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Australian fighter-sized UAS unveiled

Boeing ATS to act as 'loyal wingman'

WRITER: ANDREW McLAUGHLIN

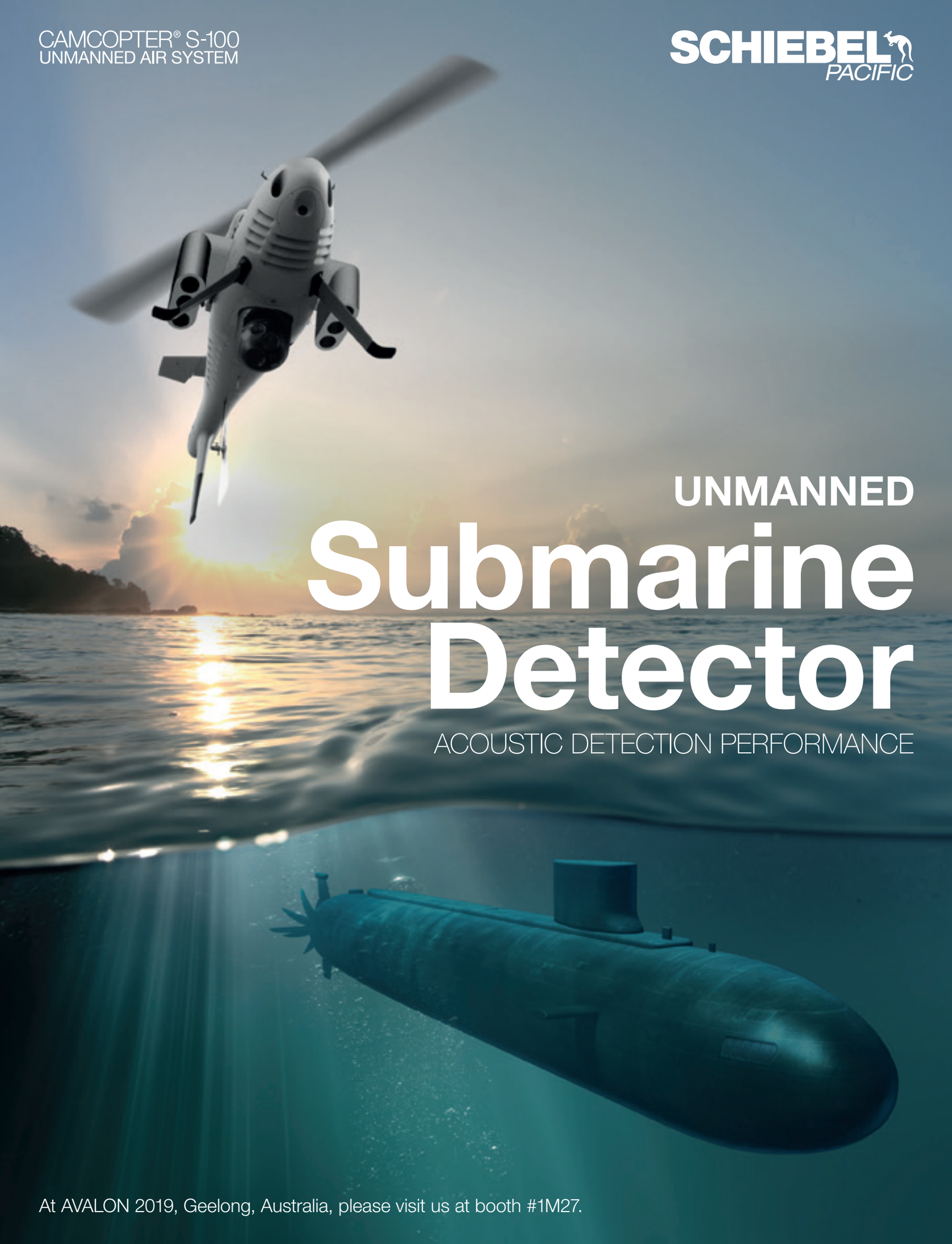
Defence Minister Christopher Pyne has unveiled what could be the first high performance military aircraft designed and built in Australia in more than 60 years.

On Wednesday morning, Minister Pyne revealed the Boeing Airpower Teaming System (ATS), an Australian-designed fighter-sized unmanned system designed to act as a 'loyal wingman' in conjunction with high value assets such as the P-8A Poseidon or E-7A Wedgetail, or with combat aircraft like the F-35A or F/A-18F.

The system has been developed in conjunction with the RAAF and the Defence Science & Technology (DST) Group. For the development, Boeing has partnered with CONTINUED PAGE 4

Defence Minister Christopher Pyne making the announcement at the airshow. PETER CHRISMAS

SHOW HIGHLIGHTS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STEM-based cadet training wins drone lift

Defence Minister Christopher Pyne has launched a program for Australian Air Force Cadets (AAFC) to work with Sydney-based JAR Aerospace in delivery of a joint training initiative.

Under the program – dubbed Project Bradfield – JAR Aerospace will deliver more than 3,000 drones to the AAFC from July 1 to support science, technology, engineering and mathematics (STEM) development.

"This new training initiative, which will focus on science, technology, engineering and maths (STEM)-based training, will inspire cadets to learn and keep pace with technologies being adopted by the Royal Australian Air Force," Minister Pyne said.

Minister for Defence Personnel, Darren Chester added: "Working with JAR Aerospace, an emerging and exciting local defence contractor, will ensure every cadet, irrespective of their location, will have exposure to drone operations and have access to engaging, fun and educational STEM courses."

JAR Aerospace is an innovative company focused on the design, manufacturing and systems integration of unmanned aerial systems (UAS) as well as the training of UAS operators and developers. With a mission to redefine Australia's position in the global aerospace industry, the development of the next generation is central to this goal and JAR Education is a driving force behind that.

Defence Minister Christopher Pyne announcing Project Bradfield accompanied by the Member for Corangamite Sarah Henderson and JAR CEO Jack Cullen. PETER CHRISMAS

JAR Aerospace says Project Bradfield is a natural solution as it provides progression appropriate to the age and stage of cadets and ties together many disciplines which can be focussed on in depth for basic, proficient and advanced levels of understanding.

These include design, engineering, fabrication and construction, programming and coding, flight theory (propulsion, rotorcraft), 'soft' and 'hard' management skills, ethics, LOAC/JWT, and capability understanding of UAS and the ADF.

JAR Aerospace will also assist the AAFC in updating its courseware by developing content to include computer science, electrical and aerospace engineering subjects for cadets to learn key future skills.

QinetiQ expands global training capability

QinetiQ has announced the acquisition of a leading airborne training services provider and an investment in another as it accelerates its international training capabilities.

QinetiQ has completed its acquisition of German company E.I.S. Aircraft Operations – which will be known as QinetiQ GmbH, and has completed a strategic investment of 85 per cent of UK-based Inzpire Group Limited.

QinetiQ GmbH provides airborne training services based in Germany, and the company says the acquisition will deliver a number of strategic benefits including strengthening capability integration, threat representation and operational readiness offerings to customers.

"The Australian market is seeing the rapid introduction of new technologies, new types of threats and high costs associated with running live rehearsals," Greg Barsby, QinetiQ's Managing Director – Australia said in a statement.

"QinetiQ GmbH will help QinetiQ and our customers in the Australian Defence Force respond to these challenges."

Inzpire is a provider of operational training and mission systems for military customers in the UK and internationally, with about 75 per cent of its revenue coming from airborne training and evaluation services for the Royal Air Force.

QinetiQ CEO Steve Wadey (pictured) said, "Defence operational training represents an area of significant growth as customers around the world increasingly recognise the need to enhance their training capabilities cost-effectively.

"The combination of Inzpire and QinetiQ's capabilities, complemented by our previous acquisitions, creates a leading provider of critical defence training."

CONTINUED FROM PAGE 1 companies such as BAE Systems Australia, Ferra Engineering, RUAG Australia, Micro Electronic Technologies, AME Systems, and Allied Data Systems.

"The partnership will produce a concept demonstrator of a low-cost unmanned 'loyal wingman' aircraft, capable of operating in concert with Air Force's fifth generation air combat capability," Minister Pyne said in a statement.

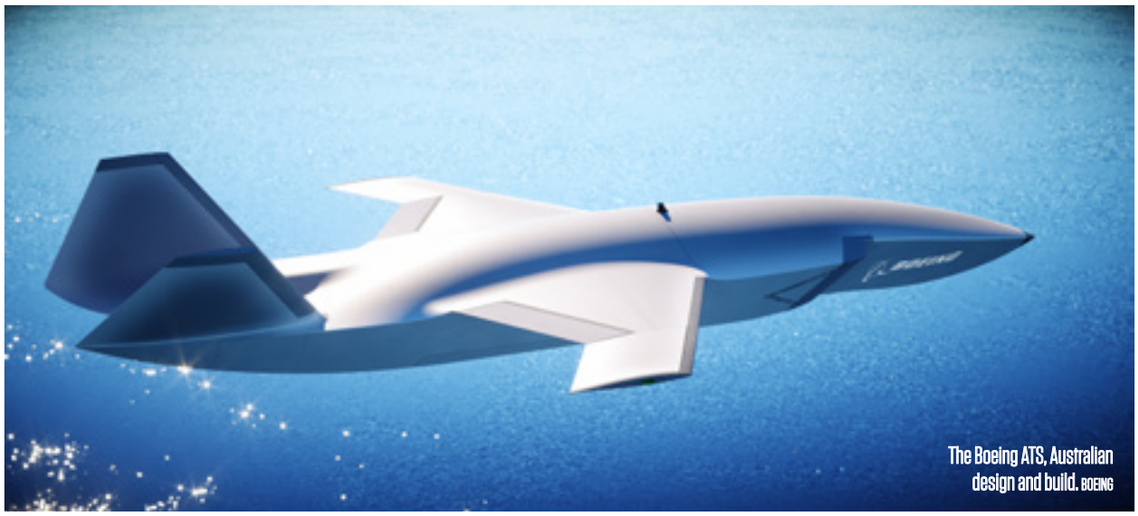
"There is significant value investing in innovative, future-leaning initiatives like this, particularly in the early conceptual stages where Defence can explore concepts and define the role such capabilities can play in our national security framework."

Initially, the ATS will employ electronic warfare or sensor payloads, but could eventually be adapted to carry weapons. At 38 feet in length, the air vehicle is about the size of an F-16, and features advanced composite construction and radar cross-section signature management in the form of shaping, materials and aligned edges.

But cost has also been a key driver of the ATS program, so the use of the expensive composite structures and low-observable shaping and materials has been offset by the substantial use of commercial and military-off-the-shelf (COTS/MOTS) components to ensure the air vehicle remains at an acceptably 'attritable' unit cost.

ATS features artificial intelligence to fly independently or in support of manned aircraft while maintaining safe distance between other aircraft. It will have a range of more than 3,000 km, giving it a four to five-hour combat endurance, well beyond that of manned fighter-sized aircraft.

"The Boeing Airpower Teaming System will provide a disruptive advantage for allied forces' manned/unmanned missions," vice president and general manager of Boeing Autonomous Systems, Kristin Robertson said. "With its ability to reconfigure quickly and perform different types of missions in tandem with other aircraft, our newest addition to Boeing's portfolio will truly be a force multiplier as it protects and projects air power."



The Boeing ATS, Australian design and build. BOEING

Potential 'wingman' duty with an E-7A Wedgetail. BOEING

Designed by Boeing Phantom Works in Brisbane, the company's largest advanced concept development office outside of the US, if ATS successfully proceeds to production it will be the first high-performance combat aircraft of Australian origin built since the Jindivik drone of the 1950s. That said, the ATS leverages 'big Boeing's' extensive experience in manned and unmanned systems development, including the X-45 of the mid 2000s and, more recently, the US Navy's MQ-25 program.

"This will be Boeing's first unmanned aircraft designed and engineered in Australia and represents the company's largest investment of its kind outside of the United States," said Minister Pyne.

Phantom Works has a team of more than 200 in Australia. Boeing says Australia is ideally placed to develop such a capability due to its expertise in the various engineering fields, government openness to support an indigenous defence industry, and the airspace regulator's progressive view towards unmanned systems. The ATS is being funded through an air force Project DEF 6014 Phase 1, for which Boeing will deliver three air vehicles and associated systems.

For the full story, check out the exclusive eight-page feature cover-story in the January-February issue of ADBR, available at the Aviator Media stand in Hall 2.

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Leonardo and Northrop Grumman offer C-27J to NZ

Push to sell the C-27J to New Zealand as a C-130 replacement.

Leonardo and Northrop Grumman Australia have joined forces in a bid to sell the C-27J Spartan battlefield airlifter to New Zealand as a replacement for the C-130H Hercules.

The companies signed a memorandum of understanding (MoU) to partner on through-life support services for the twin-engine turboprop at the 2019 Avalon Airshow on Wednesday.

Under the umbrella of the Future Air Mobility Capability project, the Royal New Zealand Air Force's five C-130H airlifters are expected to be replaced between 2021 and 2023.

While it is unclear how many aircraft New Zealand might look to acquire, manufacturer Leonardo is looking to put forward a fleet of between six and eight C-27J aircraft. The Royal Australian Air Force (RAAF) operates a fleet of 10 aircraft.

"With this partnership, we want to make Australia our hub for the C-27J in the region to provide New Zealand with true excellence not only in terms of product but also in terms of services, to ensure decades of efficient transport and relief operations," Maurizio De Mitri, marketing and sales director at Leonardo Aircraft, said in a statement.

"The successful experience of the RAAF fleet is a testament to our commitment, and we are convinced that New Zealand would receive significant advantages by becoming the next Spartan customer."

Northrop Grumman was awarded a through-life support contract for the RAAF's C-27J fleet in November 2017.

"We are excited to be able to take our combined strengths and deep knowledge of C-27J and deliver highly optimised services and support to regional customers," stated Nic Maan, director of Northrop Grumman Australia's Technology Services sector.

"This MoU confirms the importance of the establishment of this strategic partnership between Northrop Grumman Australia and Leonardo as it brings together the two organisations best placed to deliver C-27J operations in New Zealand."

The C-27J would enable the RNZAF to undertake a wide range of airlift missions, as well as humanitarian assistance and disaster relief tasks, search and rescue, and VIP transport, the companies said.

The New Zealand government is known to be taking into account the New Zealand Defence Force's role in supporting the country's interests in Antarctica as it considers different air transport fleet replacement options.

When questioned about this likely requirement, Giovanni Timossi, vice-president for Asia and Oceania sales at Leonardo Aircraft, did not rule out the possibility of the Spartan reaching Antarctica. But with a range of 1,700 km at its maximum take-off weight, the C-27J does not seem well suited to such a task.

Leonardo markets commercial tiltrotor for EMS role

Italian-headquartered aerospace, defence and security company Leonardo is promoting the AW609 tiltrotor in an emergency medical services (EMS) configuration, promising to combine the strengths of fixed and rotary-wing platforms in a hybrid aircraft.

The company is displaying a mock-up of the cabin of what is billed as the first civilian tiltrotor or 'powered lift' aircraft at the Avalon Airshow, and has been seeking feedback from potential EMS users about what form the fitout could take.

"Think of a King Air or a PC-12 that can hover," says Bill Sunick, senior manager for AW609 marketing. "We're really excited here at Leonardo about it being the world's first commercial tiltrotor; it really shows our dedication to innovation."

The tiltrotor is able to take off and land vertically, and with its pressurised cabin it is capable of flying above bad weather at higher speeds and at greater ranges than a helicopter might.

Boasting a maximum cruise speed of 275 knots, the AW609 has a service ceiling of 25,000 feet and a maximum range of 1,000 nautical miles (with auxiliary fuel).

Speaking to the Show Daily at Avalon on Wednesday, Sunick described how the AW609 would be able to complete both the 'search' and the 'rescue' elements of a SAR task, when otherwise it might take a fixed-wing aircraft to find someone in distress and then a helicopter to pick them up.

Besides the EMS and SAR roles, other potential applications for the tiltrotor in the commercial sphere include VIP transport and oil and gas industry roles.

Certification for the AW609 from the Federal Aviation Administration (FAA) is expected by the end of this year, according to Sunick.

The final prototype is anticipated to start ground testing in May or June; meanwhile, the first production example of the aircraft is currently in assembly.

Leonardo is reluctant to talk about how many orders it has for the AW609, but in February last year the company announced that helicopter operator Era has agreed to be the launch customer for the commercial tiltrotor.

Era is due to take delivery of two aircraft in a nine-passenger utility configuration next year.

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Turning sand to titanium

When heading off on a long road trip, it is often advisable to pack some spare parts. Perhaps a tyre or two, a jerrycan of petrol and replacement windscreen. After all, it can be hard to source these things in the middle of nowhere.

Now imagine the journey is not in a car across Australia but in a spaceship to Mars or the Moon, where bringing two of everything a la Noah's Ark is impossible.

The solution? CSIRO chief executive Larry Marshall (inset) says 3D printing is the answer.

The ability to turn the raw materials found on Mars or the Moon into spare parts with 3D printing is one area of study being conducted by CSIRO, Australia's peak science research agency, and Boeing as part of the pair's long-standing partnership.

Dr Marshall said the project – known more formally as "on-orbit manufacturing of space structures or satellite components" – also had an application in an Australian context.

"Australia is great in mining but we tend to dig up raw materials and we sell them as commodities," Dr Marshall said at the Avalon Airshow on Wednesday. "So we've been asking the question, is there something we can do with the raw material to make it more valuable."

"One of those things is turning, for example, beach sand into titanium ink for 3D printers. You're talking about a factor of 10 more valuable a material, not a commodity.

"Why is that really important for space? Because you can't take all of the spare parts you might need with you. You've got to extract raw material on the Moon or on Mars and then 3D-print the parts that you need."

The on-orbit printing was among a host of new projects Boeing and the CSIRO announced at the Avalon Airshow as part of a focus on space-related technologies.

In addition to the use of 3D printing in space, there were also projects covering space situational awareness for commercial and civil purposes such as monitoring space debris, on-board image processing and analytics for Earth observation satellites, and lightweight, radiation shielding materials for spaceflight.

The two organisations have been collaborating on research projects on aircraft, materials, processes, safety and efficiency, logistics and machine learning and now space, among other topics, for the past 30 years.

Boeing chief technology officer Greg Hyslop said in a statement: "Boeing and CSIRO have a wealth of space technology expertise, and our collaboration stands to propel Australia's space industry forward."

"Boeing's extensive experience in space dates back to the beginnings of NASA's crewed space program and the start of satellite-based communications systems, and CSIRO has a 75-year history in developing space technologies."

Dr Marshall said innovation had gotten "too hard to do on your own anymore".

"It needs people with very different perspectives working together to get the really big breakthroughs to work," Dr Marshall said. "So that's why Boeing."

"Breakthroughs used to happen in single disciplines of science and individual inventors, but today it is where the disciplines cross so it is machine learning meets materials or medical device meets next generation materials or AI meets environmental modelling."

ATSB links with RMIT on transport safety course

The Australian Transport Safety Bureau (ATSB) has announced a strategic partnership with RMIT University that will see one of Australia's leading tertiary institutions offer Transport Safety Investigator qualifications.

Until now the ATSB has conducted its own nationally-accredited Diploma of Transport Safety Investigation training in-house.

But under a new partnership announced at Avalon 2019 RMIT will soon offer a Graduate Certificate in Transport Safety Investigation, which encompasses the aviation, marine and rail transport modes.

Longer term, the Graduate Certificate qualification will create a pathway to further higher education programs leading to Graduate Diploma and Masters-level qualifications.

RMIT Associate Dean of Engineering, Aerospace Engineering and Aviation, Professor Pier Marzocca; ATSB Commissioner Chris Manning; RMIT Vice-Chancellor and President Martin Bean CBE; and ATSB Program Advisor Linda Spurr at the Strategic Partnership Agreement signing.

The partnership will provide industry in Australia and throughout the Asia-Pacific region with access to high quality, ATSB sponsored training in transport accident investigation, as well providing a framework to facilitate important transport safety related research through a credible university-based methodology.

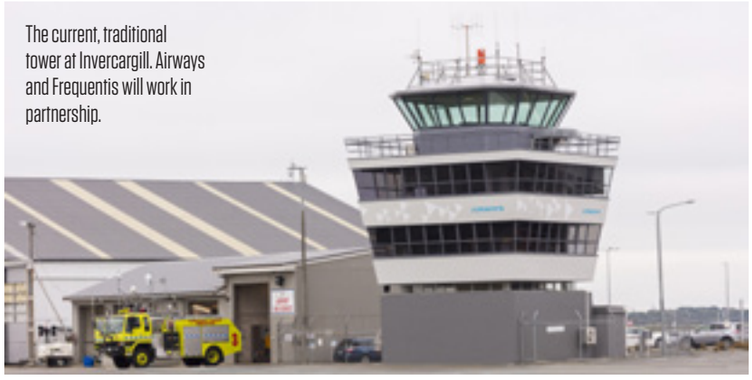
RMIT Vice-Chancellor and President, Martin Bean CBE said the partnership with the ATSB was an historic one. "Together we will work to improve transport safety throughout the Asia-Pacific region, across the aviation, maritime, and rail industries," he said.

ATSB Chief Commissioner, Mr Greg Hood said the new partnership was another key enabler that would support the Bureau to achieve its primary objective of improving transport safety through greater collaboration with a strong and highly credible research-led teaching and learning institution."

Further information on the Graduate Certificate in Transport Safety Investigation can be found on the RMIT website at: *www.rmit.edu.au/study-with-us/engineering/aerospace-engineering-and-aviation/graduate-certificate-in-transport-safety-investigation*

Remote tower control a step closer in NZ


Tower control by remote control: the Frequentis digital system.


The current, traditional tower at Invercargill. Airways and Frequentis will work in partnership.

The first remotely-operated digital air traffic control tower in New Zealand is a step closer with the awarding of a contract to global technology provider Frequentis to develop a digital system for Invercargill Airport.

New Zealand Air navigation services provider Airways is pursuing digital tower technology as a national alternative to conventional towers to provide higher levels of aviation safety, improved weather resilience and the option to provide extended levels of services to New Zealand's regions.

Airways General Manager of Air Traffic Services Tim Boyle said a digital tower at Invercargill Airport is the first step in the journey "to modernise the way we provide air traffic services at airports.

"We're excited about the safety and efficiency advantages the technology offers to the airport, airlines, and ultimately travellers," he said.

Airways and Frequentis will work in partnership to deploy the digital system. It is due to go live in 2020 and will be operated at first by controllers based at the airfield, before later moving to a centralised hub providing services to a number of regional locations.

Digital tower technology allows controllers to manage traffic from a remote location by replicating the view they would have from a conventional tower using high definition cameras and surveillance sensors.

An advanced set of tools including infrared camera equipment, object detection and tracking ability will provide improved situational awareness, particularly in low light, or during adverse weather conditions. Augmented reality features allow live aircraft information, such as altitude and speed, to be overlaid on screens.

Digital air traffic control towers are being implemented at airports worldwide, with fully operational towers already in place in Europe, and Frequentis is also deploying a solution for the US Department of Defense.

Digital air traffic services are Airways' preferred option for replacing its existing network of ageing towers in the future.

Frequentis says that after Invercargill Airport, Airways plans to install a digital tower at Auckland International Airport in 2020. This will first be as a back-up system, and later as a full replacement for the existing tower.

"As the application of remote tower technology becomes more widespread, the safety and capacity benefits that controllers can obtain become clearer," Frequentis Australasia Managing Director Martin Rampl said.

Invercargill Airport General Manager Nigel Finnerty said: "We are absolutely delighted to have been selected by Airways New Zealand to implement the Frequentis smartVISION solution in Invercargill and very much look forward to supporting them in their goal to enhance their regional air traffic control services."

As well as digital air traffic control tower systems, Frequentis is developing an unmanned aerial vehicle traffic management (UTM) system and drone detection capability.

It is also working on installation of the new Leidos Skyline-X air traffic management platform, due to go live in 2020 and replacing Airways' two existing ATM platforms installed between 2000 and 2003. The new Skyline-X platform includes a number of features to optimise the air traffic system.

Collins Aerospace looks to a bright future

Newly renamed Collins Aerospace is forging ahead with its Australian operations following its 2018 acquisition by UTAS a UTC company.

Formerly named Rockwell Collins, the company has been brought under the huge UTC umbrella and hopes to realise greater economies of scale and the benefits of a global portfolio of diverse aerospace and simulation capabilities.

"The new company's name is a testament to the reputation Rockwell Collins had as a trusted supplier, as of course UTAS has as well," Collins Aerospace vice president Asia Pacific, Jim Walker said.

The new CEO is the CEO from Rockwell Collins, and the previous CEO of UTAS is the new COO. So collectively together, they run the company, and when we came together, we now have a wide range of products across an aircraft."

We have everything from the flight deck, to the galleys, to lavatories, to engines with our sister company Pratt & Whitney (also part of UTC), to power and control, to landing gear, so we have significant content across the board."

With the integration of UTAS and Rockwell Collins legacy companies, Collins Aerospace now has six business units; avionics, interiors, mission systems, power and control, aerostructures, and mechanical.

"You can see with those six business units how we align ourselves with customers and OEMs," said Walker. "By doing that, we have a broad range of products and a very healthy approach to innovation."

Collins Aerospace has a large footprint in Australia, including a team of more than 100 mostly engineers in Sydney who have recently commenced the delivery of eight Digital Terminal Control System (DTCS) simulators to the Australian Army, a contract for which it was awarded in 2017.

The company is also a sub-contractor to Northrop Grumman which currently supplies 40 per cent of the electro optical distributed aperture systems (EA DAS) to the global F-35 JSF fleet.

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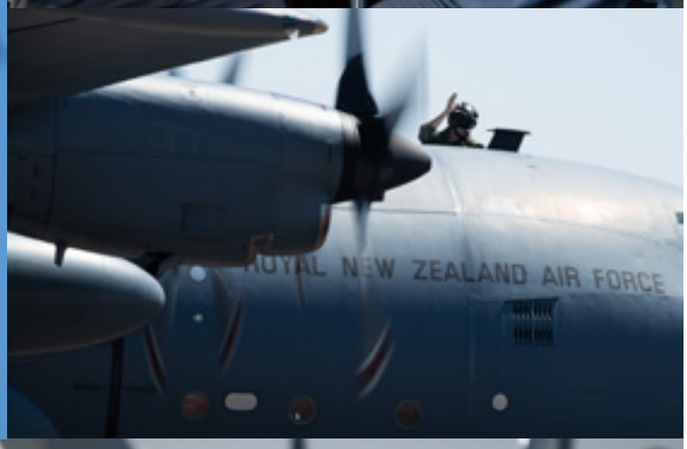
ROYAL NEW ZEALAND AIR FORCE

Gulfstream eyes a happy home for its G600

Head to head with the Gulfstream G600 (right) with a luxurious fitout on the inside (below).

Gulfstream senior regional vice-president for sales Roger Sperry says the business jet maker's soon-to-be-certified G600 should find a happy home in Australia.

The G600 is on display at this week's Avalon Airshow alongside the G550 and G650ER.

Sperry said the new technology embedded in the G600's flightdeck, such as active control side sticks and fly-by-wire technology, alongside features designed to improve the passenger experience – large windows, quiet cabins and low cabin altitude – would prove popular with potential customers.

"We expect the Gulfstream G600 to do well in Australia and the broader South Pacific region," Sperry said in an emailed response to written questions.

"We're thrilled to have the G600 on display this week for its Australian debut, and we're looking forward to its entry-into-service this year."

The clean-sheet G600 was launched in October 2014 alongside sister-ship the G500.

The aircraft was capable of seating up to 19 people, had a maximum operating speed of Mach 0.925 and maximum range of 6,500nm, according to figures from the Gulfstream website.

While the G500 entered service in September 2018, the G600 is still awaiting certification from the United States Federal Aviation Administration (FAA).

The G600, which made its first flight in December 2016, had previously been expected to be certified in early 2019.

However, the chief executive of Gulfstream parent company General Dynamics Phebe Novakovic said recently certification had been pushed back due to the recent United States government shutdown that had impacted the process underway at the FAA.

"We expect the G600 to be certified this year, although the exact timing is hard to predict given the impact of the government shutdown on the FAA, but we fully expect certification of the G600 this half," Novakovic said at General Dynamic's calendar 2018 fourth quarter results briefing on January 30.

"The pacing item for deliveries of the G500 and G600 will be our ability to deliver in itself. We have that line in good order."

The company declined to provide figures on the number of its aircraft based in Australia, noting only there were 335 Gulfstream aircraft in service in the Asia Pacific region.

Sperry said Gulfstream's product lineup meant it was well-positioned in the region.

"We are very optimistic about the business jet market in Australia," Sperry said.

"Taking it broader, the Asia Pacific region continues to be our largest international market, with a consistent pipeline of orders and deliveries.

"Around the world, we are seeing steady order activity and a continued interest in our products, especially in North America and Europe."

Sperry said Gulfstream had delivered 10 G500s since late September 2018.

The Central Blue: call for submissions

THE SIR RICHARD WILLIAMS FOUNDATION

The Sir Richard Williams Foundation is calling for submissions for its *The Central Blue* forum.

Designed to promote informed discussion and debate about airpower issues affecting Australia, *The Central Blue* covers topics from tactical integration to strategic theory, and from historical lessons to future capabilities.

The Williams Foundation welcomes submissions from any source, but particularly encourages serving military practitioners to contribute in order to foster a new generation of airpower thinkers.

Posts should be between 500 and 1,000 words long, comply with standard publishing guidelines, and be accompanied by a brief author's bio.

For more information, email thecentralblue@gmail.com, or visit *centralblue.williamsfoundation.org.au*

BAE Systems signs $245m Hawk contract

BAE Systems Australia has welcomed a two-year contract, worth $245 million, to continue sustaining the Royal Australian Air Force (RAAF) Hawk Mk127 Lead-In Fighter fleet.

The company will continue to sustain the Hawk fleet at Williamtown and RAAF Base Pearce in WA until at least 2022, with further potential performance-based extensions.

The role includes all deeper and operational-level maintenance, logistics and the management of the Australian supply chain for the program.

Hawk is the world's most successful and proven advanced jet trainer with more than 1,000 aircraft ordered and delivered to 18 countries.

Using advanced airborne simulation technology, Hawk is a flying classroom that can put student pilots at the controls of a combat aircraft, including the F-35 Joint Strike Fighter.

Reflecting the RAAF's strategy to bring innovative asset management to sustainment, the contract sees BAE Systems Australia take on the role of platform steward for the Hawk which will see the company playing a critical role in the long-term availability and capability of the aircraft.

Hawk Mk127, the world's most successful advanced jet trainer.

"The performance of the team supporting this project has been pivotal to securing this contract extension," BAE Systems Australia Aerospace and Integrated Systems Director, Steve Drury said.

"We have increased the work we do to support the aircraft, in parallel with a significant upgrade of the entire Hawk fleet and we have worked hard to reduce program costs.

"The Lead-In Fighter Capability Assurance Program upgrade ensures the aircraft is suitable for a fifth generation air force, preparing pilots for fast jets including the F-35 Joint Strike Fighter."

The aircraft are operated by 76 Squadron at RAAF Base Williamtown and by 79 Squadron at Pearce.

The Hawk Mark 127 Lead-In Fighter is a tandem, two-seat jet aircraft.

It is used to prepare the RAAF's fast jet aircrew for operational conversion to the F/A-18 Hornet, F/A-18 Super Hornet and the F-35 Joint Strike Fighter.

BAE Systems delivers availability support and training to Hawk fleets operating with theUK Royal Air Force and across the Middle East.

Lockheed Martin in new strategic partnership

Lockheed Martin and the Commonwealth have signed an Agreement for Australian F-35 sovereign sustainment contracts, establishing Lockheed Martin as a key Strategic F-35 sustainment partner for Australia.

The announcement, at the airshow, was made by the Minister for Defence, Christopher Pyne.

The Heads of Agreement provides a set of contracting principles for both the Australian Department of Defence and Lockheed Martin Australia to deliver ongoing F-35 sovereign contracts for the life of the F-35A Australian fleet.

The announcement builds upon the foundation of existing sovereign Australian Department of Defence F-35 contracts with Lockheed Martin Australia and provides a streamlined framework and conditions for the establishment of future contracts for F-35 sovereign capabilities.

Chief Executive of Lockheed Martin Australia and New Zealand, Vince Di Pietro, said the agreement is the cornerstone of the partnership between Lockheed Martin and the Australian customer and will reduce red tape for all new contracts.

Lockheed Martin and the Commonwealth agree on ongoing sovereign contract support for F-35.

"This Heads of Agreement provides a fundamental pillar in Lockheed Martin's long-term F-35 relationship with the Australian Department of Defence to deliver RAAF F-35 capability and is testament to our commitment in ensuring that the RAAF can meet its sovereign fifth generation aerospace combat capability needs."

"Lockheed Martin Australia is excited to support the RAAF in the establishment of F-35A capability and to the ongoing provision of sustainment services in Australia in the years ahead, including technical, logistics, information systems and training support.

"As the maker of the F-35, no one knows the aircraft better. We are committed to the ongoing realisation of opportunities for RAAF personnel and Australian industry partners to develop skills in high-end roles, including the development of advanced technologies and sustainment for the F-35," Mr Di Pietro said.

Australian industry plays a significant role in the F-35 program with more than 50 Australian companies contributing to the global program of record of more than 3,000 aircraft.

To date, the F-35 program has secured more than 2,400 highly skilled jobs created and generated more than $1.3 billion AUD in contracts for Australian industry.

Kongsberg extends its reach

Norwegian company Kongsberg is lifting its Australian footprint on the back of its victory in the NASAMS contest and with the prospect of selling its anti-ship missile to the RAAF.

As well the company's acquisition of Rolls Royce Commercial Marine, including its local subsidiary, adds another 40 employees to its Australian workforce.

In July 2017, the government announced Kongsberg and Raytheon had been chosen to provide a medium to long-range air defence system for the Australian Defence Force through Project LAND 19, the National Advanced Surface to Air Missile System (NASAMS) which was originally developed for Norway but now in use in the US and five other countries.

That's based around Raytheon's AMRAAM missile which in Australian service will be transported on Hawkei vehicles.

Kongsberg executive vice-president for integrated defence systems Kjetil Myhra said the company had actually been in Australia for many years, initially through its Penguin missile intended for use on the ill-fated Seasprite helicopters. Like Seasprite, they never saw service.

Lat year Kongsberg opened an office in Canberra.

"We are expanding in Australia. LAND 19 will bring a lot of local employment and local work. In addition to our Canberra office we also have our crew for LAND 19 co-located with Raytheon down in Adelaide to do the final assembly of the NASAMS system," Kyrre Lohne, Kongsberg vice-president for strategic communications said.

NASAMS will give Australia an air defence capability far greater than provided by the legacy RBS-70 missiles, able to defend point targets such as an airfield, or when networked, to defend a larger area against multiple threats. It will be able to deploy to defend a mobile task group.

Each system comprises the Fire Distribution Centre for command and control, radars for air surveillance and the missile launchers. Other nations have used the US Sentinel radar but Australia plans to use the Australian CEA Tactical radar.

AMRAAM is in service with the RAAF as an aircraft-launched beyond visual range air-to-air missile.

As part of Defence's Risk Mitigation Activity, more than 90 Defence personnel have already undertaken training to familiarise themselves with the NASAMS system and understand requirements on trade structures. So far three courses have been run.

Kongsberg is also offering Australia its Joint Strike Missile (JSM), an advanced anti-ship missile designed to be launched from the F-35 internal weapons bay. Development concluded last June with F-35 integration now under way.

Australia was especially interested in this capability as initially the US didn't regard developing F-35 maritime strike as a priority.

However, Norway had such a need, as did Australia which provided funding for an enhancement – development of a RF sensor capability into the missile seeker, allowing it to home on ship radar emissions.

"As far as we can see, JSM is still the only missile in the pipeline to be stealthy, long-range, able to attack land and sea targets and fits inside the F-35weapons bay," Myhra said.

Australian wants an anti-ship missile capability for F-35 through project AIR 3023.

"There is no guarantee they will buy it but we will see what they choose," he said.

"We have registered a lot of interest in the JSM from the whole F-35 community. So far it is probably Japan that has expressed the most interest."

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How a new jammer will play the fool

The E/A-18G Growler: ALQ-249 is regarded as critical. MARK JESSOP

By the middle of next decade the RAAF will be fielding a world class capability to blot out other people's radio communications and to fool their radar.

The Raytheon ALQ-249 next generation jammer mid-band is now in the final stages of development, with the US Navy likely to declare initial opeating capability in 2022.

Australia sees ALQ-249 as a critical element of capability for the E/A-18G Growler aircraft and has participated in the development process. Six Australians are embedded within the US Navy development program.

The next generation jammer (NGJ) will replace the legacy ALQ-99 jammer. This was initially fielded at the tail end of the Vietnam War and although much upgraded, is regarded as troublesome and unreliable and outmatched by contemporary adversary systems.

ALQ-249 has been developed to cover the mid-frequency band where most threat systems can be found. Jammer pods to cover the low and high bands of the spectrum are under development.

A Growler shipset will comprise two underwing pods, each equipped with dual AESA antennae and designed to work in concert, dealing with multiple threats simultaneously.

Raytheon says NGJ features very high power. But the actual output, along with the pod's operating frequency range are classified.

With high power, a jammer can simply swamp other people's communications but the capability reportedly extends to spoofing target radar systems through generating false returns.

"We are talking about cutting edge technology. We are talking about capability that is second to none, very very complex," said Captain Michael Orr, NGJ program manager for the US Navy.

"It looks really easy but the challenges that this team has to work through are not only that technology and the capability, but to put it in a form factor that you can put on a tactical aircraft and survive on an aircraft carrier. That's not an easy task."

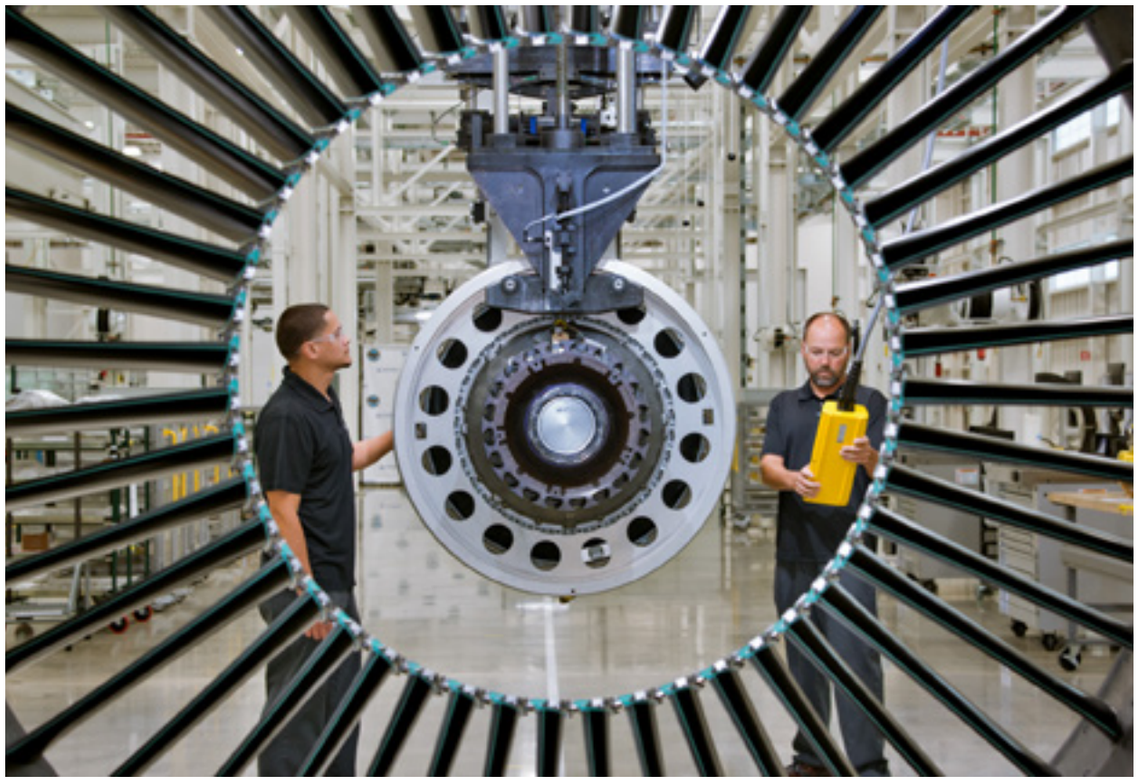
RAAF Group Captain John Haly said Australia was the only other Growler operator and it was a crucial part of Australia's defence capability.

"The contest in the electro-magnetic spectrum is real. They exist today and they will exist more and more into the future," he said.

"Clearly having the capacity and the ability to have freedom of manoeuvre in that spectrum and the complementary nature of what Growler brings to the table in the near term, let alone the future, is crucial to our success of our force."

Gearing up for the next generation engines

WRITER: TOM BALLANTYNE



Pratt & Whitney is calling it the Geared Turbofan Generation 2, or GTF2, a super engine that will power the next generation of single-aisle jets from Boeing and Airbus. According to Jeffrey Minor, deputy vice president for Asia Pacific sales at Pratt & Whitney, the aim is to achieve at least another five per cent cut in fuel use, critical to airlines given the uncertainty of where oil costs are heading.

It may be a decade away, but work is already underway on step changes to the company's current revolutionary GTF engine, the PW1000G that powers half a dozen single aisle jets including the Airbus A320neo. That technology, explained Minor, took 25 years and $US1 billion to develop behind the scenes. "It has taken us that long to get to the level of reliability and endurability that we need with the system because it's so significant and important to the design.

"We tested over 200,000 cycles in validation testing and we have done many, many things to create severe operating environments and ... to put severe loads on the system."

What is ground-breaking about the GTF is the introduction of a fan-drive gear system, with a reduction gear in front of the engine between the load compressor and the fan rotor. "That has allowed us to slow the fan rotor down where it wants to be, so it operates more efficiently," Minor said. "Then, in the core of the engine, the turbine section, we are able to optimise the speed of those modules. That is a big change from a conventional engine where the same shaft goes from the tail of the engine to the nose of the engine. It limits the operation of certain modules and their efficiency is affected. "That shaft is common from the back end to the front end of the engine, so all the modules are limited by the speed of that common shaft.

"The introduction of a reduction gear in the front, to slow the fan down, means we can get more optimal speed and performance out of the turbine section; out of the compressor section. "What that equates to is a significant reduction in fuel. You get much more work out of the fan blade and the thrust of the engine," Minor said.

Development GTF engines on the test stand.
PRATT & WHITNEY

At the same time, Pratt & Whitney has been able to keep core temperatures similar to previous engines, achieve gains in range and payload benefits, and reduce the number of parts by 50 per cent

Entry into service of the GTF has not been without its issues when airlines found that multiple GTF engines had to be removed after a short time in service because a bearing had failed or the combustion chamber had degraded. The company acknowledged the problems and designed fixes.

There is little doubt airlines are more than happy with the performance of the GTF when all goes well. It comes in three models with thrust ranging from 15,000 to 33,000lb. The lower end of the range has a 142cm fan used by the Mitsubishi MRJ regional jet. The GTF with a 73-inch fan is on the Airbus A220 (formerly the Bombardier C Series) and the Embraer E2, while the larger 205cm fan is on the A320neo and Russia's Irkut MC-21.

The engine technology without the gearing is also used on the Gulfstream G500/600 and Dassault Falcon 6X business jets. As of late last year, Minor said there were 260 aircraft operating with GTF engines among 27 customers.

"Some of the key attributes are, in general, a 16 per cent fuel burn reduction, 75 per cent reduction in noise, 50 per cent reduction in regulated emissions ... the market success has been very strong," he said.

The annual aircraft savings, from a cash operating cost perspective, is about $1 million per aircraft." Overall, 9,000 engines have been ordered by 80 customers. That has also meant a ramp up in Pratt & Whitney service facilities. "Today, we have three engine overhaul centres in operation supporting our fleet and we plan to go to eight by 2020.

As for the future, Minor suggests the move from GTF1 to GTF2 will be a phased process. In between will be what Pratt & Whitney calls the GTF1-Plus, available for improved versions of the A321 and Boeing's proposed middle-of-the-market jet. Minor said Pratt & Whitney is planning for further engine improvements to coincide with the introduction of next generation aircraft which will replace the current neo and MAX types. "We would expect that plane to be revolutionary, almost with the significance of the Douglas DC-3 in the 1950s. That airplane revolutionised air travel," he said.

There is another question, however: given the problems that have arisen within several new engine programs, is there such a thing as "peak engine" where the step change to major improvement is so difficult it will take years to overcome? "We talked about the development of the gear for the geared turbofan engine," said Minor, "20 years in the making to do it well and do a good job at it. "So, there is that element of making a step change. I would say that taking that similar architecture and moving to a next level is something that is feasible from our understanding."

Armoured tank targets get real

Exercising in command of an Abrams tank in the Australian bush, Steen Bisgaard thought there had to be better and more realistic targets than what they were shooting at.

Those included plywood shapes, shipping containers and old Centurion tanks which looked nothing like what would be encountered in a real conflict.

"We were getting to the field with these expensive assets and then we were going against a fictional enemy. We were shooting at fictional things like pieces of wood, relic targets, shipping containers, stuff that wasn't what we were looking for," he said.

And afterwards they were being asked to assess what they had just encountered in a fictional after-action report.

"Basically everyone said this is ridiculous," he said.

The result was Gaard Tech, a new company which makes realistic full size mockups of combatants such as the T-80, BMP-3 and BRDM-4 armoured vehicles. The latest is the SA-6 tracked surface-to-air missile launcher.

The company also makes two-dimensional targets used for initial training.

These are made from laser-cut sheet steel. Like Ikea furniture, they are delivered in flatpacks and can be assembled by hand

with no special tools in under an hour.

These don't just sit on the battlefield and wait to be shot. They are motorised and either directed by remote control or programmed to follow a particular pattern.

They can produce a realistic heat signature and also emit electronic signals. SA-6 targets produce a signal to initiate an attacking aircraft's threat warning receiver.

As they are made of sheet steel, they can be shot repeatedly and remain useable. Armour piercing shot simply goes in one side and out the other.

So far Gaard Tech, which started up in September, has made two sales of a total of 15 3D vehicles and a number of 2D vehicles to the Australian Defence Force.

The company exhibited at IDEX in Abu Dhabi last week with such a good response that it may start production in the UAE to expand into the Middle East.

The cost depends on volume – the more bought, the cheaper each becomes. On a sale of 50, each would cost around $9,000.

Steen said this was very good training value compared to the cost of ammunition and operating modern armoured vehicles.

"It is an immense amount of value for not a great sum of money," he said.

"It's a training enemy but it is as real as you are going to get."

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