillance (such as the Global Hawk) and support of air combat operations. UAVs will be the forward "eyes" and "ears" of stealthy fighters. Three or four anti-air-warfare destroyers (AWD), equipped with Standard SM-2 missiles, will provide air defence and limited ballistic missile defence over areas of ADF fleet operations, amphibious landings, etc.

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\* A version of this paper was published in *Australian Defence Reporter* (Vol 12, No.8), 10 May 2001. The schematic diagram of a notional submarine-related information warfare architecture was drawn by Ms Annabel Ball.

Information flow - broadband, reliable and disseminable in a timely and secure fashion to everyone who needs it, from commanders to shooters - energises the system of systems. Space-based systems will be central. Australia already has a first-class defence imagery organisation, which uses commercially-available imagery as well as very high resolution top-secret imagery provided by the US, and the ADF will probably have its own surveillance satellite system within a decade. US missile launch detection/early warning satellites already provide data to ADF commanders as well as Russell Hill. Navigation satellites (GPS), communications satellites and meteorological satellites are already widely used by the ADF.

All this will become a seamless web. Operational units (combat aircraft, surface combatants, submarines and ground forces) will have fantastic information - a full accounting of their surrounding electromagnetic environment, imagery better than 0.5 metre resolution for general distribution and the most intelligent solutions for weapons employment. Information about electronic emitters in an area of interest - their type, purpose, frequency (wavelengths), signal strength and pulse characteristics - will frequently come from the Collins-class Combat System links.

The defence of Australia depends upon maintenance of a technological edge. This requires (selective) exploitation of the Revolution in Military Affairs (RMA), in which the US is continuing to stay well ahead of other countries. But the ADF is also increasingly likely to be involved in combined or coalition operations - whether peacekeeping or major conflicts such as Desert Storm - in which inter-operability will be the key.

Inter-operability must be harmonised throughout the architecture. This is not so much a matter of common hardware as common software, procedures, training and doctrine. It involves shared source codes, software algorithms and plenty of time and personnel to ensure compatibility is maintained in all operational environments.

This paper argues that there has been insufficient attention accorded the strategic dimensions of the Combat System project, and an evident lack of vision concerning the Information Warfare architecture in which the system will fit. It briefly describes the changing roles and missions of the submarines, the implications of emerging information technologies, the communications systems and interfaces required by the submarines (and especially a high data rate satellite communications system), the necessity for extensive growth potential in any Combat System, and the opportunities provided by the US connection to exploit the RMA. It argues that this project provides a marvellous opportunity for the ADF to begin the systematic construction of a Network-enabled Warfare architecture for maintaining Australia's strategic edge in the Information Age.



## Submarine roles and missions

The role of submarines is being revolutionised.

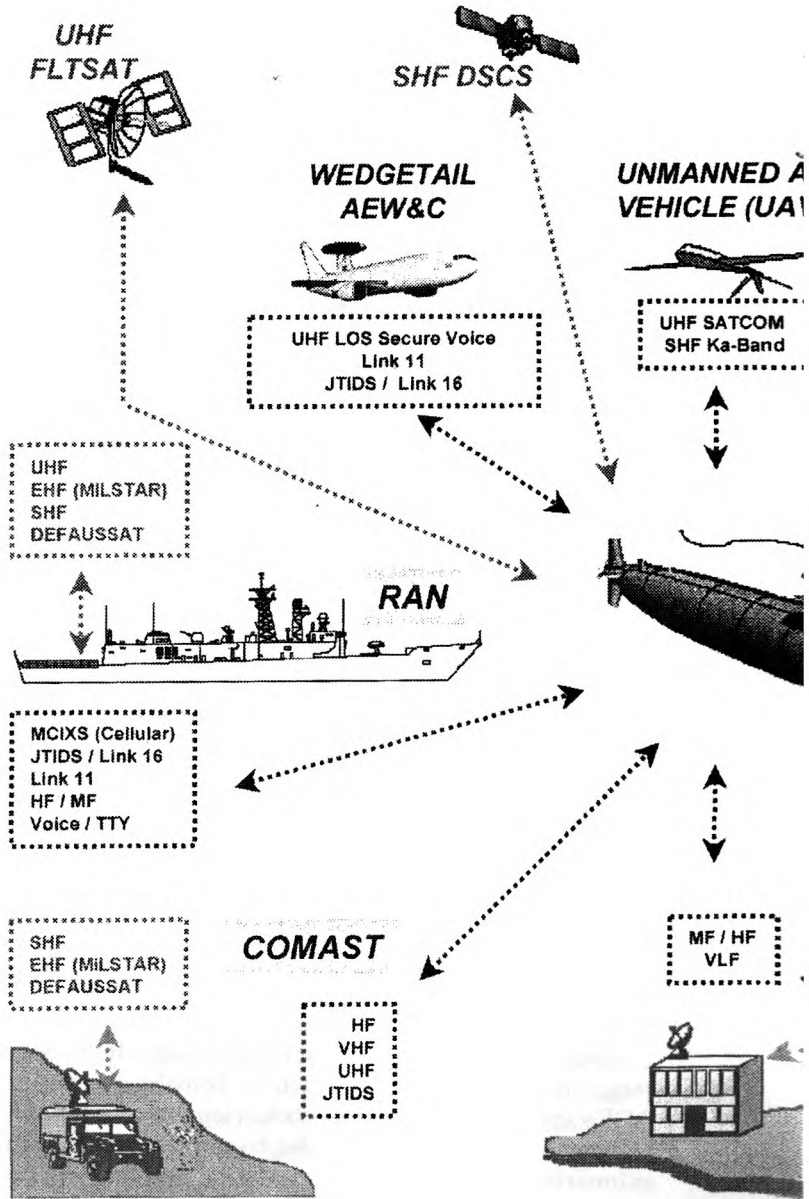
Australia's Collins-class submarines will operate very differently from submarines in the past. Their primary roles are no longer anti-submarine warfare (ASW), convoying, or supporting battle groups in large-scale open-ocean engagements. Rather, they will operate primarily in joint or combined operations in littoral regions, and in a new theatre of Information Warfare or Network-enabled Warfare. The submarines will remain an indispensable element of the RAN's fleet operations, but the chains of command, the range of information being distributed to the submarines, the recipients of information disseminated from the submarines, and hence the contribution of the submarines to ADF operations more generally, will be very different.

The US Navy is moving to a concept of Network-centric Warfare which, while not entirely applicable to Australia's circumstances, is extremely poignant. Networked command and control systems are used to achieve time-critical strike tasks; coordination is enhanced between sensors, weapons systems, and command and control among the Service units that operate these assets; and common visualisation tools are used through which the output of a variety of sensors can be viewed simultaneously by Navy, Army and Air Force units. By linking the sensor data picture collected from aircraft, ships, ground stations and space platforms to a single display, the US Navy intends both to integrate the efforts of its combat units to greatly increase their effectiveness and also to improve its contribution to joint task force-type operations. A central feature of Network-centric Warfare is the use of data from Navy Combat Systems to direct stand-off precision strikes by both US Navy and Air Force manned and unmanned combat aircraft.

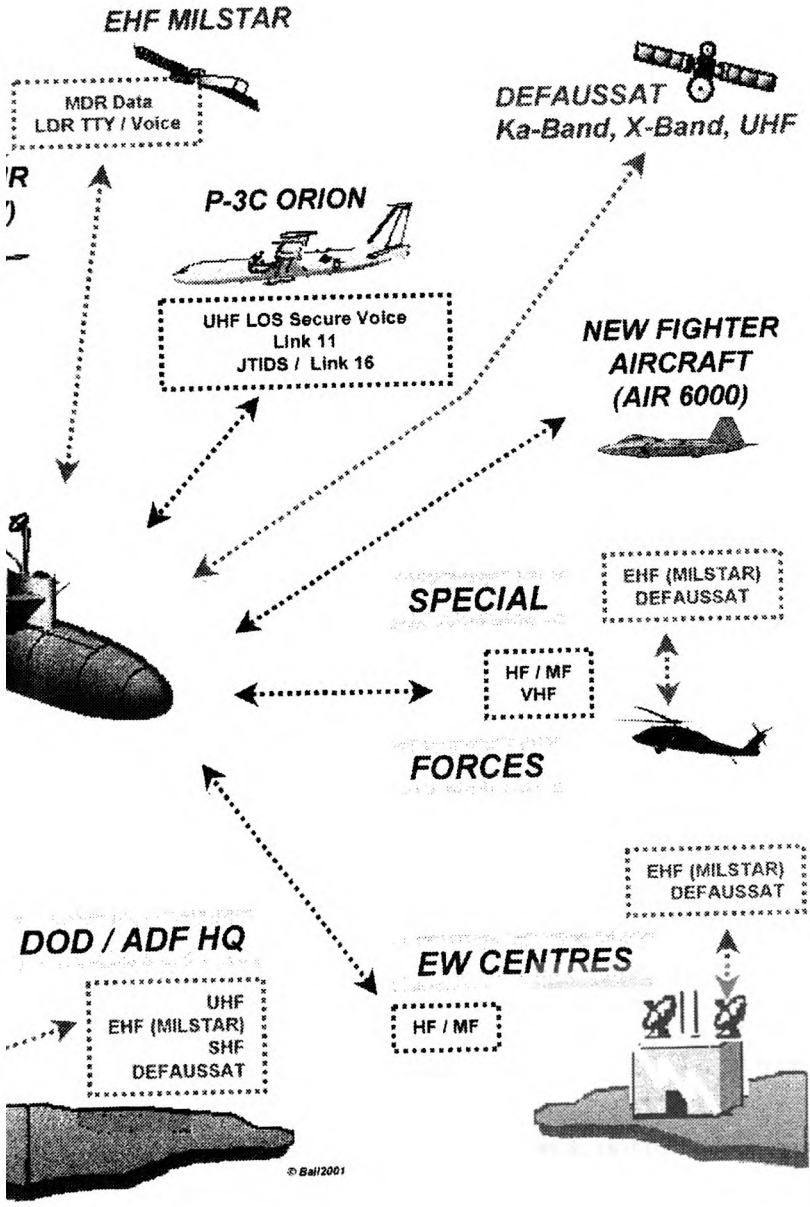
In peacetime, the Collins-class submarines will be employed primarily in reconnaissance and surveillance operations, providing information for national/strategic, ADF HQ, Fleet and tactical (all-Service) purposes.

Electronic intelligence (ELINT) collected throughout the region will be transmitted to the various ADF electronic warfare (EW) units and facilities, where it will be used not only to maintain current electronic order of battle (EOB) tables, but also to develop and refine equipment and software solutions for ADF EW operations.

The Collins-class submarines will eventually be equipped with a long-range land-attack weapon (such as Tomahawk missiles) to maintain the ADF's strike capability. Other strike elements, and most especially the strike component of AIR 6000, will also be served by Combat Systems aboard the submarines.



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In addition to supporting strike missions, the Combat System and associated communications/data connections must also be capable of supporting Special Forces operations - including operations designed to disable an adversary's information infrastructure.

### **The IT revolution**

The ongoing global telecommunications revolution is driving both military and civilian information transfer systems toward a design of open architecture, multicast resource, shared and integrated networks. Under the Copernicus concept, for example, the US Navy is providing seamless, transparent, secure communications between its submarine fleet and the entire global grid.

For the submarines to be interoperable with joint and coalition systems, they must be able to communicate within the same communications environment. Although the existing submarine communications systems are robust and reliable, they are limited to low data rates and feature "stove-piped", closed system architectures which are not compatible with the emerging technologies, and are costly to maintain and upgrade. Common open-systems architecture (OSA) hardware and software used by other forces should be used whenever feasible to take advantage of advances in commercial technology.

### **A sensor-to-shooter architecture**

The Collins-class Combat System must be considered as an integral and major component of an ADF-wide sensor-to-shooter architecture.

Within a few years, fixed and mobile Combat Information Systems and associated communications/data links will provide the shooter the same information previously available only to decision-makers in command centres. Conceptually, platforms will be linked by moving information around the information spectrum. The information spectrum can be conceived as consisting of three integrated grids:

#### *Surveillance grid*

This consists of a surveillance capabilities grid blanketing the entire battle space or area of operations (AO) instead of a series of single sensors. It consists of national, theatre and platform sensors that the war-fighter can access directly through various high command and tactical data information exchange systems.

#### *Communications grid*

This is an overlaying wide area network (WAN) of pathways that uses multiplexing and digital technology to move data and information

into and around the battlespace, throughout the command structure as well as among operators and analysts.

### *Tactical grid*

This is the network of tactical communications links that ties together all units of a force regardless of the platform or component. This grid connects the units' Combat Systems to provide fire-control grade information across the area of operations to the shooters. The tactical grid is also tied to higher echelon command centres and digital information exchange networks.

It should be a widely-distributed, user-driven infrastructure composed of the information assets owned by all the military Services into which the war-fighter can gain access from any location, for all required information.

The Sensor-to-Shooter architecture focuses on the process of putting a weapon on target. This includes surveillance and reconnaissance, acquisition and localisation, combat identification, targeting, engagement and guidance, and battle damage assessment. Historically, systems were developed to engage a specific threat with little regard for the inter-relationship with other systems or supporting infrastructure. "Stove-pipe" systems made it difficult for platforms to share information in a timely manner causing inefficiencies, especially in joint and allied operations. The sensor-to-shooter construct integrates all systems in the weapons employment process.

### **Communications requirements**

The new roles and missions to be performed by the submarine force will require greater information throughput than is presently available within existing submarine communication shore and shipboard systems. The new communication suites must support strategic communications including multiple pathways capable of performing command and control functional requirements. They must also permit seamless inter-operability and access to the common tactical picture found within the strategic, theatre and tactical Maritime Information Systems, reception of large data file transfers for land-attack and anti-ship strike planning, and reception and transmission of video, voice, facsimile, and imagery while operating with combined and joint forces in the littoral regions.

Satellites will convey most of the submarines' communications and information/data exchanges. The ADF already makes extensive use of the US Defense Satellite Communications System (DSCS) SHF satellites and the US Navy's Fleet Satellite (FLTSAT) UHF satellites. An Australian defence communications satellite (DEFAUSSAT) program will provide UHF (220-400 MHz), X-Band (8/7GHz) and Ka-Band (30/20 GHz) services, including the provision of both broadcast and spot-beam

coverages. The ADF will also have access to the US MILSTAR EHF (44/20 GHz) satellites.

### **The high data rate (HDR) satellite communications (SATCOM) requirement**

Connecting the Combat Systems in the Collins-class submarines to the ADF's Information Warfare architecture requires the installation of a high data rate (HDR) satellite communications (SATCOM) system able to provide high capacity communications capability in both the SHF and EHF bands. Using selected HDR equipment and appropriate antenna configuration, the submarines should be able to transmit and receive voice, data, video and imagery in multiple frequency bands using one HDR SHF/EHF multiband antenna group.

To support joint task force operations, intelligence collection, strike missions and Special Forces activities requires continually escalating throughput capabilities - as much as 512 kilobits per second (kbps) to properly service current requirements, 1,544 megabits per second (mbps) by about 2006, and perhaps 6 mbps by about 2010.

### **Potential growth capacity**

Any Combat Information System acquired for major elements of the ADF must have inherent and extensive growth potential.

In the case of the Collins-class submarines, the Combat System and associated communications/data links must be able to readily interface, in terms of connectivity and data storage and processing capabilities, with very high data rate SATCOM systems.

The Combat System itself should have the ability to handle double the number of network ports and an order of magnitude increase in processing capacity (with respect to both the multi-function control consoles and the system supervisory units). Fibre optic cables linking the Combat System with the sensor interfaces, the operating consoles, the weapons engagement and electronic counter-measures (ECM) sub-systems, and the external communications/data exchange antennas, should all be able to handle the projected data rates.

### **The US connection**

In most cases, only the US can provide the major systems (in any "system of systems") which fully exploit the RMA - that combination of dominant battlespace knowledge and long-range precision strike capabilities which allows military operations to be conducted extremely effectively at minimal risk.

Only the US maintains global SIGINT and imagery capabilities. The US remains the leader in most IT fields and is quite undisputed in the area of large-scale integration of the most advanced IT with precision, long-range weapons systems. The recent White Paper, *Defence 2000*, states (p. 35): "The kind of ADF that we need is not achievable without the technology access provided by the US."

Exploitation of the RMA over the next couple of decades will involve a closer and stronger US-Australia alliance. As the Government stated in *Australia's Strategic Policy* in 1997 (p. 18), the US connection "will become more important in future as we become even more dependent on exploiting technology - especially information technology - to maximise our capabilities".

The US connection provides Australia with a unique opportunity to maintain our knowledge edge. The Moore-Cohen agreement on technology access in August 2000 codifies this opportunity with respect to the Collins-class submarines. Acquisition of a US-designed Combat System would permit easy integration into the US RMA league.

On the other hand, acquisition of a non-US system could raise concerns in the US about the interface with sensitive US technologies, including the sensor systems and the satellite communications/data exchange systems. This could limit Australian access to the most advanced US technologies in the sub-systems connected to the Combat System, and in the longer-term and broader context seriously degrade the potential of Australia's Information Warfare architecture overall.

### Conclusions

Australia requires a Combat System for our Collins-class submarines that not only offers the promise of maximising the combat effectiveness of the submarines themselves, making them truly the best conventional submarines in the world; it should also be a foundation stone in the ADF's emerging Information Warfare or Network-centric Warfare architecture.

Maintenance of a technological edge often involves higher risks. Because of past problems with the Collins project, there is a temptation to avoid risk and procure only proven technology. Proven systems are undoubtedly safer, but no currently available submarine Combat System addresses the ADF's future Information Warfare environment.

Imaginatively approached, and guided by a vision of Australia's future Information Warfare architecture, the Combat System for the Collins-class submarines could become a model for further related acquisitions, putting in place an Information Warfare architecture which will secure the defence of Australia for the next generation.

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The aim of the Strategic and Defence Studies Centre, which is located in the Research School of Pacific and Asian Studies in the Australian National University, is to advance the study of strategic problems, especially those relating to the general region of Asia and the Pacific. The centre gives particular attention to Australia's strategic neighbourhood of Southeast Asia and the Southwest Pacific. Participation in the centre's activities is not limited to members of the university, but includes other interested professional, diplomatic and parliamentary groups. Research includes military, political, economic, scientific and technological aspects of strategic developments. Strategy, for the purpose of the centre, is defined in the broadest sense of embracing not only the control and application of military force, but also the peaceful settlement of disputes that could cause violence.

This is the leading academic body in Australia specialising in these studies. Centre members give frequent lectures and seminars for other departments within the ANU and other universities and Australian service training institutions are heavily dependent upon SDSC assistance with the strategic studies sections of their courses. Members of the centre provide advice and training courses in strategic affairs to the Australian Department of Defence and Department of Foreign Affairs and Trade. Regular seminars and conferences on topics of current importance to the centre's research are held.

Since its inception in 1966, the centre has supported a number of visiting and research fellows, who have undertaken a wide variety of investigations. Recently the emphasis of the centre's work has been on problems of security and confidence-building in Australia's neighbourhood; the defence of Australia; arms proliferation and arms control; policy advice to the higher levels of the Australian Defence Department; and the strategic implications of developments in Southeast Asia, the Indian Ocean and the Southwest Pacific.

The centre maintains a comprehensive collection of reference materials on strategic issues. Its publications program, which includes the Canberra Papers on Strategy and Defence and SDSC Working Papers, produces up to two dozen publications a year on strategic and defence issues.



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