

# ADM **DEFENCE WEEK** AUSTRALIAN DEFENCE MAGAZINE SERVING THE BUSINESS OF DEFENCE **PREMIUM EDITION**



A NASA sounding rocket clearing the launch tower.

NASA

## NASA rockets set to launch from Arnhem Land

Ewen Levick | Sydney

**NASA has chosen to launch rockets from the Equatorial Launch Australia (ELA) spaceport in Nhulunbuy, 700 kilometres east of Darwin, in 2020.**

NASA's Goddard Space Flight Centre/Wallops Flight Facility has indicated it would like to progress discussions with ELA on a temporary launch facility for sounding rockets for scientific investigations.

Four rockets will launch next year under the contract. Sounding rockets spend a short time in sub-orbital space, conducting tests and collecting data.

ELA CEO Carley Scott [told the ABC](#) that this is the first time NASA has agreed to launch rockets from a commercial spaceport, highlighting the maturity of Australia's space industry.

"What we think the deal will mean is bringing unprecedented growth in the space sector in Australia," Scott said.

"NASA's interest in conducting a sounding rocket campaign in Australia shows the increasing importance of commercial launch activities from Australia," head of

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## “What we think the deal will mean is bringing unprecedented growth in the space sector”

the Australian Space Agency, Dr Megan Clark said.

“As these activities build momentum, the Agency will continue its focus on creating a supportive regulatory environment that fosters industry growth, while ensuring public safety and considering our international obligations.”

ELA’s business case is built on leveraging the NT’s proximity to the equator to reduce fuel consumption and lower launch costs.

“It’s a significant point,” Scott [said to ADM](#) in April. “It gives us an internationally competitive position because if you’re within 15 degrees either side of the equator, you get extra rotational velocity from the ground speed of the Earth. So it’s less fuel and more payload per mission.

“We’ve got the low risks of a remote location, but it’s a mining town so there’s a deep water port that’s already established, city quality airport, main township, roads, and fibre optic cable.”

The prospect of an operational spaceport in the Territory will certainly be of interest to Defence, which is reportedly investigating tactically responsive space capabilities to off-set the anti-satellite capabilities of near-peer competitors. This could involve repeated launches of small satellites from Australia to provide navigation and communication services to deployed troops operating in a space-denied environment.

## What next for US Littoral Combat Ships and FFG(X)?

Duncan McCrae | Melbourne

**Earlier this year I [wrote for ADM](#) suggesting that there was opportunity to include the BAE Type 26 Global Combat Ship (GCS) in the mix for the USN’s FFG(X) program.**

In response to that article, a number of colleagues and readers not unreasonably suggested that GCS was far too much at odds with the scope and intent of the FFG(X) requirements which had clearly set its sights on a cheaper ‘parent-design’ option to sit neatly alongside its Littoral Combat Ship (LCS) fleet as part of the USN’s future small surface combatant (SSC) force.

The Congressional Research Service (CRS) has provided updates for both the [LCS](#) and [FFG\(X\)](#) programs this month. Most recently, Lockheed Martin has confirmed their withdrawal from the race for selection as FFG(X) prime. In light of these developments, analysis can suggest the likely way ahead for both programs.

CRS has identified two further concerns most recently under consideration by Congress. The first of these is whether or not to procure any further LCS in FY2020. The USN has stated it would rather see funding channelled towards advancing the FFG(X) program.

Given that the current LCS fleet of 35 vessels exceeds the projected force



The Freedom-class USS *Milwaukee* (LCS 5) slides into Lake Michigan at the Marinette shipyard in Wisconsin.

USN

of 32, it should be a fairly easy decision to cease LCS procurement. This path, however, opens the concern of shipyard sustainability in the gap between LCS completion and the commencement of the FFG(X) build.

With echoes of Australian shipbuilding's 'valley of death', the fear of having to reduce or even stop productivity at either of the two current shipyards in Mobile and Marinette is reasonably founded and would no doubt factor politically, especially during uncertainty over the China/US tariff war.

Lockheed's decision to withdraw from the FFG(X) contest potentially makes the situation even more tenuous, with ongoing work at the Marinette shipyard now heavily reliant on the success of the Fincantieri bid. The CRS report on LCS suggests a best-case solution where both yards would have obtained portions of work. This now seems unlikely. The worst scenario would see a third prime stand up its own separate yard.

For the FFG(X), the outlook is somewhat rosier. The key debate is likely to revolve around balancing the project cost against obtaining a platform which can retain a comparable capability edge over potential adversaries throughout the intended lifespan of FFG(X). With the last FFG(X) projected to be procured in FY2030 and assuming a 30-40 year service life, this is not an inconsequential factor.

This 'growth margin' (five per cent for FFG(X)) is often what provides a force with its tactical and economical edge. While the US clearly has a larger overall pot of gold, they also have far more to fund and so a proposal offering a greater duration of capability should be favourable.

While formally touted by Lockheed as a decision taken in order to concentrate on involvement the FFG(X) combat and other systems, their advice to the USN

**“Lockheed’s decision to withdraw from the FFG(X) contest potentially makes the situation even more tenuous”**

that the requirements of FFG(X) have grown beyond their initial offering is telling.

Five-Eyes navies are coming to realise that to put a major surface combatant in harms' way in the future fight requires some significant baseline capability, both offensive and defensive.

It follows that with a more mature appreciation of FFG(X) capability needs, larger offerings such as FREMM and F-100 move ahead in the race. More capable again and providing greater scope for future upgrade, Type 26/GCS now has even more validity as a contender.

Interestingly, this maturing of requirements may also be exactly what Huntington

Ingalls Industries have been waiting for. While initially offering their National Security Cutter hull, the lack of subsequent clarity has fed some speculation that the company could be looking to options such as the UK Type 31e. However, Type 31e was designed to be deliberately general-purpose, meaning it may come up against the same hurdles as the LCS variants.

There is one final factor which may yet play a part in the debate around both LCS and FFG(X). What is the impact of increased focus on unmanned sea vehicles, such as [Sea Hunter](#)? One suspects that for the moment it too will be limited

in its capability and more likely continue to be developed towards bespoke missions in discrete warfare spheres.

So in the short term, perhaps we have seen the end to LCS procurement. The strategic situation is changing too rapidly to delay the arrival of a more survivable and lethal platform armed with the capabilities the USN wants and needs. With the Freedom-class stepping out of the FFG(X) competition, it would be unsurprising to see Austal withdraw for similar reasons.

A Type 31e proposal or similar is possible and probably has a good chance if the project stands rigidly by its initial requirements. Yet as these requirements slowly appear to be developing, an invitation for BAE to enter the FFG(X) race with GCS must surely be just around the corner. Time will tell.

**“The strategic situation is changing too rapidly to delay the arrival of a more survivable and lethal platform”**

## Embraer signs electric flight partnership agreement

**Nigel Pittaway | São José dos Campos**

**Embraer and Brazilian technical company WEG signed an agreement on May 29 for the development of an electric-powered aircraft.**

The research and development program will use an Embraer EMB-203 Ipanema agricultural aircraft to develop the technology, with a view to an initial flight occurring either late this year or early in 2020. The Ipanema is currently the only aircraft currently certified for operation using 100 per cent methanol biofuel, according to Embraer.

Under the agreement, WEG will supply the electric motor, the frequency inverter for the power train and the associated control system.

“Our powertrain technology, developed over the years in tried and tested





Manfred Johann, WEG Automation superintendent director, and Daniel Moczydlower, Embraer EVP Engineering & Technology.

NIGEL PITTAWAY

applications in trains, buses, trucks and boats, and in constant evolution, has paved the way for this exciting scientific and technological co-operation project," WEG automation superintendent director Manfred Johann said.

"Together with Embraer we will work not only to enable the electric propulsion of aircraft, but also to increase the technological capacity of WEG, of Embraer and of Brazil, taking our country to an even more competitive level."

Embraer Executive Vice President of Engineering and Technology Daniel Moczydlower said the Ipanema platform was chosen because it is already in production and is not capital intensive, but also because, as an agricultural aircraft, it can carry a significant payload and is therefore readily capable of accommodating the electric propulsion system.

"Advances in scientific research can make clean and renewable energy a major enabler of a new era of urban and regional air mobility that is more accessible to the population," he said.

The initial co-operation will seek to develop opportunities for innovative technologies which may lead to future opportunities for new powerplant configurations, including hybrid propulsion.

"By creating this technological development agreement with WEG, we have combined more than 100 years of innovation from two leading companies," Moczydlower said.

Moczydlower also said that the technology has applications in the military domain, particularly for flight training, where electric propulsion has the potential to significantly decrease operating costs.

*Disclaimer: The writer travelled to Brazil as a guest of Embraer.*

**"Advances in scientific research can make clean and renewable energy a major enabler"**

# Will Germany really spend more on defence?

Jacqueline Westermann | Sunshine Coast

**At the end of last month, a new [GlobalData report](#) claimed Germany's defence budget was increasing by 6.5 per cent compound annual growth rate between 2020 and 2024.**

Before defence wonks get too excited, it is worth looking at what that means and whether this is the news that will finally bring music to NATO ears.

Since the NATO summit in Wales in 2014, NATO members have agreed to spend two per cent of GDP on defence by 2024. Whether this is a smart measure to use is a debate for itself, but the wording in the summit agreement is what Germany usually cites as an excuse: the alliance agreed to raise defence expenditure 'towards' two per cent. In early 2019, Germany assured its fellow NATO members that it would spend 1.5 per cent by 2024, which displeased members already hitting the target.

**"Federal politicians are trying to win back voters. That won't happen through defence budget increases"**

President Trump has been vocal about low defence spending in Germany, quoting big budget surpluses and export records. He hasn't been the first president to complain about European NATO members' spending behaviour, but he is the first president to threaten to 'go it alone'.

A [poll](#) from September 2018 saw more Germans expressing support for increased defence spending (43 per cent against 32 per cent the year before). Yet 55 per cent don't support more German involvement in international crises.

Overseas defence watchers often oversee the absence of foreign and security policy debate amongst the German public. Consequently, the voting public lacks understanding of how increasing military spending is in their interest. This requires an honest and transparent conversation between politicians and their electorate, but with support for ruling parties dwindling in recent elections and polling, federal politicians are trying to win back voters. That won't happen through defence budget increases.

Nonetheless, Chancellor Angela Merkel [confirmed](#) an increase in defence spending in May. A boost of more than €5 billion will raise the defence budget to €47.32 billion this year; a 10 per cent increase compared to 2018. This is

## MOST READ ONLINE AT [WWW.AUSTRALIANDEFENCE.COM.AU](http://WWW.AUSTRALIANDEFENCE.COM.AU)



1. [Hanwha announces Land 400 Phase 3 team](#)
2. [ANAO releases Land 200 report: late and over budget](#)
3. [Japanese howitzers find space in Australia](#)
4. [Research aims to improve submarine stealth](#)
5. [Army seeks new UAS](#)



US Defence Secretary Pat Shanahan is looking at his German counterpart Ursula von der Leyen to increase defence spending, but may be disappointed.

US DOD

significant for Germany but only moves spending towards 1.35 per cent of GDP. Reaching the promised 1.5 per cent of GDP by 2024 will require a budget of more than €60 billion.

There are also [important issues](#) that could thwart any bigger defence budget plans as the economic growth rate decreases. Reports on the state of the Bundeswehr and its tools put an additional question mark behind the country's commitment to common defence, even though Germany is the second largest troop contributor to NATO missions.

But is it really all about the money? An [analysis](#) by the German Council of Foreign Relations argues that more money won't work without more efficiency. The analysis shows that the current midterm plan could create an investment gap of €46 billion between 2019 and 2024. The newly announced increase of €5 billion now won't easily overcome that gap. One concrete suggestion from the analysis is a call to establish an independent parliamentary controlled office to control the budget and enhance financial transparency.

So yes, Germany is set to spend more – for now. Whether this the kind of 'more' NATO partners are expecting remains to be seen.

*Note: Jacqueline Westermann is a regular academic commentator on European and Russian security. In addition to her research for ASPI's International Program, she has also been working with The German Marshall Fund of the US' Warsaw office and the Moscow German Newspaper.*



# Defence partners with UK on materials research

**Defence has selected seven innovative research proposals from Australian universities and industry to develop and integrate advanced materials that will provide enhanced protection for military platforms.**

Research will enable the development of new adhesives for joining high temperature structures, processes for integration and repair of different composite types, and bonding of ceramic armour for enhanced protection against bullets and missiles.

Successful proposals were submitted by the University of Southern Queensland, UNSW, RMIT University, Deakin University, CSIRO and Qinetiq Australia.

Chief Defence Scientist Professor Tanya Monro congratulated the successful organisations on their proposals.

“These proposals will enable Defence to solve growing scientific challenges by developing versatile new materials that will lead to improved performance and increased durability for our platforms,” Professor Monro said.

Proposals were sought in response to a joint call led by Australia’s Defence Science and Technology Group, the UK’s Defence Science and Technology Laboratory, and the Defence and Security Accelerator. Parallel launches were held in London and Melbourne with over 120 delegates in attendance.

Professor Monro said the first synchronised bilateral call between the UK and Australia was a unique approach to sourcing innovative science and technology solutions under the Small Business Innovation Research for Defence initiative.

“These proposals will enable Defence to solve growing scientific challenges by developing versatile new materials”



The research will enable the development of ceramic armour bonding to enhance protection against missiles.

DEFENCE



"The experience has given us valuable insight and a wider perspective on problems shared by our two countries," Professor Monro said.

"This process could become standard to facilitate future international calls for high-quality, impact-focused research and increased collaboration with our allies. An opportunity exists for Australia and the UK to jointly progress some of these projects to the next stage."

A total of 70 proposals were received, 32 from Australia and 38 from the UK. The UK also selected seven, supplying funding of £562,700. The seven Australian proposals will receive \$900,000 from the [Next Generation Technologies Fund](#).

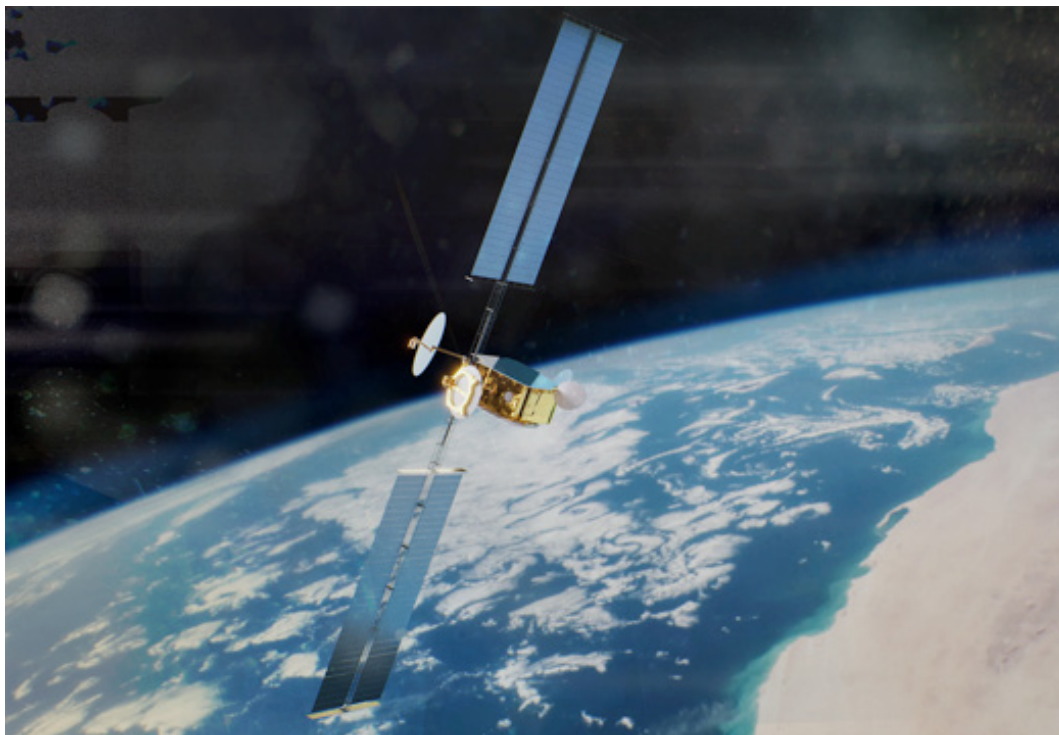
## Airbus wins deal on broadband satellites

**Airbus has signed a contract with Inmarsat to design, manufacture and build the first in their next generation of geostationary [Ka-band satellites](#), Inmarsat GX7, 8 & 9.**

The three satellites are the first to be based on Airbus' new OneSat product line, which is fully reconfigurable in orbit.

Featuring on board processing and active antennas, the three Ka-band spacecraft will be able to adjust their coverage, capacity and frequency. They will deliver power and bandwidth in real-time to adapt to Inmarsat's requirements to provide HTS (High Throughput) broadband connectivity for the mobility market.

Airbus' OneSat is based on a standard, modular and design-to-manufacture approach, and can be delivered more quickly than existing telecommunications satellites.



A concept image of a OneSat satellite deployed in space.

AIRBUS

"We are launching the OneSat product line for our customer Inmarsat, following the successes of the Airbus-built Inmarsat-4 spacecraft, Alphasat and the Inmarsat-6 satellites, which are currently under construction," Airbus' Head of Space Systems, Nicolas Chamussy said.

## "OneSat is a truly disruptive product"

"This latest contract continues the long standing innovation relationship between Airbus and Inmarsat. OneSat is a truly disruptive product, both from a manufacturing, and operational point of view, which allows Airbus to offer our customer a market enabling solution with reduced cost and time to orbit."

"OneSat's high flexibility, very compact design and fast production approach perfectly fits our ambition for our next generation GX spacecraft," Rupert Pearce, CEO of Inmarsat, said. "The new satellites will support the growth of the Global Xpress mobility services, in particular to service emerging 'hot spot' regions worldwide. The GX7, 8 & 9 satellites will represent the next evolution of HTS technology incorporating new highly flexible capabilities which can be deployed very quickly to support the rapid evolution of the traffic growth from year 2023 onwards."

The Australian Border Force was the [first comprehensive customer](#) for Inmarsat's high speed Ka band GX satellite network. ABF Cape class patrol boats are also able to access both the GX and WGS satellite networks.

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# Forthcoming Events

## ADM EVENTS

More detail on **ADM** Events can be found on our dedicated website:

- [Women in Defence Awards](#) – 11 July 2019
- [ADM STEM and Defence Summit](#) – 14 August 2019
- [ADM Defence Estate and Base Services Summit](#) – 12 September 2019
- [ADM North Australian Defence Summit](#) – 23-24 October 2019

## Defence Industry Security Program (DISP) Roadshow

**Date** 10 June 2019

**Location** AGSVA Office, Brisbane

**Website** [www.defence.gov.au/dsvs/industry](http://www.defence.gov.au/dsvs/industry)

The Department of Defence, in consultation with industry, has reformed DISP to provide industry increased opportunities to work with Defence and easier access to Defence security services. On Monday 10 June the Defence Security and Vetting Service (DS&VS) will be presenting on the new DISP. We encourage you to come along and learn about the new program and benefits of becoming a DISP member.

## ASPI International Conference: War in 2025

**Date** 12-14 June, 2019

**Location** QT Hotel, Canberra

**Website** [www.aspi.org.au/event/aspi-international-conference-war-2025](http://www.aspi.org.au/event/aspi-international-conference-war-2025)

Join distinguished international and Australian speakers for two days of debate on the future of warfare. ASPI's War in 2025 conference will consider the key drivers that could lead to conflict in the next decade, how the relative power dynamics between the great powers are changing, multi-domain warfare now and in 2025, what technologies will shape future warfare, information operations, and the next Defence White Paper.

## Paris Air Show

**Date** 17-23 June 2019

**Location** Le Bourget

**Website** [www.siae.fr/en](http://www.siae.fr/en)

The 53rd Paris Air Show will once again bring together all the players in this global industry around the latest technological innovations. The first four days of the Show will be reserved for trade visitors, followed by three days open to the general public.

## ITAR, EAR and Export Controls Training

**Date** 25 June 2019

**Location** 50 Queen St, Melbourne

**Website** [www.stickytickets.com.au](http://www.stickytickets.com.au)

Need help understanding ITAR, EAR and Export Controls? Join us for a 1-day face-to-face training course to de-mystify the complex area of Export Control regulations. The course will address: an overview of the ITAR, EAR and DEC; how the ITAR and EAR applies to all areas of your business, including technical, operations and management; advice on employing dual and third country nationals; how to establish a compliance program within your business; licensing and permit requirements, and much more.

## DTC Defence Industry Dinner & Awards Ceremony 2019

**Date** 04 July 2019

**Location** Adelaide Convention Centre

**Website** [dtd.org.au](http://dtd.org.au)

The Defence Teaming Centre's Annual Defence Industry Dinner & Awards Ceremony is the premier event of its type and last year attracted more than 540 guests, from more than 200 companies. The event is well attended by both State and Federal Government representatives, defence primes and industry SMEs who connect and network throughout the evening.

## ITAR, EAR and Australian Export Controls Training

**Date** 04 July 2019

**Location** SMC Conference Centre, Sydney

**Website** [www.internationaltradeadvisors.com.au](http://www.internationaltradeadvisors.com.au)

International Trade Advisors is proud to offer our third annual training on US and Australian Export Controls. The one-day workshop is focused on how these regulations affect Australian industry. It will be held on 4 July 2019 at the SMC in the Sydney CBD.

## The Future of Australia-Indonesia Relations in a Contested Indo-Pacific Order

**Date** 05 July 2019

**Location** Tattersalls Club, Brisbane

**Website** [www.rusi.org.au/event-3331760](http://www.rusi.org.au/event-3331760)

This seminar is RUSI Queensland's blue-ribbon event for 2019. Constant examination of the Australia-Indonesia bilateral relationship is required to understand the dynamic shifts in political, diplomatic and social foundations of these two close neighbours. This year provides a special opportunity to recalibrate the strengths and weaknesses in this key regional relationship.



## Defence Maritime Environment Working Group

**Date** 24 July 2019

**Location** National Gallery of Australia, Parkes, Canberra

**Website** [www.business.gov.au](http://www.business.gov.au)

The Maritime Environment Working Group (MEWG) is a forum for engagement between Defence and the Maritime Industry to consider opportunities for innovation and collaboration early in the capability life cycle. It provides an opportunity to test the strength of capability requirements and proposals, to inform industry regarding future capability programs and challenges and to foster the development of Navy's capability modernisation program.

## ADM Essington Lewis Awards

**Date** 31 July 2019

**Location** National Convention Centre, Canberra

**Website** [www.defence.gov.au/casg/dplusi](http://www.defence.gov.au/casg/dplusi)

ADM's Essington Lewis Awards will return to the National Convention Centre on Wednesday 31 July 2019 to recognise excellence in Defence projects. The event is limited to the first 1000 attendees wishing to network and interact with Defence and defence industry leaders, celebrate the achievements of their peers and be entertained by our celebrity MCs. This black tie gala event is not to be missed!

## Defence + Industry Conference

**Date** 01 August 2019

**Location** National Convention Centre, Canberra

**Website** [www.defence.gov.au/casg/dplusi](http://www.defence.gov.au/casg/dplusi)

The Defence + Industry Conference is the premier Defence and industry conference held in the national capital. Consistently attracting in excess of 1100 delegates to hear from Defence and industry leaders discussing collaboration in the acquisition and sustainment space. Thursday 1 August will see the National Convention Centre come alive with informative, thought-provoking presentations from Defence decision makers and industry leaders, along with interactive Q&A sessions and networking opportunities.

## DST Scindicate 2019: Partnering for Impact

**Date** 15-16 August

**Location** Adelaide, SA

**Website** [Scindicate@dst.defence.gov.au](mailto:Scindicate@dst.defence.gov.au)

Once again, industry, universities and research agencies are invited to participate in the two-day activities which will include technology demonstrations, business matchups, workshops, briefings and laboratory tours, as well as opportunities for networking and forging new collaborations. A Next Generation Technologies Fund Showcase will be a special feature of the event.

## PGCS 2019

**Date** 20 – 22 August 2019

**Location** The Canberra Rex Hotel, Canberra

**Website** [www.pgcsymposium.org.au](http://www.pgcsymposium.org.au)

Now in its 7th year, PGCS 2019 will focus on ways to build the foundations needed to create project and program success. Creating the organisational capability needed to underpin the consistent delivery of successful projects in the 2020's starts at the top. Leadership and a sustained focus are required to build a culture of excellence that can balance innovation with surveillance and accountability, encourage learning, and manage knowledge effectively.

## Hunter Defence Conference 2019

**Date** 23 August

**Location** Crown Plaza Hunter Valley

**Website** [www.trybooking.com/book/event?eid=503298](http://www.trybooking.com/book/event?eid=503298)

The 2019 10th anniversary Hunter Defence Conference will focus on driving collaboration between Defence Primes, NSW regional SMEs, academia and the Department of Defence. Key presentations at this year's conference will include capability development staff from Army, Navy and Air Force Headquarters, Defence Primes articulating the support requirements they will have over the coming decade from regional SMEs as well as a policy outline from the office of the new Minister of Defence.

## Australasian Simulation Congress

**Date** 02 – 05 September 2019

**Location** Gold Coast Convention and Exhibition Centre, Gold Coast

**Website** [www.simulationcongress.com](http://www.simulationcongress.com)

The Australasian Simulation Congress provides a focused opportunity for industry development, business growth, training, discussion and distribution of information related to Simulation, Modelling, Training and Decision Support. Simulation Australasia can help you directly engage with industry, policy makers, Government and relevant stakeholders to facilitate you and your organisation achieving the success only a truly international Congress can provide.

## Australian Cyber Conference 2019

**Date** 07-09 October 2019

**Location** Melbourne Convention and Exhibition Centre

**Website** [cyberconference.com.au](http://cyberconference.com.au)

The Australian Cyber Conference 2019 will provide business leaders with insights and best practices taught by the industry's top experts through keynotes, panel sessions and live demonstrations. Attending the conference will enable you to network with these practitioners to help you better understand and manage current threats, as well as identify and prepare to meet emerging challenges.

## Pacific 2019

**Date** 08-10 October 2019

**Location** Sydney Convention Centre

**Website** [www.pacificexpo.com.au](http://www.pacificexpo.com.au)

As the only comprehensive international exhibition of its kind in the Indo-Asia-Pacific region, PACIFIC 2019 will again provide the essential showcase for commercial maritime and naval defence industries to promote their capabilities to decision-makers from around the world.

## 2019 Parari Australian Explosive Ordnance Safety Symposium

**Date** 05-07 November

**Location** ADFA

**Website** [parari@defence.gov.au](mailto:parari@defence.gov.au)

This year's symposium brings together delegates from around the world to discuss the latest innovations and advances in explosives, munitions and weapons safety. International and local experts from industry, academia, military and government will share their research to explore Explosive Ordnance Safety opportunities and challenges as a community.

## MilCIS 2019

**Date** 12-14 November 2019

**Location** Canberra Convention Centre

**Website** [www.milcis.com.au](http://www.milcis.com.au)

In November each year, the Defence Chief Information Officer Group (CIOG) partners with the UNSW Canberra and the Institute of Electronic and Electrical Engineers (IEEE) to present MilCIS. 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.

## SubSTEC 5 Conference

**Date** 18-21 November

**Location** Esplanade Hotel, Fremantle

**Website** [www.submarineinstitute.com](http://www.submarineinstitute.com)

The 5th Submarine Science, Technology and Engineering Conference (SubSTEC 5) will be held at the Esplanade Hotel, Fremantle, WA 18th-21st November 2019. The theme of the Conference will be: 'Innovation and Investment in the Sub-Sea Environment'. SubSTEC5 will be held with the support of the Institute of Marine Engineering, Science and Technology (IMarEST).

## Corrosion and Prevention 2019

**Date** 24-27 November

**Location** Crown Promenade, Melbourne

**Website** [conference.corrosion.com.au](http://conference.corrosion.com.au)

Corrosion and Prevention 2019 will bring together leading researchers and industry practitioners who combat corrosion daily. Diverse technical streams will showcase the latest developments in corrosion, ranging from fundamental corrosion science to hands-on application.

## Land Forces 2020

**Date** 01-03 September 2020

**Location** Brisbane Convention Centre

**Website** [www.landforces.com.au](http://www.landforces.com.au)

The biennial LAND FORCES exposition is an international industry event to showcase equipment, technology and services for the armies of Australia and the Indo-Asia-Pacific. The Land Forces 2020 team is now setting about ensuring the event will achieve its goals of providing an effective platform for the exchange of ideas on key land forces issues and of taking Australian industry to the world.