### PROTECTED: Sensitive

### **Ballistic Missile Defence**

Last Updated: 31 July 2017

### What are ballistic missiles?

Ballistic missiles are distinct from other types of missiles because they can travel beyond the earth's atmosphere to reach their target, and can be used to deliver nuclear warheads. Ballistic missiles are powered by rockets on the way up (boost phase), travel through space (midcourse phase) and then follow a freefalling trajectory towards their target once they have re-entered the earth's atmosphere (terminal phase). The launch sites can include land, silos, trucks, trains, submarines, ships, and aeroplanes. Missiles are also categorised by range:

- Short-range ballistic missiles (range of less than 1,000km)
- Medium-range ballistic missiles (range of 1,000 3,000km)
- Intermediate-range ballistic missiles (IRBMs) (range of 3,000 5,500km)
- Inter-continental ballistic missiles (ICBMs) (range of more than 5,500km)

### What is ballistic missile defence?

Ballistic missile defence aims to counter ballistic missile attacks and discourage states from acquiring ballistic missiles. A ballistic missile defence system is one element of a broader, integrated air and missile defence capability, which includes protection from the air, rocket, artillery, mortar and other missiles (such as cruise and strike missile) threats.

These systems can incorporate intelligence gathering, early warning systems to detect launches, sensors to detect and track missiles, capability to intercept the warheads in flight, and battle-management systems to keep track of potential targets, available interceptors and debris.<sup>1</sup> However, it can be very difficult for these systems to distinguish between the missile, the booster, the rocket and potential decoys during flight.

Australia's Hobart Class Destroyers will be equipped with a standard missile (SM-2) and the s 33(a)(i)

 s 33(a)(i)
 which are used as area air and anti-ship missile defence systems.

 The s3(a)(i)
 capability identified in the 2016 Defence White Paper will provide an extended range of air

 defence,
 s 33(a)(i), s 47C
 s 33(a)(iii)

 s 33(a)(iii)
 s 33(a)(iii)

 s 33(a)(iii)
 s 33(a)(iii)

 s 33(a)(iii)
 s 33(a)(iii)

s 33(a)(i)

### s 33(a)(i)

### Australian approach to ballistic missile defence

Ballistic missile defence systems, such as those in use by the US,	s 33(a)(i), s 33(a)(iii)	
s 33(a)(i), s 33(a)(iii)		
s 33(a)(i), s 33(a)(iii)		
s 33(a)(i), s 33(a)(iii)	an	d

will form the basis of future decisions to be made about our integrated air and missile defence force development and acquisition.

Australia's security is underpinned by the ANZUS Treaty, US extended nuclear and conventional deterrence, and access to advanced US technology and information. Only the nuclear capabilities of the US can offer effective deterrence against the possibility of nuclear threats against Australia. s 33(a)(iii) s 33(a)(iii)

<sup>&</sup>lt;sup>1</sup>Davies, A & Lyon, R 2014, 'Ballistic missile defence: how soon, how significant and what should Australia's policy be?', *ASPI Strategic Insights,* available from <u>https://www.aspi.org.au/publications/ballistic-missile-defence-how-soon,-how-significant,-and-what-should-australias-policy-be/SI71\_BMD.pdf</u>



Australia doesn't have a stand-alone ballistic missile defence system. Defence monitors the ballistic missile threat to Australia, and maintains a program of ballistic missile defence related activities. The 2016 Defence White Paper committed to develop capabilities to protect our forces when they are deployed across large geographic areas, particularly in air and missile defence.

Instead, we work closely with the US to counter this threat through s 33(a)(iii). We also support international efforts to prevent the proliferation of technology that can be used to create these systems; we are a Proliferation Security Initiative partner, a subscribing state to the Hague Code of Conduct, and a participant in the Missile Technology Control Regime.

### **Policy Implications**

Following North Korea's recent successful test of a ballistic missile, the Prime Minister has publically stated that we will bolster our missile Defence systems. The Government has already publically committed to upgrade the ADF's existing air defence surveillance system and to acquire new ground based radars in the 2016 Defence White Paper. s 33(a)(i)

Offensive missile technology such as anti-ballistic missile defence countermeasures continue to outpace defensive measures. In addition, an increase in numbers of missiles remains a challenge for current and future ballistic missile defence, requiring **ongoing analysis of emerging threats.** 

s 47C	
s 47C	
s 47C	
s 47C	

### What does the United States use?

The US uses a sophisticated ballistic missile defence system, which includes ground and sea based radars for detecting and tracking targets to counter all types of ballistic missiles – short, medium, intermediate and long range. As the system targets multiple types of missiles, the missile defence system is integrated and provides a layered defensive system to destroy missiles before they can reach their targets by using:

- networked sensors and ground and sea based radars for target and detection tracking;
- ground and sea based interceptor missiles that destroy the ballistic missile; and

s 33(a)(i)

• a command, control, battle management and communications network that provides operational commanders with the links between sensors and interceptor missiles that they require.

The **Terminal High Altitude Area Defense** (THAAD) is a component of this defensive system. It is globally transportable via the air, land and sea, and can target missiles inside or outside the earth's atmosphere (in their final or terminal phases). It is designed to provide protection for relatively small areas, and primarily targets short and intermediate range missiles.

The **Aegis ballistic missile defence system** is a naval component of Defence, and is mounted on cruisers and destroyers to target threats. Australia's Hobart Class Air Warfare Destroyers are equipped with this system, and can work with other elements of ballistic missile defence in a task-group to target missiles. **S** 33(a)(iii)

	s 33(a)(iii)
	s 33(a)(iii)
s 33(a)(iii)	

The only system that is available to protect against longer range intercontinental ballistic missiles is a system of **ground based defences**. This is much more complex than the THAAD and Aegis systems, and would require commensurate investment in infrastructure and training to operate effectively. There are presently no plans within the 2016 Defence White Paper to acquire such a comprehensive land based ballistic missile defence capability. However, the White Paper committed to upgrade existing air defence surveillance systems and to acquire new ground based radar systems.



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### Areas working together on this brief

National Security Division (Strategic Policy and Shipbuilding & Defence Capability Teams), input from Department of Defence.



PDR: MA17-003076

### **Email Advice**

Request from PM&C: Information on how the s 33(a)(i)
s 33(a)(i) •
Response:
At initial operational capability for the Hobart Class Destroyer (planned for December 2018 with HMAS <i>Hobart</i> ), the class will be fitted with the Standard Missile-2 (SM-2) and the s 33(a)(i)
s 33(a)(i)
s 33(a)(i)
The SM-6 capability was first identified as a future capability for the Hobart Class Destroyer in
to provide to provide
extended range air defence in support of the Joint Force. s 33(a)(i)
s 33(a)(i)
s 33(a)(i), s 33(a)(iii)
s 33(a)(iii)
s 33(a)(iii)
s 33(a)(i)
s 33(a)(i)
s 33(a)(iii)
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s 33(a)(iii)

Drafted By:	CDRE David Scott	Tel:	s 22(1)(b)(	(ii)	Date:	24 Jul 17
<b>Cleared By:</b>	AVM M.E.G Hupfe	ld A/VCI	OF Tel:	s 22(1)(b)(ii)	Date:	25 Jul 17

#### FOR OFFICIAL USE OINLY

#### **Ballistic Missile Defence (BMD) and THAAD**

#### What are Ballistic Missiles?

Ballistic missiles are distinct from other types of missiles because they can travel beyond the earth's atmosphere to reach their target. Ballistic missiles are powered by rockets on the way up (boost phase), travel through space (midcourse phase) and then follow a freefalling trajectory towards their target once they have re-entered the earth's atmosphere (terminal phase). Ballistic missiles can be used to deliver nuclear warheads.



#### What is the US Ballistic Missile Defence System (BMDS)

The US Missile Defence Agency develops, tests and fields a coordinated system to defend the US, its deployed forces, allies and friends against ballistic missiles in all phases of flight.

US missile defence technology is designed to counter ballistic missiles of all ranges—short, medium, intermediate and long. Since ballistic missiles have different ranges, speeds, size and performance characteristics, the BDMS is an integrated, "layered" architecture that provides multiple opportunities to destroy missiles and their warheads before they can reach their targets. The system's architecture includes:

- networked sensors (including space-based) and ground- and sea-based radars for target detection and tracking;
- ground- and sea-based interceptor missiles for destroying a ballistic missile using either the force of a direct collision, called "hit-to-kill" technology, or an explosive blast fragmentation warhead; and
- a command, control, battle management, and communications network providing the operational commanders with the needed links between the sensors and interceptor missiles.



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### What is the Terminal High Altitude Area Defence (THAAD) System?

The THAAD element of the BMDS provides is a globally transportable, rapidly deployable capability to intercept and destroy ballistic missiles inside or outside the atmosphere during their final, or terminal, phase of flight. The system is globally transportable via air, land and sea.

### Overview

- Land-based element capable of shooting down a ballistic missile both inside and just outside the atmosphere.
- Highly effective against the asymmetric ballistic missile threats.
- Uses hit-to-kill technology whereby kinetic energy destroys the incoming warhead.
- The high-altitude intercept mitigates effects of enemy weapons of mass destruction before they reach the ground.

### **THAAD** Components

- <u>Launcher</u>: Truck-mounted, highly-mobile, able to be stored; interceptors can be fired and rapidly reloaded.
- <u>Interceptors:</u> Eight per launcher.
- <u>Radar</u>: Army Navy/Transportable Radar Surveillance (AN/TPY-2) Largest air-transportable xband radar in the world searches, tracks, and discriminates objects and provides updated tracking data to the interceptor.
- <u>Fire Control</u>: Communication and data-management backbone; links THAAD components together; links THAAD to external command and control nodes and to the entire BMDS; plans and executes intercept solutions.



### FULL COVERAGE OF ADM'S ESSINGTON LEWIS GALA DINNER AWARDS AND D+I CONFERENCE



### **ADM EXCLUSIVE**



ROM THE lan Bell VP and GM CAE Middle East and Asia Pacific Defence

JULY 2017 VOL.25 NO.7

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### Weapons

**Soldier Combat Ensemble evolution** F-35 weapons at a glance **BMD for RAN** 

## Surveillance in the Land Domain

**SATCOMS: behind the buttons** The role of UAS in land ops • P-8s on land

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- Increased crew situational awareness for enhanced combat decision superiority.
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- Future proofed for LAND 400 and beyond.



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ON THE COVER: RAAF Communications Electronics Technicians, Leading Aircraftman Nathan Vassallo (left) and Corporal Mark Schultz, from No 1 Combat Communications Squadron, set up the Hawkeye Satellite Equipment.

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# 2/

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## **S**

### Last Word Judy Hinz | Publisher

I would like to congratulate the winners of the Essington Lewis Trophies, which were presented

6

in Canberra at the D+I gala dinner. For over 20 years, I've been a fierce advocate of our local defence industry and I'm pleased that ADM is able to partner with Defence to recognise Defence/Industry project teams in this way. You'll find a report and photo spread of the awards on P18. I encourage to think about entering these prestigious awards in 2018.



### From the Source

lan Bell - VP and GM CAE Middle East, Asia

Pacific Defence & Security

"What simulationbased training helps do is put the old head on young shoulders." P58



Highlights from The Essington Lewis Awards and D+I conference. P18

## What does local content look like?



### **KATHERINE ZIESING | CANBERRA**

**THE** increased focus from government on Australian Industry Content (AIC) and supporting local companies is a welcome change for many. No longer is the overseas off the shelf solution the gold standard for acquisition and sustainment solutions. But how local companies engage with Defence and with one another still has much room to improve.

As seen on P22 of this month's edition, where is the value in the new framework of road shows and engagement programs? Particularly for SMEs, who do not have the deeper pockets and global reach back of the local primes. There is an increased emphasis on getting local companies to be part of the primes global supply chains in an effort to reach the wider international market.

Defence launched the Global Supply Chain (GSC) program in 2009 as an enhancement to the AIC program. It is designed to assist entry by Australian defence industry into the global supply chains of multinational primes. Since that time, the program has grown to include Raytheon, Boeing, Lockheed Martin, Northrop Grumman, Rheinmetall, BAE and Thales and has done a reported \$830 million in business.

As seen on P13 this month, both BAE Systems and Northrop Grumman have renewed their GSC deeds with the Commonwealth. All seven primes involved in the program have internal offices to coordinate their efforts with varying degrees of success if anecdotes from SMEs are any indication.

BAE Systems Australia CEO Glynn Phillips confirmed the company's commitment to the Australian Small Business Supplier Payment Code launched by the Business Council of Australia. This is a voluntary, industry-led initiative that recognises the importance of prompt and on-time payment for suppliers and the need for a set of best practice standards.

"Prompt and on-time of payment is particularly important for small business suppliers, as it means better cash flow and working capital which strengthens their viability and ability to grow and create jobs," he said. "It is in the longterm interest of everyone, including purchasing businesses and governments, to have a viable and productive small business supplier base." It is these practical steps that provide true support for the GSC program. Many primes also help SMEs in their journey towards various ISO standards, a key component of global readiness. Lockheed Martin, through efforts on the F-35 in particular, has seen rapid growth in the manufacturing capability of many Australian SMEs, which has seen them become globally competitive. This jump in capability has also helped these companies reach into adjacent markets. One only has to look at the likes of Quickstep to see their growth in aviation but also vehicles thanks to their composite work.

It is this high value-added work that will truly bring an economic multiplier effect to the wider Australian economy. There is only so long we can dig things out of the ground, be it food or resources, before the international high technology economy overtakes us. A greater focus on STEM through the education and economic pipeline underpins this imperative. All nations are in the race to grow their own talent in this regard. Investing in this pipeline, at all levels, will be key as Australia looks to grow its shipbuilding and sustainment capability.

Local content doesn't always have to mean a tradesperson in hi-vis gear bending metal. While it is the most visible part of the Australian Defence industry (and one favoured by politicians who also get to don said hi vis gear for a photo), it is not the be all and end all of local capability. The wide array of groundbreaking technologies that we have in country is astounding. It's piecing them together through innovative collaboration that will be essential in unlocking the potential.

Local content is Australian workers doing work for Defence, regardless of the logos on the shirts they wear. That's your taxpayer base. That's your voter base. That's your community. And that's the capability you want to be able to call on when forces need to deploy, complete with an unfair advantage. To be clear; we want the ADF to have an unfair advantage when they go into any fight.

Note: keen readers may also like to note that as of late June, the IIP website will be released in 'due course', according to a Defence spokesperson. Sigh.



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### P 8 PROVEN OVER LAND OVER SEA OVERALL

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### Austal and ASC to partner for Frigate build



**IN** early June, Austal and ASC Shipbuilding announced a teaming agreement for the build of the \$35 billion Sea 5000 Future Frigates Program.

Austal CEO David Singleton said the agreement offers a compelling, low risk, Australian shipbuilding solution for the Austal's HSSV 72 under construction. The company is no stranger to large-scale ship builds.

three shortlisted international designers; BAE, Fincantieri and Navantia.

"ASC Shipbuilding and Austal represent the success and excellence in Australia's sovereign naval shipbuilding capability, a capability established through years of investment and experience in developing an Australian skilled workforce," he said. "The agreement also offers the Australian Government an unrivalled shipbuilding partnership that has the ability to expand the existing indigenous capability."

The partnership will bring Austal's record in aluminium shipbuilding, exports and operational efficiency to combine with ASC Shipbuilding's expertise in steel warship manufacturing.

"We are exceptionally proud of Austal's export heritage, a record that has seen us sell more than 255 ships to 100 customers in 44 countries, including the United States," Singleton added. "The opportunity to work with ASC Shipbuilding to bring Australia's shipbuilding industry into an export competitive position is a game changing announcement and something we are both very excited about."

### **Kinexus releases second Defence Industry Insights**

### **KATHERINE ZIESING | CANBERRA**

**SPECIALIST** recruiting firm Kinexus has released their Defence Industry Insights paper, based on a recent survey of trends in the sector.

The report touches on a number of facets connected to Defence Industry employment such as median wages, growth hotspots, desired job titles and programs to watch.

The report notes that in the last 12 months, all states have seen an upturn in vacancy advertising, up 74.5 per cent in a year, except for SA and Queensland. The ACT is experiencing the strongest growth, mainly due to the flow on effects of the First Principles Review.

Those chasing a healthy pay packet would be well placed to focus on procurement and purchasing manager positions, which have both seen wage growth of 20 per cent nationwide in the last 12 months. The report also provides a state-by-state breakdown of average remuneration packages for a number of common Defence Industry roles.

There are three factors that will influence demand for skills (see graphic for skills in demand) in Defence Industry over the short and medium term:

- Project Environment: Numerous acquisition and upgrade projects scheduled to commence
- First Principals Review: Changing role of defence, and increased scope for Defence Industry
- Technology: New technologies and capabilities require new skills

The report also notes "tertiary institutions nationwide are looking to boost their capabilities in the autonomous systems domain, and are hoping to benefit from state and Federal Government financial assistance packages".



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See more at www.stategrowth.tas.gov.au/defence



Department of State Growth

## Currawong close to delivering world beating capability

### **PATRICK DURRANT | BRISBANE**

IN late May, Boeing Defence Australia conducted a demonstration of the digital battlespace network communications solution being delivered under Project Land 2072 Phase 2B at Damascus Barracks in Meeandah, Brisbane.

Attendees, including ADM, were updated on the project (informally known as Currawong) and given a tour of the array of communications equipment on display and set up for the purpose of the ninth site test since contract signature in September 2015.

Boeing project director Lee Davis confirmed that the design phase had been completed, with formal testing underway and a field test for Army being planned for August this year. The hardware baseline is now in low rate initial production and the release 1 software is complete and in formal qualification testing.

"We have our hardware and software finalised, we've been doing a lot of dry run activity to exercise the system both in the lab and out in the field," Davis said.

'The bearer systems are either in qualification testing or in formal acceptance and we've started transition for service introduction - there's been a lot of engagement with 7CSR, 1SIG and 1CCS, the first three units to receive the system later this year."

Currawong is performing well against schedule, though initial materiel release is now expected slightly later than originally anticipated (third quarter 2017) in the first quarter of 2018, with initial operating capability in mid-2018 and final operational capability in 2020.

Boeing's local development of key components of the system, such as the Tactical Services Router, has resulted in technology that is world beating, according to CASG Director-General Communications Systems Myra Sefton, also in attendance at the demonstration.

With agility a key requirement, the Boeing team had to look for unique methods to reduce the weight and the footprint of the TSR. This essentially required eliminating air conditioning.

"It has a heat sink design allowing passive cooling by passing airflow," Davis said.



"We've tested it successfully in up to 70 degrees of ambient temperature, and the processor is also generating heat so it's roughly 105 degrees inside the box."

Davis explained his team was able to leverage off the experience of Boeing's Satellite Manufacturing Division in El Segundo in California.

"You can imagine the space environment is similarly harsh, while also demanding weight and space efficiency, so they helped to hone our design to get the TSR as small and compact as possible."

ADM spoke with Major General (Retd) Michael Krause, who served as ISAF Deputy Chief of Staff in Afghanistan from 2011 to 2012, and now works part-time for Boeing as the strategic advisor (Land).

"I've been Lee's greatest defender and harshest critic to make sure that he gets the stuff I wanted," he said. "When I was a brigade commander, we had Parrakeet, so to see this is magnificent - I don't think we fully know yet how this will revolutionise the way we do headquarters.

"For example, what we see today is in tents and static, but as soon as you go to mobile and protected it brings along all sorts of connotations."

The second release of the project will deal with elements such as Headquarters-On-The-Move (HQOTM) and a Tropposcatter Communications System planned for Initial Materiel Release in 2020.

Davis explained the core 'brick' of the system, known as the Network Access Module (NAM), is planned for integration along with Wideband SATCOM into vehicles including the Bushmaster to provide the HQOTM capability; an EW variant of the Bushmaster (which has the necessary built-in power) was on display at the demonstration.

"All I know about SATCOM-on-themove is that it can track slightly faster than this thing can go cross-country," MAJGEN Krause said, pointing at the Bushmaster. "Put it this way - I don't want a driver to try and beat the sat dish unless I'm evading enemy fire!"

He's excited about the joint prospects offered by Currawong.

"The fact that Air Force is getting it gives us the first part of a joint operational network. There's also no reason why this couldn't go on an LHD, joining the joint ops room to shore. Once you have a single network rather than the disparate networks we have at the moment it brings so many efficiencies."

MAJGEN Krause added they were already thinking of applications for the RAAF's E-7A Wedgetail.

"As soon as you have commonality of training, networks and equipment it just makes so much sense."



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The Australian infrastructure, transport, utilities and resources giant is now extending its world leading practices and solutions to Defence.

Downer recently demonstrated its intent to apply its extensive capabilities to the Australian Defence sector with the submission of an Expression of Interest to become a Major Service Provider (MSP) of above the line services to Defence's Capability Acquisition and Sustainment Group (CASG).

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- Systematiq; and
- EBA Solutions.

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Importantly for Defence, we use our proven workforce mobilisation techniques to grow the capability and capacity of Australia's Defence industry workforce. This ability to develop and manage teams of skilled professionals is critical to achieving Defence's Integrated Investment Plan.





### Senate Estimates probes LHD pod issues

### PATRICK DURRANT | SYDNEY

**DURING** a Senate Foreign Affairs, Defence, Trade and Legislation Committee (Senate Estimates) hearing on 29th May, top Navy and Defence personnel were subjected to sustained questioning on the issues affecting the two Canberra class LHDs which are currently being investigated at Fleet Base East in Sydney.

Chief of Navy Vice Admiral Tim Barrett, in answer to questions from Labor Senator Kim Carr, confirmed that migration of oils across seals in the azimuth propulsion pod systems had been observed and investigations were continuing to confirm whether this was a design problem or rather one due to excessive wear and tear.

In HMAS *Adelaide*, currently in drydock, there was also the discovery of tiny metal particulates in the pod lube oil which, according to VADM Barrett, may be a result of excessive loads being placed upon bearings.

The two LHDs have been conducting an ambitious program of trials and evaluations since they were commissioned in 2015 and 2016. But VADM Barrett said the Navy had been careful to operate the ships within the specifications outlined by the manufacturers.

"We've not operated the ships beyond the sustainment for which we've been given funding for," he said.

VADM Barrett confirmed the total days spent at sea by both vessels in 2016 numbered 118 with *Adelaide* and *Canberra* having conducted 42 and 19 days respectively so far in 2017.

Senator Carr asked whether similar issues had been observed in pods in service elsewhere in the world, including in the merchant marine. Deputy Secretary CASG Kim Gillis replied that in the early introduction of similar systems, which were in regular use by cruise liners and other large vessels, there had been issues with seals but the particular Siemens pods in use by both the Australian and Spanish navies were quite unique.

In response to further questioning from Senator Carr, Gillis confirmed the Spanish Armada's *Juan Carlos I* did have an issue with its pods but they were unrelated to those believed to be affecting the Australian vessels.

Original equipment manufacturer Siemens had sent its top engineers and designers of the system to Sydney to inspect the problem on the HMAS *Adelaide*, Gillis said. "It is a concern to them as much as it is to us," he said.

VADM Barrett said Navy was in the midst of conducting a root cause analysis and it was far too early to suggest that the problems may be a result of a design flaw.

HMAS *Canberra* had conducted further trials at sea on 17th and 18th May. Oil samples were taken and tested but the results have proven there was no evidence of oil migration across seals; nor was there an indication of excessive loads being placed upon bearings.

As *ADM* went to print, Defence confirmed HMAS *Canberra* would participate in the multinational amphibious exercise in off Queensland at the end of June – Exercise Talisman Sabre – albeit under limited operational restrictions which will be in force until her planned docking in the third quarter of the year.

At that point HMAS *Adelaide* was expected to leave the Captain Cook graving dock. She would then undergo further testing and any learnings from this would be applied to HMAS *Canberra*.

"Both ships will be back in service by the fourth quarter this year," VADM Barrett said.



With the original intent of improving the LHDs amphibious capability at Talisman Sabre now in jeopardy, VADM Barrett said that Navy would now need to consider other ways of doing that and referred to experience that had been gained by HMAS *Canberra* from the recent Rim of the Pacific (RIMPAC) exercise conducted off Hawaii last year.

Gillis confirmed that Navy was able to draw upon one complete set of spares for the propulsion pods, but further spares were required as a result of problems in the additional pod. Imports of further spares were given top priority after there had been some initial delays he said.



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### **NEWS REVIEW** INDUSTRY UPDATE

### **RfP out for SA Shipbuilding College**

**DEFENCE** has issued a Request for Proposal (RfP) for the Naval Shipbuilding College announced as a key initiative in the Naval Shipbuilding Plan, released earlier this month.

The Naval Shipbuilding Plan outlined that the naval shipbuilding workforce is expected to grow to around 5,200 workers by the mid to late-2020s, and according to Defence Industry Minister Christopher Pyne, the release of the RfP is an important step in ensuring the required workforce is equipped with the right skills at the right time to implement the Government's ambitious naval shipbuilding program.

"The initial focus will be on key entrylevel trades, and will later expand to include higher education qualifications such as naval architecture and engineering."

Headquartered at Adelaide, the college would provide opportunities for education and training providers across Australia.

"Training providers from across the

country such as the Australian Maritime College in Launceston and TAFE providers across the country are in the perfect position to benefit from this government initiative," Minister Pyne said. "[It] will be national in scope [and] will work with, rather than compete with, existing education institutions across Australia."

There would be opportunities for current workers in shipbuilding, sustainment, and supply industries and he expected the College will have to attract, train or retrain more than 1,500 students across the country over the first few years of operation.

"Developing training to facilitate career paths from entry level trades to more senior positions like foreman and middle managers will be important. The [college] will also reach out to workers in adjacent industries, including those recently made redundant in the automotive industry," he said.

On 24 March 2017 the Government announced an initial investment of \$25 mil-



lion, over the first few years, to establish the Naval Shipbuilding College.

Minister Pyne said the Naval Shipbuilding College must be industry driven to be effective and SMEs are also encouraged to participate.

"Not only will the shipbuilders selected for the various shipbuilding projects be key stakeholders, but also companies involved in sustainment and supply chain work.

"A person could be enrolled at the Naval Shipbuilding College headquartered in Adelaide, but be completing the course at a TAFE in Perth, Sydney, Melbourne, Darwin, Brisbane, Canberra, Hobart, or a regional centre such as Cairns."

The Naval Shipbuilding College will commence operations on 1 January 2018.

### AUSTALFASSMER. A POWERFUL SHIPBUILDING PARTNERSHIP. THE RIGHT CHOICE FOR AUSTRALIA'S OPVs.

### Primes renew global supply chain agreements

**BOTH** Australian subsidiaries of BAE Systems and Northrop Grumman have renewed their Global Supply Chain (GSC) agreements with the Commonwealth for an additional three years. The renewal of the GSC agreement enables them to continue working with the Commonwealth to facilitate military and commercial opportunities for Australian companies within their respective global supply chains.

"The agreement is of mutual benefit as it advances the government's objectives outlined in the 2016 Defence White Paper and Defence Industrial Policy Statement, and helps Northrop Grumman to continue efforts to strengthen our supply chain with world-leading Australian suppliers and technology," Ian Irving, CEO, Northrop Grumman Australia said.

CEO BAE Systems Australia Glynn Phillips said the company has one of the nation's largest defence supply chains and a long and successful history of working closely with Australian suppliers, to open up both local and international opportunities.

"Since its inception in 2012, our Global Access Program has recorded a number of export successes for Australian businesses including military vehicle restraint systems, ship evacuation equipment, precision components for the aerospace sector, armoured steel and various software analysis tools.

"Fifteen Australian businesses have directly benefitted from the Global Access Program by securing export contracts and over 100 companies have taken advantage of various training programs, overseas trade missions, and international networking events facilitated by the program.

Phillips confirmed the company's commitment to the Australian Small Business Supplier Payment Code launched by the Business Council of Australia. This is a voluntary, industry-led initiative that recognises the importance of prompt and on-



time payment for suppliers and the need for a set of best practice standards.

"Prompt and on-time of payment is particularly important for small business suppliers, as it means better cash flow and working capital which strengthens their viability and ability to grow and create jobs," he said.

NIGEL PITTAWAY Mei baiirne

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Image: The Chilean Navy's Piloto Pardo – one of seven OPV80 vessels in service around the world'





### Siemens and Airbus throw hat in for deployable health



**AIRBUS** and global healthcare company Siemens Healthineers have announced a teaming arrangement for JP2060 Ph3 (Deployable Health Capability) offering a system of medical facilities which can be readily deployed for both combat and humanitarian missions.

Airbus and Siemens Healthineers intend to propose the Airbus TransHospital medical care system, which is in service with defence forces around the world.

A modular system that can clip convenient ISO Standard 20x8x8 container modules together in order to assemble field medical facilities of any size, the TransHospital ISO containers can be combined in accordance with the operational requirements versatile military and desaster relief missions. These containers are provided for functions such as diagnotics, laboratory, surgical unit, ambulance station, dentist, intensive care.

Tony Fraser, Airbus Group Australia

Pacific Managing Director, said the Deployable Health Capability is a key enabler for a modern and agile defence force. It facilitates clinical health care delivery of the highest standards to support operational deployments, exercises, and humanitarian assistance and disaster relief operations.

"Experience has demonstrated how important it is to have the right medical facilities to ensure that the men and women of the ADF are provided with the best practice military health care available," Fraser said.

Under the proposal, a responsive and resilient support system will be backed by Australian industry to enable the ADF to count on this important capability whenever and wherever it is needed. In addition to military service in places like Afghanistan, Kosovo, Djibouti and Mali, the Airbus TransHospital has proven its effectiveness and reliability in international disaster relief missions. "Disaster relief is about more than a oneoff gesture of aid; it is a lasting, long-term approach to recovery," MD ANZ Siemens Healthineers Michael Shaw said.

"Drawing on our key competencies in providing a unique portfolio of healthcare innovations as well as scientific research, we strive to give as many people as possible access to high-quality medical technologies and support affected communities in their challenges to maintain or regain functionality."

The modular TransHospital system is designed to international standards and meets the most stringent hygiene regulations. It is built for, qualified against, and proven in mission profiles for both military and civil disaster relief operations.

A team comprised of Aspen Medical, Saab, Phillips and Marshall will also bid for the project. Other potential contenders are Mobilis and a team led by Leidos.

### Vigilare to be established at RAAF Base Edinburgh

**BOEING** Defence Australia is supporting the Royal Australian Air Force (RAAF) Base Edinburgh's emerging role as the national intelligence, surveillance and reconnaissance (ISR) hub, establishing a new node at the Jindalee Operational Radar Network (JORN) Coordination Centre (JCC).

No 1 Radar Surveillance Unit (1RSU) will operate a prototype Boeing-built Vigilare System node, providing additional civil and military radar surveillance to over-thehorizon surveillance capabilities already in place at the JCC.

Integrating the new Vigilare system node with established JCC surveillance capabilities will deliver operational efficiencies and cost-savings to the RAAF through more streamlined wide area surveillance and better support for joint operations. "Bringing together surveillance capabilities at Edinburgh makes a lot of sense," Arthur Mamalis, Boeing C3I Project Management Specialist said. "Operators can share intelligence immediately instead of chasing information from each other via other channels. Ultimately, it enables them to provide a more complete surveillance picture".

In supporting the additional role for 1RSU, Boeing Defence Australia has incorporated physical architecture upgrades to the Vigilare System node including small form-factor computers and virtual machine servers.

Both of the key upgrades reduce the system's physical size and power requirements, and will deliver life-cycle cost savings. EAST-ROC's Vigilare System, located at RAAF Base Williamtown, will receive the same physical architecture upgrades in early 2020. Boeing Defence Australia is also working alongside strategic suppliers, such as Daramount Technologies, to install and support the Vigilare System across Mobile Control and Reporting Centres (MCRCs) which will bring about a single software system across fixed and mobile systems to provide RAAF with enhanced sustainment options across their C2 network.

The ongoing Vigilare System upgrades are being supported from Boeing Defence Australia's newly opened CBD site in Adelaide. Twenty-five Adelaidebased Boeing Defence Australia specialist software engineers have established a surveillance and sensor capability centre at the Adelaide office to meet the needs of the national ISR hub at RAAF Base Edinburgh.

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### DEFENCE BUSINESS SIA COLUMN

# Submarine historical insights for present-day challenges

### SUBMARINE INSTITUTE OF AUSTRALIA | CANBERRA

The submarine capability of the Japanese Maritime Self-Defence Force was recalled on 1 June at a memorial service at Sydney's Garden Island.

**THE** 75th Anniversary of the audacious attack on allied shipping in Sydney Harbour on the morning of 1 June 1942 by three midget submarines of the Type A Ko-hyoteki class was recalled in the memorial service for the lives of the 21 sailors lost in the sinking of HMAS *Kuttabul* and the six midget submarine crew members of the Imperial Japanese Navy. The event was attended by the Deputy Commander of the Australian Fleet, the Japanese Consul-General and the Consuls-General of the countries whose ships were present during the attack.

Delivering the keynote address on behalf of the Submarine Institute of Australia (SIA), retired Captain Chris Skinner noted the cutting-edge technology employed by the Japanese force in its employment of catapulted aircraft from two of the fleet submarines, with the other three submarines carrying the midget boats. The parallels to today's use of unmanned aerial and underwater vehicles are uncanny.

The 50th anniversary of the modern era of Australian submarine capability is in August this year at the former HMAS *Platypus*, also in Sydney at Neutral Bay, where the Sydney Harbour Federation Trust is partnering with the submarine community in the lead-up to opening the site to the public next year.

Another focus for the SIA has been preparations for our fourth Submarine Science, Technology and Engineering Conference (SubSTEC4), to be held in Adelaide 13-16



DEFENCE

November. The responses to invitations to keynote speakers and to the call for papers have been excellent and augurs well for further engagement with academia and industry to advance the understanding of submarine matters.

The SIA has maintained an even-handed approach to the current dialogue on naval shipbuilding strategy, but has taken care to emphasise the unique aspects of submarine design and construction, lest these aspects be "lumped in" with general naval shipbuilding practice. The undersea environment is unforgiving and demands stringent attention to design and construction of all underwater structures. Naval submarines require even greater attention to minimisation of radiated signatures – especially acoustic – and resilience to underwater shock.

The SIA is actively engaged with schools in several aspects of undersea science, technology and engineering, and very much welcomed the participation of two schools in the *Kuttabul* memorial service, as well as in STEM (science, technology, engineering, mathematics) classes and "Subs in Schools" programs elsewhere.

### A SPECIAL CORRESPONDENT | CANBERRA

So we're sending additional troops to Afghanistan and already various pundits are pointing to the risk of insider attack by disaffected Afghans.

### The motives behind blue on green attacks

**SUCH** "blue on green" attacks claimed the lives of seven of 41 Australians to die in Afghanistan in three separate incidents.

The inquest into the deaths of the last three soldiers, shot dead as they played cards and board games inside a patrol base in August 2012 made various criticisms of Defence procedures and risk assessments.

The lessons would appear to have been taken on board, given the rigorous force protection measures applied to the ongoing training mission in Iraq. So-called "guardian angels" watch over activities and Australian and NZ participants wear body armour while working with Iraqi forces.

So far there have been no such attacks on our guys. It would appear Iraq and Afghanistan are very different places.

In Afghanistan from around 2007 to now, 102 documented attacks killed some 157 coalition personnel and civilian contractors. More than 500 Afghan troops have also died in 271 attacks by fellow soldiers.

Green-on-blue incidents escalated along with the surge of US and other coalition forces from 2009, peaking in 2012 then diminishing in step with the diminishing coalition presence.

But they haven't ended. In March, an Afghan special forces soldier was killed and three US soldiers wounded in an incident in Helmand Province. The Taliban have invariably claimed responsibility, but the conventional wisdom attributed such attacks less to insurgent infiltration than to a whole range of individual cultural and personal factors including responses to religious and cultural gaffes, unhappy family circumstances and perceived insults.

The ADF took that view in its explanations for attacks in 2011 and 2012. Yet there's growing scholarship that suggests otherwise.

A new study by Javid Ahmad of the Modern War Institute at West Point says insider attacks had become a preferred Taliban warfighting tactic, effectively using their modest resources against a stronger enemy. As well as wreaking significant casualties – at times in 2012, deaths to insider attack exceeded those in combat – they erode trust between coalition and Afghan forces and can corrode support for a mission by soldiers and the community – if some of our so-called friends at willing to murder us, why the heck are we in Afghanistan?

The Afghan National Army (ANA) had taken big steps towards vetting its members, initially recruited hastily and without adequate background checks. Many alleged Taliban sympathisers were given the boot. For new recruits, references will be sought from local elders.

The additional Australian troop contribution numbers just 30, bringing the total force in Afghanistan to 300. Since the end of 2013, Australia has played no role in Uruzgan Province and most of the remaining force has been based in Kabul, operating from the main coalition base adjacent to the international airport.

Just what the 30 extra personnel will be doing hasn't been spelled out. Defence Minister Marise Payne said additional advisors would "further develop the long-term capabilities of the Afghan security forces as part of our current Train, Advise and Assist mission".

It seems Defence Chief Air Chief Marshal Mark Binskin will be nutting out the fine details in discussion with NATO officials. It's likely to be in the area of enablers such as logistics. Since the combat troops withdrew, Australia's main mission in Afghanistan has been in helping to mentor trainees at the UK-led Afghan National Army Officer Academy (ANAOA).

Junior officer graduates go on to command platoons in the ongoing fight against the Taliban, so Australia is making a useful contribution. Others are embedded within the NATO headquarters while a few special forces advise NATO special operations command.

To those unfamiliar with what's now called Operation Highroad, it might appear that all 300 Aussies in Afghanistan are directly assisting the Afghans in the fight against the Taliban and now Islamic State. The reality is most aren't and are there for admin, medical, transport, communications support and of course, protective security.

As more western troops return to Afghanistan, insurgents will surely seek to escalate insider attacks. ANAOA, which sounds like a genteel establishment a bit like the UK's Sandhurst on which it was modelled, has already seen one nasty insider attack.

In August 2014, a disgruntled Afghan ambushed a group of VIP visitors, shooting dead Major General Harold Greene, the most senior US officer to die in a combat zone since Vietnam.





## **Essington Lewis Awards:** Recognising outstanding Defence and

### **KATHERINE ZIESING | CANBERRA**

The Defence and Industry Gala Awards were held in Canberra to recognise to recognise the excellent work Defence + Industry perform in the delivery of capability to the war fighter.

**AFTER** missing last year thanks to the transition from the old Defence Materiel Organisation (DMO) into Capability Acquisition and Sustainment Group (CASG), *ADM* has once again partnership with the Department of Defence to recognise the strong working relationship between Defence and Industry in supporting the ADF and the warfighter on the ground, at sea and in the air.

The Essington Lewis Awards are designed to recognise excellence in the degree to which industry and CASG have worked together in a spirit of collaboration to overcome challenges or problems – ensuring that the ADF has or will have the materiel it needs, when it needs it, and at a cost that represents value for money. There is an emphasis from the judges on acknowledging those programs who have had troubles and overcome them.

The field this year saw 21 entrants across the five categories, with the finalists narrowed down to nine companies. Each category has a winner (and a highly commended where the judges were hard pressed to pick between the two finalists) from which the two Essington Lewis trophies are selected; one for work with a Prime and one with an SME.

Though the event is barely over, preparation work has already begun on the awards for year which will be expanded to cover project work from other Defence agencies such as CIO Group, DST Group and Defence Infrastructure and Estate Group.

Details of the winners and their citations are as follows:

### Major Acquisition over \$50 million Highly commended

Land 121 Phase 3A – Lightweight / Light Capability: Mercedes-Benz Australia/Pacific and Land 121 Phase 3A Program office This program was Highly Commended by the judging panel in recognition of the great working relationship between the program office, prime contractor and sub contractors where appropriate. The team delivered the Land Rover replacement vehicles and trailers on time and on budget to all three services along with the necessary support measures.

### Winner

Joint Project 3027 – JDAM Enhancements: Aerospace Explosive Ordnance – Acquisition Management Unit and Ferra Engineering



### Industry collaboration

This program, which began life as a Capability Technology Demonstrator, is an Australian innovation success story with work being done by a number of parties. Working closely for years, Boeing Defence Australia, Ferra Engineering, DST Group and the Commonwealth have delivered a world beating technology and an industrial solution to the RAAF that has enormous export opportunities. Despite the developmental nature of the program it was delivered on time and on budget.

### Minor acquisition under \$50 million Finalist

*C-130J Link 16 Project team: C-130J LMU Capability Enhancement Project and Airbus* The scope of this project was to integrate the Link 16 Capability onto the C-130J aircraft, as part of the wider Plan Jericho program of work. The Airbus / CASG / RAAF team was able to successfully complete the design, integration and testing of the capability onto the C-130J as per the agreed schedule. This provided the ADF with a first of type beyond line of sight Link 16 capability, enabling the re-transmittal of local Link 16 information for command and control. The program is now being rolled out across the C-130J fleet.

#### Winner

Air Force Minor 0972 – Deployable Catering Capability: RAAF Combat Support Group and Global Defence Solutions

Part of Air Force's combat capability is the ability to sustain (feed and water) forces at deployed air bases. Under this Minor program, the program office was able to get a program of work back on track after a long delay in the initial stages of the project. Working with contractors in Australia, the USA and Denmark, the capability was declared operational earlier this year with its first showing at the Avalon Air show. The judges noted that just because elements are Military Off the Shelf (MOTS) does not mean that the entire solution is MOTS and congratulates the team on their success.

### CLOCKWISE FROM

**OPPOSITE PAGE: The** Joint Project 3027 – JDAM **Enhancements: Aerospace Explosive Ordnance tem on** stage, the FFG Enterprise of FFG SPO and Thales and **BAE** Systems win their category, The Future **Through Collaboration** (TFTC) mentoring program accept their certificate, the team from Air Force Minor 0972 – Deployable **Catering Capability: RAAF Combat Support Group and Global Defence Solutions** accept their award, **Defence Industry Minister Christopher Pyne addresses** the crowd, the JDAM team from Defence and Ferra with their Essington Lewis trophy, the Deployable catering program team accept their certificate, and The Future **Through Collaboration team** with hosts Vince Sorrenti and Erin Molan.



### DEFENCE BUSINESS



### Major Sustainment over \$20 million annually Highly commended

Air Combat & Electronic Attack Enterprise: Air Combat Electronic Attack Systems Program Office with Jacobs, Raytheon, Boeing and GE As part of the wider First Principles Review for industry and government to work together, an enterprise view has been taken for capability generation. The Air Combat & Electronic Attack Enterprise is still in its early stages but the judges recognise that laying a solid foundational framework for future relationships is important and can achieve the benefits to be derived from improved integration and alignment of the Enterprise partners for the Growler capability and associated elements. This program is a great start towards removing silos in the Defence organisation and industry.

### Winner

### FFG Enterprise: FFG SPO and Thales and BAE Systems

This project builds on the work begun in 2014 under the Enterprise model by FFG-SPO and their industry partners of BAE Systems and Thales Australia. The FFG platform is the oldest major surface combatant in the RAN fleet, yet the ships are considered to be in outstanding materiel condition. They are the most affordable surface combatant per Material Ready Day (MRD). They are reliable, capable, available, lethal and highly valued by the Navy. This program is an excellent demonstration of what an enterprise approach can achieve for all participants.

ENCE+IN

#### Minor Sustainment Activity under \$20 million annually Finalist

Remediation of on shore power and high voltage issues for LHD Platforms: LHDSPO and KBR Many elements of the RAN's two new LHDs are a paradigm shift for the ADF, from both an operators and sustainment effort view. One such example is the power profile of the LHDs. These ships are the only RAN platforms that operate a maritime high voltage (6,600v) system. This program was key in the rapid remediation efforts so that the ships could operate with on shore power during sustainment activities.

#### Winner

#### Land 907-1 Tank Replacement Project: Tank Program and TAE

This program is an excellent demonstration of what an agile and innovative SME can do when given an opportunity. TAE began with light repairs on the Abrams tank in 2013 and has moved on to heavy maintenance of the engine this year, all in country, thanks to a relationship with the US OEM. The TAE team can now deliver engine maintenance at a fraction of the time of the US Foreign Military sales (three weeks compared with six to nine months via FMS) at between 20-30 per cent less cost. This is an outstanding achievement for all participants.

### Support Services Winner

The Future Through Collaboration (TFTC)mentoring program: Capacity Management& Professionalisation and TFTC

Though not a traditional support service, the mentoring of young female program managers and engineers through The Future Through Collaboration (TFTC) deserves to be recognised for its efforts in promoting diversity in the Defence community. The 12-month mentoring program is growing significantly year on year in terms of the number of mentors and mentees. It provides an excellent opportunity for all participants to promote leadership and networking within these critical disciplines.

### Trophy winners CASG/Major Company Team of the Year for 2017

FFG Enterprise: FFG SPO and Thales and BAE Systems

### CASG/SME Team of the Year for 2017

Joint Project 3027 – JDAM Enhancements: Aerospace Explosive Ordnance – Acquisition Management Unit and Ferra Engineering Once again, Defence and Industry gathered in Canberra on June 14 for the Defence plus Industry conference. Building on the success of the rebooted event from last year, this year had a solid foundation on which to build.

The TED style format worked well with plenty of time for Q&A from a wide range of speakers. The standout presentation this year was from managing director of EM Solutions, Dr Rowan Gilmore who spoke on the SME experience in Defence, drawing on his experience in adjacent industries.

He made the interesting observation that the NBN program that has cost Australian tax payers \$78 billion has no version of Australian Industry Capability (AIC).

"Imagine Defence spend \$78 billion and Australian companies had nothing to show for it," Dr Gilmore said to the 1,200 delegates. "There would be a massive outcry but this has flown under the radar for many people. Digging trenches for the NBN does not count as AIC."

The quote of the day also goes to Dr Gilmore: "Risk is used as a cop out, and is over-used in Defence compared to other industries when dealing with SMEs".

A close second came from CASG's chief engineer Luke Brown when it came to culture and relationship management.

KATHERINE ZIESING | CANBERRA

**D+I FORMAT A WINNER** 

"Culture is about how we behave when things go wrong."

A host of CASG and Defence officials gave the audience an update on the reform being done under the aegis of the First Principles Review two years in and associated internal restructuring.

Clive Billiald of Bechtel explained how the Smart Buyer program is bedding down; he also covered the formation of Centres of Expertise and how work on the Systems Program Offices (SPOs) is progressing.

CASG Deputy Secretary Kim Gillis provided more detail on how the SPO audit program is performing, saying that three-year process will touch about 80 per cent of the SPOs in his organisation.

"This is about right-sizing," he said. "Some SPOs have already undergone a reform process and don't need to be reexamined but we are making sure that we're making the right changes for the right reasons. And right-sizing will be an ongoing process."

The role of partnering and collaboration was high on the agenda as speakers from both sides looked at what is working and what isn't in this space. There was also an emphasis on the relationship between Primes and SMEs and how they can work together more effectively.

Kate Louis first assistant secretary defence industry policy provided an out-

line of how the Centre for Defence Industry Capability (CDIC) and its associated are developing, boasting some impressive metrics for the nascent programs.

"To date, the Global Supply chain program has seen work done including 179 companies under 741 contracts totalling almost \$900 million," Louis said.

"There are more contractors working on operations than you would think," RADM Tony Dalton, CASG's Head Joint Systems Division said in response to a question from the audience on how to balance effectiveness vs efficiency.

"There are some things that need to be done in house, due to the nature of our business, and some things that contractors can do. It's a constant balancing act based on lessons learned," Major General David Coghlan, CASG's Head Land Systems Division said in follow up.

**ADM Comment:** D+I this year provided ample time for networking, a welcome change to the common conference format. Speakers provided a range of views and were open to robust Q&A sessions, with many staying during the networking breaks to answer follow ups offline.

The reboot of D+I is a good format for Defence and Industry, both Primes and SMEs, to come together and work on the trust building and relationship management elements, the foundation of good business.



## What is the true cost of AIC

### INDUSTRY INSIDER | CANBERRA

Another day, another industry roadshow in some conference hall, another quad-chart and online portal registration, another factory visit from a jet-lagged supply-chain team, another set of NDA documents to mark up... and yet the risk of not being seen to participate means that the cycle perpetuates. But is it effective, and if so to whom? **THERE** is no doubt that after a challenging decade Australian defence-related industry is in a period of unprecedented opportunity. The recapitalisation of the ADF's major platforms across all domains and the Commonwealth's commitment to a two per cent of GDP Defence budget is delivering real programs for real companies. And the tangible, indeed pervasive, pressure from the highest political levels to link capability outcomes to industrial and economic policy, and to ensure Australian workshare and innovation, has never before had this level of focus and fervour. The Government's policy direction, and its commitment to whole-ofindustry outcomes should be commended.

But the question that this article poses is whether the implementation of this mandate is delivering, and how it is being experienced throughout industry. How are the major OEMs and Primes working this new Australian Industry Content (AIC) or Global Supply Chain (GSC) focus into their campaigns? Are AIC headline statements being put out useful or relevant? What cycle of bureaucratic activities has this policy area spawned? Are conversations happening between the right people, at the right time, and for more than 'box-ticking' reasons? And ultimately how are the many SMEs who deliver so much of Australia's innovative defence capability balancing these new activities with their existing workloads and budgetary constraints? These questions are being privately shared across many parts of the Australian defence industrial community.

The issues for the SME community are mounting. Firstly, there needs to be an improved degree of sophistication in the definition of AIC and the way it is presented in roadshows and other prime-led campaigning. At the most macro of levels, total workforce size or revenue is an indication of a total Australian industrial capacity. But what does this mean when the real question is whether Australia has the domestic capacity to develop and support specific areas of advanced sovereign capability delivering identifiable operational effects to the ADF?

Without seeking to target some very fine and committed companies, is the size of a business unit comprising a majority bluecollar maritime support workforce really relevant if assessing capability delivery, future road-maps and skills growth in hightech underwater warfare systems?

Similarly is the size of a land vehicle workforce containing many mechanical trades-

> people relevant to a discussion of land capability in the context of networked battle-space systems and other advanced C2 elements? All that a discussion of absolute workforce size does is reinforce the significant overall foreign direct investments of the leading Primes in industry. There are different experiences for different domains as well, with some performing better than others in this space.

> These investments are not to be derided and have had a generally positive effect on

Both BAE Systems Australia and Rheinmetall ran a series of roadshows on Land 400 Phase 2 to engage SMEs as directed by Government



## to SMEs?

Australia's overall defence capability. But, when looking at specific high-end capability, gross size is not a measure of great relevance – and indeed may serve to perpetuate a perception in the SME community that their workforces that may number 10 to 50 advanced engineers, is insignificant.

In fact they are every bit as sizeable as the directly comparable capability in the larger vertically integrated Primes.

Secondly, there needs to be a more efficient way of ensuring that the major OEMs and Primes communicate to the Commonwealth their commitment to supply chain engagement.

#### SME resourcing

Because while lists of roadshow attendees, registrations on portals and supplier-audit factory visits give an indication of industry activity which serve the Prime's messaging to government well, the economic cost to the second and third tiers of industry – who are already typically highly constrained in both time and working capital – may be hidden but is becoming overwhelming.

Taking the usual cycle of a roadshow attendance, a detailed registration on a supplier portal, a factory visit, and negotiation of enabling documents (NDAs, MOUs, etc), if each of these four steps take half a day then two days is removed from that company's capability to deliver capability.

Global supply chain initiatives involving overseas travel and activities greatly increase this time and resource load. And as this cycle is repeated for every Prime and across every major program, the common experience of SMEs is that significant resources are being diverted into the meeting of these processes, which are often frustratingly similar – but just different enough to involve significant rework each time.

Thirdly, the level of accountability that Government places on the Primes to have the right people engaged with industry at the right time is a real issue. There is no doubt that as AIC and GSC programs have progressed, there has been great variability in the effectiveness of the individuals and teams carrying out those functions within the major companies.



In some instances senior leaders with advanced technical expertise and a high level of reach into their Australian and global organisations have delivered great outcomes for Australian businesses. But equally in others, AIC and GSC have been staffed by support functions and personnel outside of the core program areas of the Prime, resulting in much more limited

effectiveness in their interaction with industry and delivery of contractual outcomes. When the time and resource imposts of AIC and GSC activities as they currently exist are considered, this is not an acceptable position.

The graver dan-

ger in GSC is the inability of Australian companies to manage the ramp-up required to join in to some global supply chains. For example, a Prime might want 30 of something in Australia but require 3,000 worldwide. The capacity to deliver once part of a company's GSC is a large part of the risk Prime's have to evaluate when adding new SMEs.

There is immense positivity about the future for capability delivery for the ADF, both in the commitment to new platform and systems across all domains, and also in the intense focus on ensuring industrial outcomes for the nation.

But we collectively need to break out of a cycle where the response to the strengthened AIC mandate feels very much like we are doing proportionally much more of old models that have not been based on meaningful measures, nor implemented with a view to optimise effectiveness. We are

"There needs to be a more efficient way of ensuring that Primes communicate to the Commonwealth their commitment to supply chain engagement."

working harder, but not necessarily smarter.

The challenge is to critically appraise the pattern we are in, look beyond the standard rhetoric and activities. We need to ask the questions:

- What really constitutes AIC?
- Where does capability really lie?
- How do we properly assess commitment local producers?
- How do we engage to genuinely maximise it where it is valuable?
- Who do we task within our organisations to ensure it happens?

SURVEILLANCE COMMS

## The ADF and SATCOMs

**PERHAPS** one of the most challenging parts of the communications network is related to satellite communication (SATCOM) capabilities. Defence's current SATCOM capabilities comprise wideband systems in military X and Ka bands through the Wideband Global SATCOM (or WGS) constellation, as well as through a payload on Optus C1, which has been in place since 2003.

Last month, Minister for Defence Senator Marise Payne announced that the contracts surrounding the C1 satellites had been extended. The total cost of the contract is approximately \$40 million over the next 10 years, which includes the necessary preparation of ground infrastructure within Optus facilities at Belrose, NSW and Lockridge, WA as well as operating and sustainment costs associated with continued use of Optus C1.

### **KATHERINE ZIESING | CANBERRA**

Communications are key to navigating through the fog of war. But for many, they are a service that simply just works when a button is pressed or an icon clicked. What goes on behind the screens, through the cables and around the world? "Optus will reconfigure the C1 satellite to operate in an inclined orbit to reduce on board fuel usage and extend the life of the satellite as far as 2027. The existing agreement with Optus was due to expire in 2020 coinciding with the satellite's anticipated end-of-life," Minister Payne said.

In narrowband, the ADF has UHF capabilities through the Optus C1 and a payload on the Intelsat IS-22 over the Indian Ocean, as well as through arrangements with the US to use each other's UHF capacity under an Equal Value Exchange MOU.

### JP2008

Defence's current JP2008 wideband phases have delivered significant MILSATCOM capability through the WGS program, which has been a critical enabler for the ADF, according to Air Vice Marshal An-



drew Dowse, Head of ICT Operations in Chief Information Officer Group.

"Entry into the program through Australia's funding of the sixth satellite in the constellation has provided us with a robust worldwide coverage," he told the audience at the MilCIS conference in November last year.

The various JP2008 phases have been delivering enhanced SATCOM systems comprising the four segments of space, anchoring, terminal and network management. However, it has not been without issues, AVM Dowse confirmed.

In fact, the program is actively being managed as a Project of Concern.

"You asked about what is keeping me awake at night," head of CASG Kim Gillis said at a Senate Estimates hearing in March this year. "It is JP 2008 Phase 3F, the ADF

#### LEFT: Leading Aircraftman Andrew Speirs of No 1 Combat Communications Squadron sends a message for No 4 Squadron's Combat Control Team via satellite communications at Tinian North.

satcom terrestrial enhancements. That is truly the project of my concern. It is a fouryear project that is currently five years late. We are in detailed negotiations with BAE, which is the prime contractor there. I understand that the minister has had dialogue with the CEO of BAE – in no uncertain terms – as I have.

"But we are in a commercial negotiation with him trying to work out a settlement with him. I am not in a position to talk about the financial settlement details because they are part of a commercial negotiation that we are having with BAE Systems.

"It is the facilities on the ground that link to the satellites that give us access into the Wideband Global Satcom system, the

WGS. This has been a problem. There has been poor systems-engineering requirements management; lack of coherent verification and validation, planning and execution strategies; and poor application of quality standards. This is one of those ones which have not gone well at all."

The program is now im-

pinging on related comms programs, such as upgrades at HMAS *Harman*, between Canberra and Queanbeyan. In terms of a solution moving forward, Gillis was blunt.

"Probably a termination of the Harman site and a commercial negotiation, which will involve a significant payment to the Commonwealth," he concluded.

When BAE Systems Australia was approached for comment on the program, a single line statement was provided: "We are at an advanced stage of system testing and we are working closely with CASG to ensure we deliver this project to its satisfaction."

This fails to mention the company has not received a single payment from the Commonwealth for three years after failing to reach milestones. Gillis confirmed at the same Estimates hearing that the overall budget was "\$86.4 million and we have currently expended \$69.9 million, or 81 per cent of it".

*ADM* does understand that the company has poured significant effort into the program. Senior industry sources have high-

lighted the fact that the program uses the BAE workforce related to their work on the JORN program (where BAE Systems and Lockheed Martin are shortlisted together under a restricted tender, due for a decision this year) and the program has to make gains sooner rather than later.

#### Lessons learned

"With JP2008 wideband phases running both sequentially and concurrently, we effectively did not keep the segments synchronised, especially due to the time taken to acquire terminal capabilities," AVM Dowse said. "Now, as significant numbers of WGS certified terminals are being delivered, we are finding we are constrained by anchoring capacity."

The high bar set to access WGS, in terms of infrastructure and service management requirements, has made it difficult for other government agencies, which don't have

### **BAE Systems Australia has not received a single payment from the Commonwealth for three years after failing to reach milestones.**"

military-sized budgets, to access the WGS constellation. Defence is currently working closely with wider government, and the Australian Border Force in particular, to facilitate increased utilisation of this Whole of Government resource.

JP2008 is also introducing a wideband TDMA SATCOM capability to enable new SATCOM architectures and thereby access greater space, terminal and anchoring segment efficiencies and flexibility. These efficiencies are becoming essential as the JP2008 projects continue to deliver operational capabilities and the ADF's terminal fleet and data rate expectations grow significantly.

However, implementing new architectures and concepts of operations for TDMA SATCOM requires a holistic approach, and has presented a range of challenges. These challenges include integrating new SAT-COM network architectures into the existing Defence ICT systems and across the four SATCOM segments, and introducing new methods of planning and operation to make the most of the efficiencies and flexibility offered by TDMA.



### The need for commanders to re-task assets on the fly, rather than deliberate planning, leads to an on-demand approach to SATCOMS."

According to AVM Dowse, other challenges facing current Defence SATCOM projects include:

- ensuring SATCOM segments being delivered to different Defence internal customers integrate at all levels
- integration of SATCOM with the wider Defence ICT systems to ensure end-to-end security, resilience and redundancy, and
- preserving Australia's space interests in orbital and spectrum filings.

### **Sustainment**

There are many legacy systems approaching end of life, or that have been extended beyond life of type, and a significant portion of the overall support cost is allocated to managing obsolescence and addressing mid-life upgrades to maintain and/or improve performance, usability, reliability and maintainability.

"SATCOM technology continues to evolve and new demands are emerging," AVM Dowse said. "We need to learn from the past, and plan and implement future capabilities in a way so we don't repeat past mistakes and adequately manage identified challenges."

There is an expectation that the effectiveness of the force will be enhanced through shared awareness of the environment, integrated command and control and synchronised manoeuvre. The future ADF will demand greater access to beyond line of sight communications because of the reach of platforms and the expanse of Australia's area of interest, as well as the desire for real time communications.

"For example, we don't want to wait for ISR aircraft to land before they pass on their valuable information," AVM Dowse explained. "By the same token, we might not want them to pass over finite SATCOM links the terabytes of raw data they collect during a mission."

In planning for the ADF's future communications, there are many factors that are influencing the way we?? are thinking about SATCOM. Firstly, the services want small terminals to maximise mobility and transportability. Accordingly Defence is acquiring a significant number of relatively small terminals in the order of 0.6m, 1.2m and 2.4m. These smaller terminals require a higher Power Equivalent Bandwidth when operating and therefore consume more of our?? available space and ground resources than larger terminals would.

Secondly, platforms with a heavy C2 component or ISR component, as well as C2 nodes such as deployed headquarters, are making greater demand for SATCOM to support higher data rates. Whilst this trend is manageable at the moment, it may be difficult to support into the future, especially in combination with the power equivalent issues of small terminals, AVM Dowse said.

Thirdly, fast movers such as Air Force platforms pose an additional challenge because they are seeking very high bandwidth uplink and downlink capabilities. Things like transiting through beams, changing frequencies, the size and shape of aircraft antennae, and the aspect angles of antennae in flight, all factor into the difference between performance expectations and performance reality.

Another driver on SATCOM is the higher tempo of modern warfare. The need for commanders to re-task assets on the fly, rather than through deliberate planning, leads to an On-Demand approach to SATCOM.



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### SURVEILLANCE COMMS

"Under most of our current arrangements, be it MILSATCOM or Commercial SATCOM, we can be challenged to find ways to meet communications needs at short notice," AVM Dowse said. "MIL-SATCOM systems at present require planning weeks in advance which is not good for something like Op Fiji Assist where Defence needed SATCOM resources at very short notice to support a Humanitarian Assistance Operation. Often, commercial SATCOM services are called in to fill the gap but are often limited to the agreements in play and can be expensive."

A fifth driver is the desire for information integration across the force. The Defence White Paper has emphasised the criticality of Enabling Capabilities like SATCOM, especially where it? enhances capability through the sharing of operational information. This is increasing the demand for reliable push and pull of large amounts of information on a beyond line of sight basis. In some cases, we? can utilise terrestrial communications, but increasingly Defence is relying upon SATCOM.

Integration is being realised in the tactical data link environment, in which Defence, through activities such as Plan Jericho, is developing integration between disparate line of sight data link systems. It is only a matter of time before Defence also recognises the need for better integration of those systems with beyond line of sight capabilities such as SATCOM.

A final factor is that investing heavily in Defence SATCOM capabilities comes with expectations to support Whole of Government requirements, to maximise the use of taxpayer dollars. For example, Defence engages with the Australian Federal Police and the Australian Border Force to assist them to leverage Defence SATCOM resources where possible.

"We work closely with other departments to synchronise their requirements with Defence, where it makes sense, so they can be supported by Defence," AVM Dowse said. "We also assist these entities with things like WGS certification and operational planning, as well as to leverage best returns from Commercial SATCOM arrangements.

"The bottom line is that Defence requires SATCOM be provided as soon as we need it, to a variety of fixed and mobile users, integrated with other communications technologies, with as much capacity as we need and wherever we are in the world but also, we need it to be affordable and with some level of assurance."

### \$500 MILLION FOR ENHANCED SATELLITE CAPABILITY



The Government announced a \$500 million investment to improve Australia's space-based intelligence, surveillance and reconnaissance capabilities, to support ADF operations in late June.

Minister for Defence Marise Payne said that Defence Project 799 was introduced in the 2016 Defence White Paper to enhance Australia's geospatial-intelligence capabilities.

Phase 1 of the project will provide Australia with direct and more timely access to commercial imaging satellites to support a wide range of Defence and national security activities.

"Defence's enhanced access to these satellites will increase Australia's capacity to maintain surveillance and improve situational awareness for the ADF and other national security agencies through the provision of high-quality imagery," Minister Payne said.

"This means imagery from high-end commercial satellites, now in orbit, will be integrated directly into the Australian Geospatial-Intelligence Organisation's imagery dissemination systems, reducing the time it will take for satellite imagery to get to a member of the ADF or the officers of Australia's national security agencies."

Minister for Defence Industry Chris-

topher Pyne said these contracting arrangements will provide improved value for money for the Australian Government when accessing commercial imagery.

The investment will immediately create 22 new jobs in Defence and industry across Australia in direct support of the establishment and maintenance of the capability, with many others created in the supply chain as the project matures.

"The Turnbull Government is committed to maximising Australian Industry content, with this project forecasting over \$144 million to be spent in Australia, creating jobs and generating economic growth. Australian industry will benefit with around \$14 million spent locally to build the ground infrastructure to collect imagery from commercial satellites," Minister Pyne said.

A total of \$130 million will be spent on support contracts over the 13-year life of the project providing commercial opportunities for Australian companies - including in the NT and SA.

This investment will also create opportunities for Australian companies interested in satellite technology and imagery analysis.



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### INMARSAT LAUNCHES FOURTH GLOBAL EXPRESS SATELLITE

### **KATHERINE ZIESING | FLORIDA**

KNOWN as I-5 F4 (Inmarsat's 5th generation, number four in the series), the fourth and final satellite provides a layer of redundancy to the global Ka-band Global Express network which went live in 2015.

Though the Boeing-built satellite was originally planned to be a groundbased test article, Inmarsat decided to launch the six-tonne satellite to provide greater bandwidth in support of the growing demand for speed worldwide. The three existing satellites provide global coverage with 89 steerable spot beams each and the fourth has a currently expected geo-stationary location providing service to Europe, Middle East and the Indian sub-continent. Its final location will be advised in due course. Inmarsat CEO Rupert Pearce told media in Cocoa Beach.

Pearce explained that the final satellite completes the \$1.6 billion program, complementing over a dozen other Inmarsat satellites on various bandwidths already in orbit.

I-5 F4 is the heaviest launch on record for SpaceX and Inmarsat, and the Falcon 9 two-stage launch vehicle was used from the Kennedy Space Centre's launch pad 39A. Launch Complex 39A has an impressive history dating back to the early days of the Apollo program; it was from here that Apollo-11 took off in July 1969 to become the first manned mission to land on the moon.

The first of the I-5 series, F1, was launched in 2013 from the Baikonur Cosmodrome in Kazakhstan, atop a Proton booster. The next two satellites, F2 and F3, followed in 2015, also on Protons.

I-5 F4 was deployed approximately 32 minutes after launch at 7:21pm local Florida time on May 15, when it came under the command of the Boeing and Inmarsat satellite operations teams based at the Boeing facility in El Segundo. From here I-5 F4 will be manoeuvred to its geostationary orbit, 35,786 kilometres above Earth, where it will deploy its solar arrays and reflectors and undergo intensive payload testing before beginning commercial service later this year.

Chief Technology Officer for Inmarsat Michele Franci explained that the satellite would take roughly 50 days to reach its geosynchronous orbit.

The rest of the constellation is already in place with the fourth satellite most likely to find its home over the Indian Ocean.

The Australian Government is a large user of Inmarsat services across a range of bandwidths and with various agencies. This is set to grow further, according to Inmarsat's Global Government President, Andy Start.

"We provide satcom services across land, sea and air for many militaries and government customers, including those in Australia," Start explained to *ADM*. "In the land domain it could be anything from allowing forces to be able to quickly deploy anywhere around the world at any one time, through to operational communications for army teams through to providing welfare communications for people who quite simply are away from their home and expect to be able to talk to their family.

"In the maritime domain we do a lot of work with Australian Border Force as well as the RAN, providing communications for everything from a small RHIB all the way up to the largest vessels you have and that's because our communications work not only in Australia but they'll work anywhere they wish to go on the planet.

"On the aviation side, we experience similar dynamics to the maritime market. Not only does Inmarsat provide safer communications to the cockpit, which we do extensively for both commercial and military customers, but increasingly we are seeing the requirement to provide the higher levels of


# SURVEILLANCE COMMS

connectivity that goes into the back of the aircraft."

The company compliments other satcoms services such as WGS and Skynet, as appropriate, to Defence customers globally.

"There are two types of service we can bring to Australia, NATO and the five eyes nations," Start said. "There is a standard commercial frequency band service which is capable of offering about 50 megabits of speed into land, sea or air assets.

"But wealso provide our military Ka services. So that allows WGS capable terminals to flip across to our military KA service, which means that our system can complement and augment the capabilities of WGS.

"For example, you can have a terminal which is purely on our commercial network. That's probably a relatively low cost terminal that's relatively high speed and relatively small. Or you can have a standard WGS terminal, whereby if you lease one of our steerable beams – and there are six on each spacecraft – then the WGS terminal can work directly on our satellite, because it would look to that terminal as if it was operating on a WGS satellite. The only difference is that it is an Inmarsat lease service rather than one that's procured through a WGS arrangement."

Both WGS and the first four GX satellites are built by Boeing, and therefore the military payload has, as far as the terminal is concerned, have similar characteristics.

Not long after the May launch of the supposedly fourth and final satellite, the company announced they would be adding a fifth GX satellite to the constellation in order to further boost capacity. However, Thales Alenia rather than Boeing would build this final satellite which is due for launch in 2019. Start confirmed that while the new satellite would be in the GX constellation it would not be the same design as the units currently in orbit.

"No, it's an entirely different design," Start confirmed to *ADM*. "It's an enhanced capability in some respects to the other satellites. But it's fully compatible with the GX network."

Note: Katherine Ziesing travelled to Florida as a guest of Inmarsat.



# Commercial arrangements

Commercial SATCOM supporting tactical users accounts for the majority of Defence's current commercial SATCOM airtime costs. These are services for:

- niche requirements for certain end-users,
- requirements to supplement existing services,
- requirements where there's no other coverage, or
- where certain terminals or equipment can only be serviced by a certain band.

For example, the ADF uses a number of different L-band-dependent systems to support operations such as telephony, Blue Force Tracking and low-to-medium data applications.

In many cases, Defence uses these types of services to maintain its SATCOM during poor weather where wideband systems experience rain fade. Looking to the future, Defence is considering commercial SATCOM to provide for supplemental capacity, coverage and diversity, but also for a range of other benefits. For example, to enable Defence access to efficiencies and improvements offered by innovation and advances in SATCOM technology, which are far more quickly adopted and implemented within the Commercial sector.

As previously mentioned, Defence also hopes to take advantage of commercial SATCOM's support for airborne SAT-COM, albeit with the unique asymmetrical Defence requirements.

Defence is also looking to the commercial sector to provide greater agility and flexibility for 'on-demand' SATCOM. This is a requirement where speedy deployment of SATCOM services is required for fast-deployment or dynamic operations. In these situations, long lead times for establishing SATCOM services are not practical.

"However, no matter what sort of services Defence seeks from the commercial sector, we will continue to look for ways to reduce costs through establishment of things like ADF officers, Lieutenant Colonel Cliff White (right) and Squadron Leader Daryl Henderson examine a medium satellite communication terminal during a VIP day at Damascus Barracks.

fixed rates or seeking services that are readily available from numerous providers to create competition and provide a market advantage for Defence," AVM Dowse said.

"With the cost premium of leased capacity or managed services over hosted payload options, in the past we have presumed we should focus on the latter, as the cost for bandwidth is less. However, when you take into account the reducing price of managed services, as well as unused capacity and the total cost of ownership for hosted payloads, we may see a shift in the balance as we plan future SATCOM capability.

"So what messages can I provide to industry? Defence wants the latest and the best capabilities but it also wants the best deal."

The future appears to be pointing towards a hybrid SATCOM capability for Defence using a combination of MILSATCOM and commercial SATCOM. In making choices about this combination, the enhancements that each option provides to capabilities need to be considered. Also issues like the ownership and use of systems in extremis, the requirements to synchronise SATCOM system segments, the certification of terminals and the speed to market. There are also challenges here in ensuring integration and interoperability between the mix of MIL-SATCOM and commercial SATCOM across the four SATCOM segments.

"In planning our future requirements, we also need to consider whether we should obtain these services through a capital investment or operating cost approach," AVM Dowse said. "We will seek to maximise portability and interoperability between systems and service providers, so that we can exploit the concepts of diversity and agility.

"Industry needs to continue to work closely with Defence and offer creative options that offer both a profit to industry and provide Defence with a capability that meets its needs including the need for coverage, affordability and assurance."

# What next for tactical UAS?

# **PATRICK DURRANT | SYDNEY**

As Army prepares to roll out a dismounted and manportable small UAS (SUAS) capability across its entirety for the first time, it is also considering applications for the future integration of SUAS into mechanised and armoured units for a 'SUAS-on-the-move' capability.

**UNDER** the first tranche of funding for Land 129 Phase 4 (known as Tranche 'A' or 4A) Army will receive approximately 78 Wasp AE SUAS to provide tactical land forces an organic Intelligence, Surveillance and Reconnaissance (ISR) capability. The system, with a take-off weight typically less than 1.3 kilograms, is capable of semi-autonomous operation and the associated ground control and support systems (operated by two-person crews) will provide land-based units including Special Forces with their own dedicated SUAS.

Within the next decade (more likely in about five years) the Commonwealth has signalled there will be a requirement for either an upgrade or replacement of the Wasp, a prudent measure given the rapid technological advances in this domain – one only has to observe the rapid development of SUAS in campaigns such as Iraq, Afghanistan and especially now in the Ukraine.

Tranche 'B' will attempt to harness technological advancements that will undoubtedly occur in that timeframe; this may include more advanced software and even integration of SUAS into land vehicles and boats.

According to UAS program manager Lieutenant Colonel Keirin Joyce, Army has been working through SUAS applications and possibilities ever since it started using Codarra's locally developed UAS back in 1999 (see our recent SME Spotlight in the May edition).

"But our use of Skylark from the mid to late 2000s, including on deployments to Afghanistan, Iraq and East Timor was where a lot of the experimentation started," LTCOL Joyce said to *ADM*.

LTCOL Joyce explained there had been efforts to integrate that system into a Land Rover in order to test mobile ground control; there had also been some trialling of "more adventurous" launch and recovery operations.

"For example we looked at shortening the 'bungy' cord launch mechanism, so as to reduce the size of the launch area while still achieving the required velocity to get it airborne."



In 2009 Army had also tested the Wasp 3 (a predecessor to the AE), deploying it to a number of exercises.

"It was the first waterproof UAS on the market, so we did operations from boats; we also trialled the functionality of it in an 'onthe-move' or mounted capacity as well."

The conclusions drawn from the test and evaluation reports then revealed that there were limitations to using SUAS in that capacity which exist to this day, as LTCOL Joyce explained.

"In 2009 we quickly discovered that a SUAS used, for example, in support of an armoured vehicle callsign that was either static or moving at a slow pace, provided great ISR support however as soon as that convoy needed to deploy at speed down a road, the system was unable to keep up."

He added the observations gleaned from the numerous trials Army had conducted fed into the shaping of the requirement for Land 129 Phase 4 Tranche A, which has

> limited the requirement to a dismounted capability.

"Presently among the SUAS class, there is no system that can operate at a speed necessary to support vehicles on the move – those that claim they can have a power endurance that would require recovery of the system every twenty minutes in order to change battery."

LTCOL Joyce said technology is constraining the operational employment at the moment and it is very much a case of watch and wait.

"It all depends on just how fast the technology develops, there are certainly some innovative solutions being developed that we are keeping our eye on."

He explained that in the near term, tethered systems such as a high-speed quadrotor deployed from the roof of a vehicle could provide vehicles with an ISR capability.

Australian Army soldiers Private Madeliene Goodfellow (left) and Corporal Doug Coombs from 2nd/14th Light Horse Regiment (Queensland Mounted Infantry) with a Wasp AE small unmanned aircraft vehicle.

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"They are essentially a 'wobbly' mastmounted sensor, and because they can draw power via the cable tether, their endurance is congruent with the running of the vehicle engine."

LTCOL Joyce suggested that within five years systems like this might be at a readiness level such that they will be of interest.

# Local content

The Commonwealth has indicated that for Tranche B it will seek to maximise Australian Industry Content.

"Defence will work closely with Australian industry through the Centre for Defence Industry Capability to maximise opportunities for local companies to get involved in this important project," Minister for Defence Christopher Pyne has said.

XTEK Limited, who will supply and maintain the Wasps for Tranche A, is certainly interested in playing a role in either the upgrade or replacement of the system.

"With Tranche A, the Army's operational doctrine is going to be modified which is exciting; we'll be hoping that this might lead to considerations for more SUAS of different sizes and capabilities," managing director Philippe Odouard told *ADM*.

For XTEK, it will be a case of finding the right mix of capability, cost, local versus foreign content, and exportability, he explained.

"We'd be looking to develop something that would be attractive not only to the ADF but also the global market."

As featured in our recent SME Spotlight on the company, XTEK considers the processing, exploitation and dissemination (PED) of SUAS video stream feeds in real time as a capability that will provide the war fighter with a hitherto untapped resource. Its XTatlas software currently under development will provide geospatial video overlays and mosaic mapping in real time from video obtained from tactical systems such as SUAS. This can instantaneously be integrated with other feeds to form a common operational picture (COP) that will enable unit commanders to more rapidly appreciate the tactical situation and make decisions without having to rely upon larger UAS or satellites that are not always available for tasking.

"The integration of SUAS with this capability into vehicles is certainly something we would be keen on solving," Odouard said.



The old and new together in the air.

# Overland SR expanding Poseidon's capabilities

AUSTRALIA'S AP-3C Orions have had an important overland ISR role since being deployed to the Middle East in 2003 and subsequent operations over Iraq and, later, Afghanistan. Today the role is one of the five major roles of 92 Wing, based at Edinburgh, together with the more 'traditional' maritime roles of Anti-Submarine Warfare (ASW), Anti-Surface Warfare (ASuW), Maritime ISR and Search and Rescue (SAR).

The first of up to 15 Poseidons for the RAAF arrived in Australia last November and the current fleet of three is now working through Operational Test and Evaluation (OT&E) with 11 Sqn. Beginning with the traditional maritime roles, the testing is now expanding and the first exercise with Land forces was conducted at Cultana in May.

# **Overland ISR for the maritime force**

The initial 92 Wing deployment to the Middle East was undertaken by the Orion

# **NIGEL PITTAWAY | MELBOURNE**

One of the major differences between the US Navy and the RAAF when it comes to the concept of operations of the P-8A is the overland intelligence, surveillance and reconnaissance (ISR) role.

in its original P-3C configuration and it wasn't until the upgraded AP-3C was deployed later in 2003 that the overland ISR role began to be significantly developed.

Upgrades to the AP-3C included the capability to communicate directly with land forces, albeit by taking one of the aircraft's VHF radios off-line from air traffic control

for the purpose, and it also had an Electronic Warfare Self Protection (EWSP) system, which allowed some of the operational restrictions to be relaxed.

Due to the mountainous regions of Afghanistan, where line of sight communications are often significantly restricted by terrain, at least one AP-3C was later modified with a wideband satellite communications (SATCOM) capability. According to the RAAF this experience is now being leveraged to develop understanding of the communications links required for the Poseidon and MQ-4C Triton.

# **Development of the CONOPS**

Wing Commander David Titheridge is the Commanding Officer of 11 Sqn, the first of the RAAF's two AP-3C squadrons to convert to the Poseidon and he was part of the first crew to conduct overland ISR missions over Iraq in 2003.



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"The mindset of working for a supported commander, whether it's a Navy ship which is dictating requirements and controlling you tactically, or whether it's a US Marines formation on the ground that's seeking some sort of ISR effect from you, the principles are the same," he explained to *ADM*. "The tactics, techniques and procedures (TTPs) we were using in Iraq in 2003 were modified heavily for operations in Afghanistan."

In Iraq and Afghanistan Australian AP-3C crews were heavily tasked with supporting US Marines forces on the ground and, in Iraq, initially used US Marine Corp liaison personnel on board the aircraft to determine essential requirements.

"That arrangement existed for the first couple of years, but by then we had a structured training program back here in Edinburgh, where we could take those lessons and we could train our crews in this new role," WGCDR Titheridge detailed.

The primary sensor in the overland role is the electro-optical turret, but the AP-3C was largely only capable of sending still images.

"In the early days we had to essentially take a 'screen shot' and send it to the Air Operations Centre in US Air Force Central Command (CENTAF) and it would then



No 11 Squadron Air Combat Officer, Flying Officer Steven Martin tracks a USN P-8 Poseidon maritime patrol aircraft using the external cameras on an AP-3C Orion during Exercise Balikatan 2016.

## P-8A overland capabilities

Even though the US Navy does not currently have an overland requirement in its P-8 CONOPS, the aircraft has enabling features incorporated into the baseline design.

The EWSP suite includes flares and a Directed Infra Red Counter Measures (DIRCM) system, to provide protection against missile attack. Other protective measures include an On Board Inert Gas Generating System (OBIGGS) for the fuel tanks and a dry bay fire detection and suppression system, which provides a measure of protection for underfloor compartments in the case of ground fire damage.

"Even though the USN does not currently have an overland requirement in its P–8 CONOPS, the aircraft has enabling features incorporated into the baseline design."

be passed up to the Land Component Commander's staff for coordinating air and ISR effects, who would then push it out to the Joint Terminal Attack Controller (JTAC) in company with the Marines or Army. So it was a very convoluted process," WGCDR Titheridge said.

"Before we did the AP-3C upgrade we didn't have the ability to share data directly with Land forces, but with the tactical data link (added during upgrade), we could push still images directly to the ground, albeit within line of sight."

The AP-3C was withdrawn from the Middle East in November 2011 and by then the overland ISR concept was mature, to the point where the consideration was being given to how the role could be enhanced in its intended successor, the P-8A.

The primary sensor will continue to be the onboard EO capability, in this case the Wescam MX-20 turret, but future upgrades will likely add additional functionality to the Poseidon's Raytheon APY-10 radar for littoral and overland roles.

"The P-8A also has a TCDL and we can currently pipe pictures to the ground within line of sight," WGCDR Titheridge added. "We will continually upgrade the aircraft over its planned 30 year life and in the next few years we'll be able to produce Beyond Line Of Sight (BLOS) moving imagery via satellite communications (SATCOM)."

The recent OT&E work has expanded capability in the core maritime roles and 11 Sqn has been working with Navy's surface combatants to develop tactics, techniques and procedures. The P-8A has already performed its first real SAR mission, when one aircraft was re-tasked during a training flight to come to the assistance of a ferry off the South Australian coast. Expansion into the overland ISR role has also recently occurred with one aircraft working with land forces in the Cultana Training Area.

"We are initially doing a low-level test and evaluation, measuring the sensors, our ability to communicate with the ground force, our ability to be tasked by them and supply information off the aircraft. We can chat directly and with the right classification with ground and maritime forces, so we will go out and exercise those capabilities and then begin writing the TTPs for how we want to move forward in the ISR space," WGCDR Titheridge explained to *ADM*.

"We've had some interaction with Army already, trying to establish exactly how we'll interact across projects with them and we're exploring how to communicate with their Battlefield Management System (BMS) at the moment."

The next iteration of Poseidon's capability, known as Increment Three is progressively being rolled into production aircraft, with final configuration expected in the mid 2020s. Earlier aircraft will be brought to Increment Three standard, but Australia's first P-8A with some of these capabilities will be aircraft number five, which is due to be delivered in the fourth quarter of this year.

"For example, the co-operative P-8A development program has realised that we need to get data off the jet via satellite, so we've moved that forward from 2020 and the capability will be available in 2017.

"The aircraft is currently set up to perform the ISR role now and it's only going to get better with the planned improvements in the future," WGCDR Titheridge concluded.

A further test of Poseidon's capabilities during OT&E will occur during Exercise Talisman Sabre in the middle of the year.

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# Made in Australia Cubesats

**SMALL**, light (nanosats by definition are between one and 10 kilograms in mass), and cheap in satellite terms at around one million dollars per unit, their payload defines their utility. Some are built by joining modular cube units to add more payloads, hence the name CubeSats. And like iPad applications, the opportunities are limited only by human imagination.

Since the first two nanosats launched in 1998 more than 650 have followed, 141 in 2014 alone. And the wave is about to become a tsunami: the 2017 worldwide schedule alone calls for 569 launches. US analysts predict the nanosatellite and microsatellite markets will grow from US\$890 million in 2015 to around US\$2.52 billion by 2020.



# PHILIP SMART | ADELAIDE

In the nano class of satellites, the commercial space industry may have found its equivalent of the iPad.

But while universities, small businesses and even well heeled individuals ponder the very real prospect of owning satellites, defence analysts and related space industries are only too aware that this "new space" brings both opportunity and risk to existing expensive, sometimes critical space based assets from nanosat equipped adversaries.

At first glance a two-kilogram nanosat could hardly be useful as a kinetic weapon against traditional communications or surveillance satellites, some of which are larger than the family car. But it wouldn't have to, according to Dr Matt Tetlow, founder of Adelaide satellite design and integration company Inovor Technologies. A radio broadcasting close enough to drown out the satellite's ability to hear anything else would be enough.

"You could literally send a nanosatellites up, close to a communications satellite,

Dr Tetlow believes nanosats offer an affordable route to space for industry and defence. shout in its ear and render it useless," he said. "So you could render a billion dollar satellite useless with something that could be produced for a million dollars."

Tetlow has form in the field. Inovor Technologies is an experienced defence contractor, consulting in fields such as satellite technologies, space situational awareness, electronic warfare, systems engineering, and simulation and modelling for the Defence Science and Technology Group, among others.

# **Building skills**

As an adjunct researcher in aerospace engineering at Adelaide University, Tetlow is also one of a handful of Australians who can claim to have a new satellite in orbit. He instigated, then headed up the university's involvement in the international QB50 nanosatellite project, a novel worldwide challenge in which competing research institutions were offered a free launch of their own satellite as long as it carried a QB50 scientific payload in addition to the university's own. On April 19 the combined University of Adelaide and University of South Australia team saw its two-kilogram SUSat nanosat launched from NASA's Cape Canaveral site on an Atlas V rocket, bound for the International Space Station (ISS). It was deployed into orbit from the ISS on May 25.

"It was a good opportunity for us to build skills," Tetlow said of the project. "QB50 started in 2012 and cube satellites were not really spoken of much at all at that time, but I could see that it was a good way to get in to that industry if it were to take off."

QB50 also proved the Adelaide team, comprising around 50 university students and a dozen staff, already had a lot of what was needed to build a functioning nanosat.

"Most people in CubeSats typically buy stuff off the shelf," Tetlow said. "But my area of expertise is guidance and control, and UniSA's ITR (Institute for Telecommunications Research) is very much in to communications, so I said right, we'll make the communications system, the attitude control, the structure, and then our own special separate payload and also do the software ourselves, which is the biggest thing. And then we'll buy the other stuff off the shelf.

"So we've taken a huge amount of risk but I think at the end of this process we are far higher up the path than anybody else in Australia because we actually have built these systems off a number of iterations. We learnt one way to make a satellite and about 200 ways how not to make a satellite; that's what the process was all about."

# Funding

QB50 was more than a hobby. When the university team's original grant money ran out, Tetlow began contributing funds from Inovor's consulting services. The company retains all of the relevant intellectual property it created for the program and is now translating that in to a range of satellite design and integration services, with plans to build modular small satellite platforms for defence, academia and industry.

"We want to make the satellite for other team's payloads," Tetlow said. "Many universities, research organisations and defence typically don't want to get involved in making platforms because they are interested in research and applications. We'd like to be able to provide a family of platforms, a three, a six and a 12-unit bus platform (power, steering and structure). Then integrate the payload. It could be imaging, it could be comms, anything you imagine."

And Inovor sees limitless defence potential for nanosats. Networks of nanosats are now being considered as space asset tracking devices, feeding object tracks in to an existing US government database to allow identification of suspicious objects, reduce the chance of collision and enable more considered risk analysis for future satellite positioning in orbit. They could also serve as low-cost, quicklaunched stopgaps to cover loss or damage to a less easily replaced larger satellite.

Tetlow sees some irony in SUSat's launch from the ISS, as the two spacecraft are poles apart in complexity, affordability and accessibility for those who could make best use of the new technology. The majority of future nanosats are likely to be launched by private operators, not national space agencies.

"People have this perception that space equals International Space Station, that space is special, it's too hard, it's huge," he said. "Space is exciting, but it's not special. Nanosatellites are made in a laminar flow cabinet, which is just a \$10,000 cupboard that blows laminar air out to stop dust going in.

"This level of space is not something that can only be done by NASA. This is achievable and is being done in Adelaide. It's not something that's kind of out of this world and too expensive."



Lieutenant Commander Marc Beecroft from HMAS Sydney conducts training with the Aegis Combat System onboard USS Kidd to prepare for the arrival of the AWDs.

# A path for Australian BMD

# JULIAN KERR | SYDNEY

An upgrade to the AEGIS combat system of the RAN's Air Warfare Destroyers (AWDs) referenced in the 2017-18 budget papers suggests planning is underway to provide the three ships with a Ballistic Missile Defence (BMD) capability.

**GIVEN** concerns about North Korea's strategic missile program and the introduction by China of the Dong Feng-21D "carrier killer" anti-ship ballistic missile said to be able to hit a moving target, this should come as no surprise.

Although the Integrated Investment Plan (IIP) includes a \$4-5 billion provision for upgrades to the AWD combat system between 2017 and 2028, it says nothing about what the upgrades will involve.

Likewise, the 2017-18 Defence Portfolio Budget Statements disclose that first pass approval will be sought for Project Sea 4000 Phase 6 Aegis Capability Upgrade in 2017-18, but it too provides no additional information.

However, the intention to equip the AWDs with the SM-6 long range missile to enhance their capability "against emerging air threats" was explicitly confirmed in both the 2009 and 2012 Defence Capability Plans. This was to have occurred under Project Sea 1360 Phase 1, which now appears to have been absorbed within the wider Sea 4000 Phase 6 undertaking.

For its part, the 2016 Defence White Paper states simply that the AWDs will be equipped with "new advanced surface to air missiles" by the middle of the next decade. The only credible candidate remains the SM-6, and to deploy this on the AWDs will require the command and control element of their Aegis systems to be upgraded to the latest Baseline 9.0 configuration.

The Baseline 8.0 Aegis systems with which the AWDs will enter service - the first Aegis configuration to incorporate an open architecture computing environment – were ordered in 2006 and produced in 2009. Each system languished in storage for several years before testing and integration into its host vessel and is no longer state-of-the-art.

Given the SM-6 requirement, the designation by the USN of Baseline 9.0 as the foundation for all future Aegis upgrades and the RAN's desire to maintain system commonality with the US, the only question would seem to be not if, but when such an upgrade will take place.

Any vessel with Aegis Baseline 9.0 can be given a BMD capability via an optional module. Previous Aegis baselines require a parallel BMD capability that is integrated separately.

Taking into account the expense and time that would be involved in moving to the latest configuration, a decision to upgrade without including the BMD element would seem unlikely.



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# WEAPONS BMD

Those USN Arleigh Burke guided missile destroyers that are already in service are receiving the Baseline 9.C1 configuration. The Baseline 9.D variant is intended for Arleigh Burke Flight IIA new construction.

Both configurations incorporate a multi-mission signal processor that allows the ships to simultaneously track and target both aircraft and ballistic missiles. Earlier baselines handle only one of these missions at a time, a limitation that has required non-upgraded Arleigh Burkes to operate in pairs on some operations.

The Aegis system of the third and final AWD could conceivably have been upgraded to the 9.C1 configuration prior to the ship's delivery to the RAN in early 2020. However, as of early June Ship Three was 60 per cent complete and combat system elements had already been installed.

# **Current missiles**

The AWDs will therefore enter service equipped with the 169km range SM-2 Block IIIB anti-air missile. This is also effective against sea-skimming anti-ship cruise missiles and has a limited utility against surface targets, but it has no BMD capability.

The USN's current standard exo-atmospheric ballistic missile interceptor is the SM-3, equipping the Arleigh Burke-class and several Ticonderoga-class cruisers. The missile is also deployed on two Japanese Maritime Self-Defence Force Atago-class and four Kongo-class destroyers and is to be deployed on three South Korean new-build Sejong the Great destroyers.

Since the first SM-2 was deployed by the USN in 1981 the type has undergone a series of upgrades as well as its evolution into the SM-3 with its LEAP (Lightweight Exo-Atmospheric Projectile) manoeuvring kinetic hit-to-kill warhead for defence against short to medium range (1,000-3,000 km) ballistic missiles in the midcourse phase of flight.

Manufacturer Raytheon says the SM-3's kinetic impact on a target equals that of a 10-tonne truck travelling at 600 mph.

The SM-3 Block IA has a range of about 700km, travels at more than Mach 10, and entered service with the USN in 2006. The more capable Block 1B was commissioned in 2014 and locates its target via a mix of GPS/INS data, midcourse guidance from the launching ship, and its own infrared homing sensors.

The Block IIA, a co-development between the US and Japan, features an improved seeker, a range of 2,500km, travels at more than Mach 15, and is scheduled to enter service in 2018.

Its ability to engage distant targets above the atmosphere means the SM-3 can defend large areas, although its cost of around \$12.5 million per copy renders it unlikely to be fired in salvo.

## SM-6

Enter the SM-6, a development that combines missile propulsion, airframe and ordnance from the limited-production BMD-capable SM-2 Block IV, and features an enlarged version of the active radar seeker on the Advanced Medium Range Air-to-Air Missile (AMRAAM) in service with the RAAF.

Not only is the SM-6 more affordable at around \$5 million each; the missile is



capable of over-the-horizon engagement of enemy aircraft and cruise missiles using networked targeting information while the SM-6 Dual 1 upgrade adds a new, more powerful processor and sophisticated targeting software to also provide a proven inatmosphere ballistic missile defence.

As part of its new 'Distributed Lethality' surface warfare doctrine, the USN in 2015 revealed plans to additionally employ the SM-6 in an offensive anti-surface warfare role.

Then US Secretary of Defence Ash Carter disclosed in February 2016 that the missile's range in the ASuW role had been increased from 250 to 370 km. Together with its Mach 3.5 speed, this represents a major advance in range and velocity, although not in warhead size, on the RAN's in-service RGM-84 Harpoon anti-ship/anti-surface missile.

The SM-6's new surface-to-surface mode, reportedly enabled by a software modification without any hardware changes being necessary, was successfully demonstrated against an ex-USN FFG-7 frigate in March 2016.

Nine months' later, two ship-launched

SM-6s intercepted and destroyed a medium-range ballistic missile, suggesting that their targeting capability and high-explosive warheads could also be successfully employed against the Dong-Feng 21D.

In combatting anti-ship ballistic missiles (ASBMs) such as the DF-21D and the

longer-range (3,000-4,000 km) DF-26, it's worth remembering that active defences are just one part of an equation that also focuses on severing or disrupting the many links in the ASBM 'kill chain'.

Since only one of the RAN's three AWDs may be available for operations at any one time due to maintenance, the multi-role flexibility offered by SM-6 would maximise the capabilities available from that ship's 48-cell Mark 41 Vertical Launch System (VLS). The VLS cannot be reloaded at sea.

Each VLS cell can hold an individual SM-6, but a number of cells would need to be retained for the quadpacked Evolved SeaSparrow Missiles (ESSMs) that provide

# "Any vessel with Aegis Baseline 9.0 can be given a BMD capability via an optional module."

the AWD's close-in protection against aircraft and anti-ship missiles.

Using an SM-6 against an enemy surface vessel would, however, mean one less that could be used for the AWD's primary task of air defence. And using an SM-6 against an aircraft would mean one less that could be used to intercept a ballistic missile – although a BMD tasking could take place distant from hostile air activity.

There is, however, no known technical impediment relating to their CEAFAR2 radar and strike-length 48-cell VLS as to why the nine Future Frigates to be built under Project Sea 5000 could not also deploy SM-6 to bolster the fleet's BMD resources.



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The weapons fitout will depend on the mission.

# Lightning lethality — F-35 weapons

# **NIGEL PITTAWAY | MELBOURNE**

WEAPONS

F-35

In December one of Australia's two F-35A Lightning II Joint Strike Fighters notched up an important milestone with the first release of a Paveway II Laser Guided Bomb (LGB).

**THE** event occurred during a sortie over the Barry M. Goldwater Range (BMGR) in the US on December 14 and involved a 500lb GBU-12 weapon, which has been in service on other RAAF platforms for several years. However the occasion was significant in the fact that it marked certification of the first in a series of weapons to be cleared on the F-35A in the lead up to Australian Initial Operational Capability (IOC) in late 2020.

The GBU-12 is so far the only air to ground weapon to be certified for use on the F-35, across all nations. Together with the Raytheon AIM-120C-7 Advanced Medium Range Air to Air Missile (AM-RAAM) beyond visual range weapon, the GBU-12 forms the baseline suite specified by both the US Marine Corps (F-35B) and US Air Force (F-35A) for their IOC milestones, which occurred in July 2015 and August 2016 respectively. This suite confers the F-35 with a limited air to air and air to ground weapons capability from the outset.

Although the deployment of the GBU-12 in December was a first for Australia, both this weapon and AMRAAM have been launched on numerous occasions during the international JSF test program.

Both weapons are able to be carried in the F-35's weapons bay - a requirement if the stealthy characteristics of the aircraft are to be maintained, and it is the dimensions of the bay which will determine which weapons will be integrated with the jet in future times.

The F-35A also has an internal GAU-22/A 25mm Gatling gun, manufactured by General Dynamics Ordnance and Tactical Systems and with 182 rounds of ammunition.

The GBU-12 and earlier AIM-120C-7 variant of the AMRAAM are weapons capabilities hosted within the current 'Block 3I' (Initial) software build. This baseline suite will be further expanded to include other laser and GPS-guided weapons, together with a later version of AMRAAM and the Raytheon AIM-9X-2 within visual range missile, when the 'Block 3F' (Final) software upgrade is introduced to service in 2018 or thereabouts.

Australian IOC requires this expanded range of weapons, but Stephen McDonald, Project Director for F-35 Missions Systems at Capability Acquisition and Sustainment Group (CASG), says all have already successfully been deployed during the F-35 test program and does not see any risk in this respect.

"The 3F software is being tested quite strongly right now," he said to ADM. "That will be delivered in 2018 and we don't go to IOC until the end of 2020, so we've got two years' float and all systems are go."

# **IOC** and beyond

When Australian IOC is eventually achieved, the F-35 weapons suite will include the AIM-120D variant of AM-RAAM, AIM-9X Block II, GBU-12 and two variants of the 1,000 lb GBU-31 Joint Direct Attack Munition (JDAM).





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These weapons are initially being delivered under the aegis of Air 6000 Phases 2A/B, which is acquiring sufficient numbers of weapons and expendable countermeasures to support Operational Test and Evaluation (OT&E), together with five years of sustainment. bWar stocks of the weapons and countermeasures will be acquired under Air 6000 Phase 3 (air to ground) and Phase 5 (air to air).

The AIM-120D is the latest AMRAAM variant, which offers increased range, GPS-guided navigation and a two-way data link over the earlier AIM-120C-7.

The AIM-9X-2 (Block II) is a within visual range infra-red (IR) weapon which has updated electronics' systems and a new data link, which allows a Lock-On After Launch (LOAL) capability that the earlier variant does not currently boast.

RAAF Hornets and Super Hornets currently use the C-7 version of AMRAAM and the earlier version of AIM-9X is the baseline WVR weapon aboard Australia's Super Hornets and Growlers. Both AIM-120D and AIM-9X-2 are already on order for the Hornet, Super Hornet and Growler.

Two variants of the GBU-31 JDAM will be acquired; the standard Mk.84, and the BLU-109/B, which has a penetrator warhead, and also the GBU-39 250lb Small Diameter Bomb (SDB). Australia and Norway are also jointly funding the development of Nammo's APEX (Armour Piercing EXplosive) 25mm rounds for the internal gun.

One of the criticisms often levelled at the F-35 is that it doesn't have the ability to engage moving targets. A basic moving target capability is actually provided by the laser-guided GBU-12, in conjunction with the aircraft's Electro-Optical Targeting System (EOTS), and Stephen McDonald said this will be further enhanced in the future with the acquisition of the GBU-54 Laser JDAM.

"The GBU-54 is a laser and GPS guided weapon which is capable of engaging highspeed ground targets and the latest version of the Small Diameter Bomb (SDB-II), which is a fully-networked weapon with a tri-mode seeker that has out-

standing capability against these types of targets, as well as others," he explained. "Together with an EOTS upgrade scheduled in 2022, they will make targeting moving vehicles more automated."

## Maritime strike weapon

Australia and other JSF partners, such as Norway and Turkey, also have a requirement for a maritime strike weapon, which can be carried within the F-35's weapons bay, and a future software block will address this current shortcoming in the early part of the next decade.

In Australia this capability will be acquired under Air 3023 Phase 1, which was flagged in the recent Defence Portfolio Budget Statement to achieve Second Pass approval in the 2017-18 financial year, but will need to wait for the incorporation of software Block 4.2, which is due for release in the 2022/23 timeframe.

At the 2015 Avalon Air Show, then-Defence Minister Kevin Andrews announced that Australia would co-operate with the Norwegian Ministry of Defence to develop Kongsberg's Joint strike Missile (JSM) as a possible solution to the requirement.

Local Defence industry received a welcome boost with the agreement, with BAE Systems Australia tasked by the Australian Government to develop a passive radio frequency (RF) sensor for JSM, complementing the weapons' current IR seeker.

Competing with Kongsberg/BAE for the maritime strike requirement is Turkey's Roketsan, which signed an agreement with Lockheed Martin in September 2015 to co-operate on the development of the company's SOM-J stand –off cruise missile.

# **Future Capabilities**

Aside from the maritime strike weapon (which was of no interest to the US and therefore left for international partners to develop further down the track) all the F-35 weapons currently on the roadmap are USstandard weapons, chosen initially at least to reduce program risk.

The UK however has sovereign weapons requirements which will be enabled by future software blocks which may well offer alternatives to Australia from the middle of next decade.

The first to be integrated with the JSF is MBDA ASRAAM (Advanced Short Range Air to Air Missile), which was successfully test fired from an F-35B in March. ASRAAM is no stranger to the RAAF, having been the mainstay WVR weapon on the 'Classic' Hornet for many years.

ASRAAM has recently received a technology refresh, particularly in terms of the seeker, to keep it viable until the 2040 timeframe and MBDA literature claims the weapon has70 per cent more propellant than its US rival, conferring greater range and speed and agility.

The UK has also specified MBDA's Meteor as its BVR weapon of choice, which will be integrated with Block 4 software. Meteor has recently been declared operational with the Swedish Air Force's Gripen and will also be integrated with the RAF's Typhoons and France's Rafale fighters. It is earning a reputation for a weapon which cannot be outrun, given its unique throttleable ram jet propulsion system which ensures maximum power when needed, namely in the endgame.

"Not only does Meteor have a long range, but it still has energy at that range and it is highly manoeuvrable," Andy Watson, managing director MBDA Australia explained to *ADM*. "Depending on the engagement geometry it has two or three times the 'no escape' zone of current BVR weapons. It offers a massive step change in missile performance at range."

The third weapon specified by the UK is also an MBDA weapon, in this instance the air to ground SPEAR. This long-range weapon featuring a multi-mode seeker, is designed to meet the threats of the future battlespace, including the ability to engage high end enemy Air Defence Systems as well as a range of static and fast moving land and sea targets.

"I sense a definite desire within Defence to step-up F-35 weapons capability from the mid-2020's and that's really the area we're interested in," Watson said.

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# The soldier as a system

# JULIAN KERR | SYDNEY

Deliveries of 22,000 sets of the Soldier Combat Ensemble (SCE) to the ADF will be completed in the first half of 2018, and several iterative improvements are included in the most recent tranches of the system. **DEVELOPED** under Project Land 125 Phase 3B by Diggerworks and a Capability and Sustainment Group (CASG) project team working closely with the three services, primarily Army, the SCE comprises five elements: Load Carriage Equipment (LCE); Protective Equipment (PE); Tiered Combat Helmet (TCH); Combat Hearing Protection (CHP); and Ballistic Laser Ocular Protection (BLOPS).

Work on the SCE design began in 2009 with its requirements derived from analysis, trial and earlier combat experience.

Feedback on the performance of the



Tiered Body Armour System (TBAS) that was first issued in 2011 to Special Forces and elements of 2nd Battalion RAR in Afghanistan informed spiral development of Tranche One of the SCE prior to its issue in 2015, predominantly to 1st Brigade in Darwin.

The initial tranche was released on the understanding that further improvements would be required, and this process was driven by 7th Battalion RAR in Adelaide and some Special Forces units in collaboration with Diggerworks and CASG.

Tranche Two deliveries in 2016 were allocated predominantly to 3rd Brigade in Townsville, and Tranche Three deliveries will begin later this year to 7th Brigade in Brisbane, southern states, and Special Operations Command.

The SCE has already been delivered to entitled RAAF and RAN units in the Northern Territory, northern Queensland and South Australia. Units elsewhere will receive their equipment as part of Tranche Three allocations.

Due to its expense the SCE is not a onefor-one replacement for legacy equipment. Units receive the SCE on an 'access not ownership' methodology and troops receive the ensemble through the unit as opposed to individual issue.

# TBAS

The SCE and its Tiered Body Armour System (TBAS) is essentially a deconstruct of an earlier focus by Defence on a general purpose soldier system as opposed to a specialist solution. The tier definitions equip combatants according to their primary operating task and likelihood of threat encountered.

Tier 0 is a basic configuration consisting of baseline belt webbing, assault pack and ballistic and laser eye protection that is issued to all combatants.

Tier 1 is a bespoke SCE configuration for unique or specialist combatants who require highly specialised equipment for a particular role. This includes combat diving, and concealable systems.

Tier 2 Dismounted involves close combat troops within a dismounted combined arms team - infantry, joint fires, and combat engineers and medics. It may also include select signallers and other common attachments to dismounted combined arms teams; RAAF security force squadrons; and RAN boarding parties.

Tier 2 Mounted comprises troops who operate armoured fighting vehicles as part of a combined arms team.

Tier 3 General Combatant encompasses



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# WEAPONS SCE



combatants whose role is primarily focused on providing combat support to combined arms teams, and includes all corps not included in the Tier 2 definitions and select RAAF non-security force personnel.

"We decided that if need be we'd discriminate on the price of equipment to get the very best for Tier Two combatants who will engage in close combat as their core role," Colonel Mark Jennings, Director Soldier Combat Systems Program at Army Headquarters, told *ADM*. (AP) threats. Soft armour inserts protect against low velocity rounds, fragmentation and blunt force trauma as well as supporting the hard armour plates.

Also included are edged blade/spike inserts which defeat piercing and slashing hand weapons as well as blunt force trauma, and extremity (shoulders, neck, abdomen and groin) protection against low velocity rounds and fragmentation. A side highvelocity plate can also be used in the lower back/side area.

"The laws of physics and material science mean that SCE changes are iterative rather than evolutionary."

"Generally speaking, Tier Two combatants have more equipment and the opportunity to reconfigure it for the mission being undertaken."

The TBAS element of the SCE delivers ballistic plate carriers in Tier 2 and Tier 3 designs.

Both designs provide a platform for the carriage of protective equipment, including two types of ceramic armour plates, one of which defeats 7.62mm and 5.56mm high velocity rounds, and a heavier and bulkier plate that protects against armour-piercing The Tier 3 TBAS plate carrier provides additional coverage of the combatant for greater protection, while the Tier 2 carrier maximises mobility and reduces the thermal burden (core temperature) of the soldier.

Both tiers include the Modular Lightweight Load Carriage Equipment (MOLLE) which allows the attachment of other role-specific pouches directly onto the plate carriers.

The Tiered Combat Helmet from US company Team Wendy utilises a high cut design with rails to facilitate the integration of head-borne equipment and provides protection from fragmentation, blunt force impact and rounds of up to 9mm. The helmet uses an over-ear protection system and external microphones to enable active listening, and also integrates with service radios, providing an increased level of situational awareness.

Initially tendered as a Tier 2 solution, it

was subsequently selected for use by both Tier 2 and 3 to replace an over-ear style helmet used in Tranche 1 for both tiers.

#### Weight

"We're trying to reduce the weight of the ensemble as best we can. In some cases that means we've traded off some soft armour protection, and we've balanced survivability in terms of a high-cut helmet and the need to integrate head-mounted combat equipment," COL Jennings said.

"What we haven't done is reduce ballistic protection which is common to all configurations. When we first went to Iraq we settled on protection against armour-piercing ballistic threats which gave us a fairly weighty ballistic plate. When we went to Afghanistan and started doing more mobile infantry-type tasks we decided on the high-velocity plates as the benchmark for both Tier 2 and Tier 3, with the opportunity to upscale to the heavier AP plates where appropriate.

"Craig International Ballistics on the Gold Coast have done some fantastic work on both plates and cut the weight of the body armour system by four to five kilograms."

The TBAS currently weighs around 6.5 kg for a Tier 2 system and 7.3 kg for the Tier 3. This weight is for a baseline configuration and includes the nylon body armour carrier, soft armour inserts and two high velocity ballistic plates. It does not include other load-carrying equipment or mission essentials such as water and ammunition.

Although the carrier in which the plates are inserted comes in a range of sizes, both types of protective plates are the same size.

"It's not ideal, but printing a plate for an individual size at the same price we pay for them now is some way off," COL Jennings commented.

As he points out, the laws of physics and material science mean that SCE changes are iterative rather than evolutionary, and tend to focus on scaleable issues.

"If you're inside the lethal radius of an IED, unfortunately it probably means the loss of a soldier. If you're in close proximity, that's where the system is designed to protect you."

Modifications for Tranches Two and Three include adoption of the high cut helmet, numerous small improvements to pouches, and a complete redesign of the large field pack. Lumbar issues resulting from sitting in Bushmasters and other vehicles for lengthy periods have seen the TBAS redesigned to enable the backplate to be quickly removed and reinserted by a soldier or a battle buddy.

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# SOLDIERS AND GENTLEMEN

**AUSTRALIAN BATTALION COMMANDERS IN THE GREAT WAR, 1914 - 1918 By William Westerman** Published by Cambridge **University Press RRP \$59.95 in hardback** ISBN 9781107190627 Published as part of the Australian Army History Series, this book examines the background, role and conduct of the Australian infantry battalion commanders of the AIF during WWI. Despite being a vital position within the AIF





LINE OF FIRE AFTER PEARL HARBOUR CAME RABAUL By Ian Townsend Published by Fourth Estate/ HarperCollins RRP \$29.99 in paperback ISBN 9781460750926

lan Townsend had planned to write a novel about life in 1942 but along the way he stumbled across the tantalizing true story of an Australian woman and her 11 year old son executed as spies in 1942. Not long after the attack on

Pearl Harbour, the Japanese swept into the strategically important coastal town of Rabaul in the then Australian Territory of New Guinea. Marjorie Manson, a dressmaker from Adelaide, was living in Rabaul at the time with her son Richard (Dickie). She had left her husband in Adelaide to live with plantation owner Ted Harvey in Rabaul. When the Japanese invaded, the trio, along with Marjorie's brother Jimmy and plantation manager Bill Parker fled into the jungle. They were a small part of the 1,500 Australian contingent in Rabaul at the time. Unfortunately they were betrayed. When caught they had in their possession a pistol and a radio. After a three-day trial, the five Australians were found guilty of being spies and soon after executed by firing squad. Townsend has captured the mood of this terrible act in a story that successfully combines fact with fiction.



THE BATTLES BEFORE **CASE STUDIES OF AUSTRALIAN ARMY** LEADERSHIP AFTER THE VIETNAM WAR **Edited by David Connerv** Published by Big Sky Publishing RRP \$19.99 in paperback ISBN 9781925520194 Part of the Australian Military History Series, The Battles Before examines the role of our senior Army leaders in preparing the army for war. **David Connery characterises** the work of generals in peacetime as "battles" whether this be battling



#### AUSTRALIA'S DEFENCE STRATEGY EVALUATING ALTERNATIVES FOR A CONTESTED ASIA

By Adam Lockyer Published by Melbourne University Publishing RRP \$59.99 in paperback ISBN 9780522869316

How would we know a good defence strategy if we saw one? This is one of the first questions posed in this book, having first acknowledged that there is no shortage of defence strategy suggestions across the range of Australian defence scholarship. The central aim of this book is for budgets in committee rooms; battling the volume of paperwork; shaping the army's image in the media or fighting for the acceptance of ideas that may lead to change in the service. The five case studies cover the period from the early 1970s to 2010 and involve a series of pivotal moments in the history of the Australian Army: the dramatic downsizing that followed the Vietnam War; the 1985 Dibb Review and the build up to the East Timor intervention in 1999. The final chapter focuses on the crucial role of the Army's leadership in developing the next generation of leaders. Brig Nicholas Jans, in his foreword, highlights the fact that, of the 100 or so Australian officers who achieved the rank of major general since the Vietnam War, only a small number commanded troops on overseas operations.

to take our knowledge of strategy that final mile and construct a framework that can 'test' proposed defence strategies and identify their respective strengths and weakness. By doing so, this book breaks new theoretical ground and makes an important contribution to our understanding of strategy in general and defence strategy in particular. Lockyer then applies this analytical tool to the leading arguments in Australia's defence debate and finds that there is still substantial work to be done. He writes compellingly of his understanding of 'measures short of war' that nations use to expand their spheres of influence, stopping short of anything that would prompt a military response. He concludes by proposing a new Australian defence strategy for a contested Asia that would pass the test for a 'good' defence strategy.

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Location Crowne Plaza, Newcastle Email Amy.Hamilton@hunternet.com.au The event theme will be 'Collaboration with SME's in Defence'; there will also be a gala dinner on the preceding evening from 6pm. Please send expressions of interest to Amy Hamilton.

#### AUSTRALIAN SIMULATION CONGRESS (FORMERLY SIMTECT) Date: 28-31 August Location: Sydney

Website: www.simulationcongress.com Simulation Australasia, the national body for those working in simulation in Australasia, will once again bring together the SimHealth and SimTecT streams for the 2017 Australasian Simulation Congress (ASC) with opportunities for a number of joint sessions of mutual interest.

#### NATIONAL SECURITY SUMMIT Date 29-30 August 2017 Location Canberra Website informa.com.au

This year's Summit will provide a high level, policy-driven dialogue with a theme and focus on 'Policy, Coordination & Stability' and con¬sider the nuanced and often divergent approaches to securing peace and stability within and around Australia.

#### ADM DEFENCE ESTATE AND BASE SERVICES SUMMIT Date: 21 September

#### Location: Hyatt Hotel, Canberra Website: www.admevents.com.au/ defence-conference/defence-supportservices-summit

Faced with the biggest reform for 40 years, budget cuts and organisational change, Defence is presented with a new paradigm how to effectively innovate and deliver value for money services to support our armed forces in the wake of a changing fiscal and operating environment.

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A theme and focus on 'Innovation, Management and Integration of the Defence Estate' and will examine the 2016 White Paper, the First Principles Review and what this means, current & future reforms, total asset management, BIM in defence and non-materiel procurement.

# INTERNATIONAL ASTRONAUTICAL CONGRESS 2017

Location: Adelaide Venue: Adelaide Convention centre 25 Sep - 30 Sep, 2017 Web: http://www.ice2017.cen/

Web: http://www.iac2017.org/ The Adelaide congress will be the 68th annual IAC. The Congress is the one time of the year when all space actors come together. Global, multidisciplinary and covering all space sectors and topics, it offers everyone the latest space information, developments and above all, contacts and potential partnerships. Please note that the Space Generation Advisory Council (for young space professionals) will be holding their annual event from 21 September, together with a United Nations workshop.

#### PACIFIC 2017 Date: 3-5 October 2017 Location: Sydney Website: www.pacific2017.com.au

PACIFIC 2017 will be a comprehensive showcase of the latest developments in naval, underwater and commercial maritime technology. The expo will again provide the essential showcase for commercial maritime and naval defence industries to promote their capabilities to decision-makers from around the world.

#### NZDIA FORUM Date: 10-11 October Location: Wellington Website: www.nzdia.co.nz

NZ's premier Defence event for the Defence and Defence Industry community.

# ADM'S NORTHERN AUSTRALIA DEFENCE SUMMIT

#### Date: 25-26 October Location: Darwin Convention Centre Website: www.admevents.com.au/ defence-conference/northern-australiadefence-summit

As Northern Australia continues to establish itself as a key military and strategic region for the ADF and its partners, further investment is needed to support the multitude of major defence projects and the necessary infrastructure, maintenance and sustainment required for their operation. With defence industry contributing almost seven per cent of economic growth of the top end, the region continues to maximise the benefits as the ADF's gateway to Asia and as a strategic base for long term defence collaboration and force posture.

#### MILCIS

#### Date: 14-16 November 2017 Location: Canberra Convention Centre Website: www.milcis.com.au

The annual Military Communications and Information Systems (MilCIS) Conference welcomes military and government organisations, academia, and defence industries to contribute to the future direction of military communications and information systems.

#### PARARI 2017: AUSTRALIAN EXPLOSIVE ORDNANCE SAFETY SYMPOSIUM

Location: UNSW Canberra Venue: Adams Auditorium 21 Nov - 23 Nov, 2017 **Organised by: Capability Systems Centre Contact name: Wayne Hargreaves** Phone: 20 6268 9566 Email: capabilitysystems@adfa.edu.au Web: capabilitysystems@unsw.adfa.edu.au PARARI 2017: Australian Explosive Ordnance Safety Symposium is an international explosive ordnance safety symposium hosted jointly by the Australian Department of Defence Directorate of Ordnance Safety, Thales and the Capability Systems Centre. The Conference welcomes delegates from around the globe to discuss a broad range of explosives, munitions and weapons safety topics.

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#### Continued from page 58

**BELL:** We are probably the largest aircrew training company in the world and we're very proud of that, both across our defence business and in civil aviation. But I think the important factor to look at here is how CAE is changing its business to become a training systems integrator, where we look to partner with our customers address their training requirements in a much more holistic way.

The Air domain is clearly a very important part of our heritage but actually, we have significant experience in the naval and land domains. I believe the integrated nature of training, future operations and true mission capability will come through having a company alongside the ADF that concentrates on training across all domains.

A great example in the naval domain is that CAE is building a naval training centre in the UAE, and this epitomises our training systems integrator strategy. There will be a major training facility at Taweelah and six distributed training sites, all of which will be networked to completely transform the ability of the Emirates to train and rehearse across all platform types in the naval environment, including aviation assets that support maritime operations. The comprehensive training solution will train everything from individual sailors right up to a flotilla.

# ADM: What do you envisage as short term and longer term advances in simulation? Where is it heading?

**BELL:** Everybody agrees simulation is far more cost effective than flying a live aero-

plane, driving the live tank or putting a fleet of ships at sea, but to think in that way I think is missing the point. The beauty of simulation-based training is that you can move everything into a more integrated environment where you can put live, virtual constructive (LVC) train-

ing together in a balance that makes sense to accomplish your training objective.

One of the phrases I've used many times is that military training is all about repetition. What simulation-based training helps do is put the old head on young shoulders, so that our airmen, sailors and soldiers can go to conflict in defence of the nation best prepared for the operations that we ask them to do.

I think also about how I trained many years ago. Today's generation learns differently and I think it's the art of learning that is important and making learning relevant to the way kids think today. It means that they retain information longer and they're better able to replicate that training under stressful situations. And that's where we spend a lot of our R&D efforts at a company like CAE, looking at the art of learning and how to make it more effective.

# ADM: How is the Hawk Mk127 simulator capability going since the contract was announced in February this year?

**BELL:** The Hawk simulator program is going fine. We've had a few ups and downs but the first Hawk into RAAF Williamtown was ready-for-training in May. The second, going

"That's where we spend a lot of our R&D efforts; looking at the art of learning and how to make it more effective."

> into RAAF Pearce, was expected to be readyfor-training in June, and we're hopeful that by September the second simulator into Williamtown will be fully up and running. The Hawk program is a great example of how the ADF are embracing the modern simulation technologies and investing in a cost-effective training solution.

> And again, using technologies like a common database (CDB) in these training devices encourages the ability to link into frontline aircraft as well as land and naval forces, which is great for integrated training.

# **ADM:** What are your intentions for the King Air 350 simulator at East Sale once the RAAF's earlier Pro Line 2 aircraft are retired?

**BELL:** We're in the process of looking at continuing to keep that training device relevant and we're looking at the Pro Line 21 configuration update at a time when the ADF is ready.

# **ADM:** Are there any other applications for a King Air 350 simulator style contract to other platforms?

**BELL:** We definitely believe the training services delivery model like we are

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#### Continued from page 55 🕨

providing for RAAF King Air training is one that should be exploited in the future. There's huge capacity for third party training on various devices.

The King Air is good because it's outside of the base (at RAAF East Sale), but one of the things that I think is important for defence forces to look at is to better utilise their training devices, perhaps as contracts are being written, so that there is a facility for friendly nations and allies to come and use - not just use the training devices, but share and exchange experiences and tactics. I think it's very important that you train alongside the people that you're going to fight with.

We do believe defence forces globally are looking more at training services delivery opportunities where the government doesn't necessarily need to own the capital assets. Another great example is the US Army Fixed-Wing Flight Training Centre that CAE has just opened in Dothan, Alabama, where we have a long term training service to provide US Army with academic, simulator, and live flying training.

ADM: The RAAF is ideally moving towards all KC-30 training being undertaken in the simulator. Is this possible with other types, for example, the C-17? BELL: I am clearly very familiar with CAE's technology and the KC-30, though I'm less familiar with just what capabilities the C-17 simulator has.

But I would hope that the future is all about transferring a significant portion of training off the operational assets and putting it into realistic and high quality synthetic training. And that synthetic training can be done on a range of training media, from desktop and part-task trainers up through the full-mission simulators.

What's important for Defence is that their training partner should be working hand in glove with them, such that the misintellectual property rights embedded in the simulators themselves or third party training media, but as long as there are good interfaces that can link into the open standards then there are no technical issues that cannot be overcome.

ADM: Can you provide some more detail of your involvement with Team Reaper Australia that was announced at Avalon? BELL: This is a really exciting program for CAE. CAE is the provider of all MQ-1 Predator and MQ-9 Reaper training to the United States Air Force and we are also about to deliver the highest-fidelity Predator Mission Trainer for the Italian Air Force.

We also just announced we will be providing a comprehensive remotely piloted aircraft training centre to the UAE Air Force. We are the global training partner for General Atomics and as such we'll have a very important role to play should the General Atomics platform be chosen as the RPA platform for Australia.

**ADM:** Given that a lot of the air programs have now been decided, are you optimistic for future growth in Australia? **BELL:** Yes, absolutely. I mentioned the fact that CAE has a wonderful presence in air programs and we're very grateful for that. I think we have a responsibility as a defence contractor to provide good value for money to the ADF. I do see growth in the naval domain, particularly with power

# " What's important to Defence is that their training partner is working hand in glove with them."

sion readiness and having trained crews is the primary goal so they are available at the point of need.

**ADM:** Are there barriers to being able to link simulators together that are operated by different companies or supplied by different manufacturers?

**BELL:** There are a few technical challenges, but it can be done and CAE has done it for defence forces around the world. Sometimes there might be sensitivities around projection and the link to the US as highlighted in the 2016 Defence White Paper. So I think there is good opportunity for growth in Australia.

And Australia is a thought leader in many, many respects in this part of the world and we've been here for 30 years, we're not about to close up shop and move.

My remit is very much to become more integrated with the ADF and to grow CAE's business from Australia and its influence across the region.

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# FROM THE SOURCE

# NIGEL PITTAWAY | MELBOURNE

CAE is a major provider of training and simulation services to the ADF and Ian Bell took up his role in January 2017. *ADM*'s Deputy Editor-at-Large Nigel Pittaway recently spoke with him to learn more about the company's presence in Australia.

# lan Bell

Vice President and General Manager CAE Middle East and Asia Pacific Defence and Security

# PROFILE | IAN BELL

1979	Joined Royal Air Force and became a helicopter pilot
1990	Exchange posting to US Air Force Special Operations Command as an MH-60G pilot and later Evaluator and Flight Commander
2005	Commander of RAF Aldergrove in Northern Ireland
2007	Joined CAE as managing director of CAE Aircrew Training Services
2009	Became managing director of CAE (UK)
2012	Appointed vice president and regional business lead for CAE Europe, Defence & Security
2015	Added responsibility as vice president and general manager, Europe, Middle East and Africa (EMEA)
2017	Vice president and general manager for the Middle East and Asia Pacific



# **ADM:** To begin, can you provide a brief overview of CAE's footprint in Australia and your current activities here.

**BELL:** CAE has had a great presence in Australia now for over 30 years and are very proud of the way that we've serviced the ADF. We have staff at over 20 sites across Australia and NZ, and provide a range of training support services on airborne platforms across the Army, Air Force and Navy.

For example, we delivered the MH-60R Seahawk training system at Nowra and are now providing the on-site training support. We have over 300 employees in Australia alone but, we also make Australia our headquarters for Asia/Pacific and the Middle East, so we reach all the way from Abu Dhabi to Auckland from our headquarters here in Sydney.

# **ADM**: You have been in the current position for a little while. How do you perceive the state of the defence industry in Australia at the current time?

**BELL:** I think it's a very interesting time. I've always viewed Australia as being a very mature, very professional defence force, and that's borne out really by the amount of engagement the ADF has across the world. We're very fortunate to be here in this exciting time because of the renewed focus on developing the local industry and a growing defence budget. As a home market – we view Australia as one of our home markets – and the footprint is very good.

I think the defence budget is exciting. Ministers have announced big programs worth billions of dollars, particularly in the naval environment, and we very much look forward to being part of that modernisation program.

# **ADM**: What impact do you foresee as a result of Defence's Smart Buyer initiative which has been the topic of some discussion lately?

**BELL:** I think it's a very commendable initiative. We haven't really seen too much of it in CAE at the moment, but we have particular skill sets, given our depth and breadth of training expertise and I think as long as the process is transparent and the initiative is consistent across all services, then I believe CAE and perhaps the wider industry at large will be very supportive.

# **ADM**: Do you foresee opportunities for CAE to further engage with Defence through strategies like Air Force's Plan Jericho?

**BELL:** Absolutely. Plan Jericho is basically what we're all about, which is helping create an integrated training enterprise to cost-effectively support mission readiness. I think that as equipment becomes far more complex in the real world, simulation-based training will become more and more critical, particularly when we look at mission effectiveness. I think Jericho is a great initiative and when we look at moving forward, the plans for programmes such as JP9711 (Core Simulation Capability), will also link into it.

This will become increasingly important with the introduction of sophisticated equipment such as the F-35, which will find it very challenging to practice missions in the live environment. Fifth-generation platforms like the F-35 will drive training into a fully integrated and joined up synthetic environment.

We're ideally placed to be part of that and to really bring value with our training systems integration expertise. It's all about industry bringing value to the Defence Forces.

**ADM**: CAE is known predominantly as an air-related company. What opportunities are you pursuing in other domains here in Australia?

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# **Ballistic Missile Defence**

# What are Ballistic Missiles?

Ballistic missiles are distinct from other types of missiles because they can travel beyond the earth's atmosphere to reach their target. Ballistic missiles are powered by rockets on the way up (boost phase), travel through space (midcourse phase) and then follow a freefalling trajectory towards their target once they have re-entered the earth's atmosphere (terminal phase). Ballistic missile launch sites can include land, silos, trucks, trains, submarines, ships, and aeroplanes. Ballistic missiles can be used to deliver nuclear warheads.

Ballistic missiles are categorised by range:

- Short-range ballistic missiles (range of less than 1,000km)
- Medium-range ballistic missiles (range of 1,000 3,000km)
- Intermediate-range ballistic missiles (IRBMs) (range of 3,000 5,500km)
- Inter-continental ballistic missiles (ICBMs) (range of more than 5,500km)

States with the ability to deploy nuclear warheads using ballistic missiles include the US, China, Russia,

UK, France, Pakistan and India.	s 33(a)(i)		
	s 33(a)(i)	An inventory of	
nublicly known ballistic missile stocks by country is at Attachment A			

# What is Ballistic Missile Defence (BMD)?

BMD aims to counter ballistic missile attacks and discourage states from acquiring ballistic missiles. BMD systems can incorporate intelligence gathering, early warning systems to detect launches, sensors to detect and track missiles, capability to intercept the warheads in flight, and battle-management systems to keep track of potential targets, available interceptors and debris.<sup>1</sup> One of the challenges of BMD is distinguishing between the missile, the rocket or booster and potential decoys during flight.

# Australian Approach to BMD

In July 2004, Australia and the US signed a Framework Memorandum of Understanding (MoU) on Missile Defense Cooperation and, in October 2005, agreed to a Research and Development MoU. Since then, Australian support for and cooperation with the US BMD program has been reinforced in the majority of Australia-United States Ministerial Consultations (AUSMIN) communiques.

The 2013 Defence White Paper recognised the specific threats to Australian interests from states such as the Democratic People's Republic of Korea and Iran, and the increasing range of ballistic missile threats to deployed forces. While supporting the deployment of BMD systems by the United States in response to such threats, the White Paper undertook to continually examine potential Australian capability responses – including for the defence of deployed forces and strategic interests. The White Paper stated that Australia will continue to participate in exercises and research programs with key partners to ensure

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<sup>&</sup>lt;sup>1</sup>Davies, A & Lyon, R 2014, 'Ballistic missile defence: how soon, how significant and what should Australia's policy be?', *ASPI Strategic Insights,* available from <u>https://www.aspi.org.au/publications/ballistic-missile-defence-how-soon,-how-significant,-and-what-should-australias-policybe/SI71\_BMD.pdf</u>

Government remains fully informed of global developments in BMD. This is an evolved position from the 2009 Defence White Paper, which stated the Government's opposition to the development of a unilateral national missile defence system by any nation as it would be at odds with the maintenance of global nuclear deterrence.

Following a meeting on 12 June 2014 between Prime Minister Abbott and US President Obama, the White House announced that the two countries were 'working to explore opportunities to expand cooperation on ballistic missile defense, including working together to identify potential Australian contributions to ballistic missile defense in the Asia-Pacific region.'<sup>2</sup>

#### US Ballistic Missile Defence System (BMDS)

US missile defence technology is designed to counter all types of ballistic missiles. The US Ballistic Missile Defence System (BMDS) includes ground- and sea-based radars for detecting and tracking targets, and ground- and sea-based interceptor missiles for destroying incoming ballistic missiles, either by a direct collision ('hit-to-kill' technology) or through an explosive blast fragment warhead (i.e. the explosion destroys the missile without a direct hit). The **Patriot missile** and its variants, including the **Patriot Advanced Capability-3 (PAC-3) missile**, are part of the US land-based BMD system.

# Aegis Ballistic Missile Defence System

The Aegis BMD system is the naval component of the BMDS and aims to combat missile threats from detection to kill. Currently, Aegis involves missile launchers and radars mounted on cruisers and destroyers, but is intended to transition to land in the future in the form of 'Aegis-Ashore', part of the Obama Administration's phased adaptive approach towards missile defence in Europe.

The Aegis BMD system enables ships use hit-to-kill technology to intercept and destroy short- and medium-range ballistic missiles. The Aegis BMD system also enables ships to survey and track intercontinental ballistic missiles and work with other BMDS elements to provide advance warning. In addition to the US and Australia, Aegis technology is presently used by Japan, Norway, Republic of Korea and Spain.

The Hobart Class Air Warfare Destroyer (AWD) is equipped with the Aegis Weapon System Baseline 7.1, which allows the AWDs to employ SM-2 missiles (see below) for air defence. s 33(a)(i), s 47C

s 33(a)(i), s 47C

<sup>&</sup>lt;sup>2</sup> White House, Office of the Press Secretary, 12 June 2014, *The United States and Australia: An Alliance for the Future*, available from <a href="http://www.whitehouse.gov/the-press-office/2014/06/12/fact-sheet-united-states-and-australia-alliance-future">http://www.whitehouse.gov/the-press-office/2014/06/12/fact-sheet-united-states-and-australia-alliance-future</a>

# Standard Missiles 2, 3 & 6 (SM-2, SM-3 & SM-6)

- Part of the Aegis BMD system, the SM-2 is the main surface-to-air, air defence weapon used by the US Navy, designed for fleet area air defence and ship self defence. The SM-2 Block IV, the most advanced variant, can intercept short range ballistic missiles in the terminal stage of flight.
   15 allied navies, including Australia, use SM-2s and its variants.
- The **SM-6** is intended to succeed the SM-2 Block IV and will provide defence against ballistic missiles in the terminal stage of flight. Intended for deployment on cruisers and destroyers, the SM-6 will have advanced signal processing, advanced guidance control capabilities and the ability to defend against fixed- and rotary-wing aircraft, unmanned aerial vehicles, and land-attack anti-ship cruise missiles in flight, both over sea and land.
- The **SM-3** is a hit-to-kill missile used on Aegis BMD warships, but can be launched from both sea and land. The SM-3 can intercept ballistic missiles in space by releasing an exoatmospheric 'kill vehicle' which directly collides with the target and destroys it. This contrasts to the SM-2 and SM-6, which can only intercept ballistic missiles when they have re-entered the earth's atmosphere in the terminal flight stage, which is the shortest intercept window.

# **Strategic Implications for Australia**

- At present, the potential for ballistic missile attacks on Australian are limited to intercontinental range missiles, making nationally-based BMD a low priority for Australia.
  - However, the tactical ballistic missiles possessed by North Korea and China make BMD a key capability for regional defence posturing.
- BMD cooperation is becoming an important strategic consideration in both the US alliance and Australia's relationship with Japan<sup>3</sup>.
  - Further, BMD capabilities could be of use s 33(a)(i) s 33(a)(i)
- Equipping Australia's AWDs with Aegis BMD capabilities is a practicable example of what increased BMD cooperation could entail, enabling joint deployment with American or Japanese forces to contribute to broader BMD efforts in the region.<sup>4</sup>
  - However Australia should consider the developmental nature of the capability to achieve this, the significant costs associated with the capability, and how it fits with the force structure requirements currently being reviewed.

<sup>&</sup>lt;sup>3</sup> Davies, A & Lyon, R 2014, 'Ballistic missile defence: how soon, how significant and what should Australia's policy be?', *ASPI Strategic Insights,* available from <a href="https://www.aspi.org.au/publications/ballistic-missile-defence-how-soon,-how-significant,-and-what-should-australias-policy-be/SI71\_BMD.pdf">https://www.aspi.org.au/publications/ballistic-missile-defence-how-soon,-how-significant,-and-what-should-australias-policy-be/SI71\_BMD.pdf</a>
<sup>4</sup> Ibid.

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# **Attachment A - Ballistic Missile Inventories by Country**

**Source:** Arms Control Association, July 2014, 'Worldwide Ballistic Missile Inventories', accessed 29 July 2014 <u>http://www.armscontrol.org/factsheets/missiles</u>

Additional Information: Nuclear Threat Initiative, 2014, 'Country Profiles', accessed 29 July 2014 http://www.nti.org/country-profiles/

ICBM

Country	System	Status	Range	Nuclear Capable
Afghanistan	Frog-7	Operational	70 km	
	Scud-B	Unknown	300 km	
Armenia	Frog-7	Operational	70 km	
	Scud-B	Operational	300 km	
Bahrain	ATACMS (MGM-140)	Operational	Up to 300 km	
Belarus	Frog-7	Operational	70 km	
	SS-21	Operational	120 km	
	Scud-B	Operational	300 km	
China	B611 (CSS-X-11)	Operational	250 km	
	M-7 (CSS-8)	Operational	150-230 km	
	DF-3A (CSS-2)	Retiring	3,100 km	Nuclear Capable
	DF-4 (CSS-3)	Operational	5,500 km	Nuclear Capable
	DF-5 (CSS-4, Mod 1)	Operational	12,000 km	Nuclear Capable
	DF-5A (CSS-4, Mod 2)	Operational	13,000 km	Nuclear Capable
	DF-11 (CSS-7)	Operational	300 km	Nuclear Capable

	DF-11A (CSS-7)	Operational	600 km	Nuclear Capable
	DF-15 (CSS-6)	Operational	600 km	Nuclear Capable
	DF-15 (CSS-6 Mod 2)	Operational	880+ km	Nuclear Capable
	DF-15 (CSS-6 Mod 3)	Operational	720+ km	Nuclear Capable
	DF-21 (CSS-5, Mod 1)	Operational	2,100 km	Nuclear Capable
	DF-21A (CSS-5, Mod 2)	Operational	1,770+ km	Nuclear Capable
	DF-21C (CSS-5 Mod 3)	Operational	2,150-2,500 km	
	DF-21D ASBM variant	Development	1,500 km	
	DF-31 (CSS-10 Mod 1)	Operational	7,200+ km	Nuclear Capable
	DF-31A (CSS-10 Mod 2)	Operational	11,200+ km	Nuclear Capable
	Julang (JL) 1 (SLBM)	Operational	1,700+ km	
	Julang (JL) 2 (SLBM)	Tested/Development	7400+ km	
Egypt	Scud-B	Operational	300 km	
	Project-T (Scud B)	Operational	450 km	
	Scud-C	Operational	550 km	
	Frog-7	Operational	70 km	
	Sakr-80	Operational	80+ km	
France	M4A/B (SLBM)	Operational	6,000 km	Nuclear Capable
	M51.1 (SLBM)	Operational	6,000 km	Nuclear Capable
	M51.2 (SLBM)	Development	6,000 km	
Georgia	Scud B	Operational	300 km	
Greece	ATACMS (MGM-140)	Operational	165 km	
India	Prithvi-1	Operational	150 km	Nuclear Capable
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	Prithvi-2	Operational	250 km	
	Prithvi-3	Development	350 km	
	Dhanush	Testing	350 km	
	Sagarika/K-15 (SLBM)	Testing	700 km	
	Agni-I	Operational	700 km	Nuclear Capable
	Agni-II	Operational	2,000 km	
	Agni-III	Testing	3,000 km	
	Agni-IV	Tested	4,000 km	
	Agni-V	Testing	5,000+ km	
	Agni-VI	Development	8,000-10,000 km	
	К-4	Testing	3,000 km	
	K-5 (SLBM)	Rumoured Development	5,000 km	
Iran	Mushak-120	Operational	130 km	
	Mushak-160	Operational	160 km	
	Qiam-1	Testing	500-1,000 km	
	Fateh-110	Operational	200 km	
	Tondar-69 (CSS-8)	Operational	150 km	
	Scud-B (Shahab 1)	Operational	300 km	
	Scud-C (Shahab 2)	Operational	550 km	
	Shahab-3 (Zelzal-3)	Operational	800-1,000 km	
	Ghadr 1/Modified Shahab-3/Kadr Ghadr 110	Tested/Development	1,000-2,000 km	

	Ashura/Sejjil/Sejjil-2	Tested/Development	2,000-2,500 km	Nuclear Capable <sup>5</sup>
	BM-25/Musudan (Suspected)	Unclear	2,500+ km	
Iraq	Al Fat'h (Ababil-100)	Operational	160 km	
	Al Samoud II	Operational	180-200 km	
Israel	Lance	Operational	130 km	
	Jericho-1	Operational	500 km	Unknown
	Jericho-2	Operational	1,500-1,800 km	Unknown
	Jericho-3	Tested/Status Unknown	4,000+ km	
Kazakhstan	Frog-7	Operational	70 km	
	Tochka-U (SS-21)	Operational	120 km	
	Scud-B	Operational	300 km	
Libya	Frog-7	Operational	70 km	
	Al Fatah (Itislat)	Tested/Development	200 km	
	Scud-B	Operational	300 km	
North Korea	KN-02 (Toksa/SS-21 variant)	Tested/Development	100 km	
	Scud-B variant/Hwasong 5	Operational	320 km	
	Scud-C variant/Hwasong 6	Operational	500 km	
	Scud-D/Hwasong 7	Operational	700 km	
	No-Dong-1(A)	Operational	1,300 km	
	Frog-7	Operational	70 km	

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	Taepo Dong-1	Tested	1,600+ km	
	Taepo Dong-2 (2-stage)	Tested/Development	5,500+ km	
	Taepo Dong-2 (3- stage)/Unha-2 SLV	Tested/Development	15,000 km	
	No-Dong-2(B)/ Musudan/BM-25	Tested/Development	2,500+ km	
Pakistan	Hatf-1	Operational	80-100 km	
	Hatf-2 (Abdali)	Tested/Development	190 km	
	Hatf-3 (Ghaznavi)	Operational	300 km	Nuclear Capable
	Shaheen-1 (Hatf-4)	Operational	750 km	Nuclear Capable
	Ghauri-1 (Hatf-5)	Operational	1,300 km	Nuclear Capable
	Ghauri-2 (Hatf-5a)	Tested/Development	2,300 km	
	Shaheen-2 (Hatf-6)	Tested/Development	2,500 km	
	Ghauri-3	Development	3,000 km	
Romania	Scud-B	Operational	300 km	
Russia	Scud-B (SS-1c Mod 1)	Operational	300 km	
	Scud-B (SS-1c Mod 2)	Operational	240 km	
	RS-20V (SS-18 Satan)	Operational	11,000-15,000 km	Nuclear Capable
	RS-18 (SS-19 Stiletto)	Operational	10,000 km	Nuclear Capable
	SS-21	Operational	120 km	
	SS-21 Mod 2	Operational	120 km	
	SS-21 Mod 3	Operational	70 km	
	SS-24	Operational	10,000 km	
	RS-12M Topol (SS-25 Sickle)	Operational	10,500 km	Nuclear Capable

	RS-12M1 Topol-M (SS- 27)	Operational	10,500 km	Nuclear Capable
	RS-12M2 Topol-M (SS- 27 Mod-X-2) (silo)	Operational	11,000 km	Nuclear Capable
	RS-24 Yars (mobile and silo versions) (SS-27 Mod 2)	Operational	10,500 km	Nuclear Capable
	RS-26 Rubezh	Operational	5,800 km	
	SS-26 Iskander	Operational	400 km	
	SS-N-8 (SLBM)	Operational	8,000 km	
	RSM-50 Volna (SS-N-18) (SLBM)	Operational	6,500-8,000 km	Nuclear Capable
	SS-N-20 (SLBM)	Retiring	8,300 km	
	RSM-54 Sineva (SS-N- 23) (SLBM)	Operational	8,000 km	Nuclear Capable
	RSM-56 (Bulava-30) (SLBM)	Operational	8,050+ km	Nuclear Capable
	SS-26 Stone (Iskander-E)	Operational	280 km	
	Frog-7	Operational	70 km	
Saudi Arabia	DF-3 (CSS-2)	Operational	2,600 km	
	DF-21 East Wind (CSS-5)	Operational	2,100+ km	
Slovakia	SS-21	Operational	120 km	
South Korea	NHK-1	Operational	180 km	
	NHK-2	Operational	260-300 km	
	ATACMS Block 1/A	Operational	300 km	
Syria	SS-21	Operational	120 km	
	Scud-B	Operational	300 km	

	Scud-C	Operational	500 km	
	Scud-D	Tested/Development	700 km	
	Frog-7	Operational	70 km	
Taiwan	Ching Feng	Operational	130 km	
	Tien Chi	Operational	300 km	
Turkey	ATACMS (MGM-140)	Operational	165 km	
	Project J	Development	150 km	
Turkmenistan	Scud-B	Operational	300 km	
United Arab Emirates	Scud-B	Operational	300 km	
United Kingdom	D-5 Trident II (SLBM)	Operational	7,400+ km	Nuclear Capable
United States	ATACMS Block I	Operational	165 km	
	ATACMS Block IA	Operational	300 km	
	ATACMS Block II	Operational	140 km	
	Minuteman III (LGM- 30G)	Operational	9,650-13,000 km	Nuclear Capable
	D-5 Trident II (SLBM)	Operational	7,400+ km	Nuclear Capable
Vietnam	Scud-B	Operational	300 km	
Yemen	Scud-B	Operational	300 km	
	SS-21 (Scarab)	Operational	120 km	
	Scud variant	Operational	300-500 km	
	Frog-7	Operational	70 km	