WINGS

AUTUMN 2025
VOLUME 77 NO. 1

CHIEF OF AIR FORCE
ON A CHALLENGING FUTURE

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MANAGING EDITOR'S MESSAGE

WELCOME TO a special Avalon Australian International Airshow edition. Australia's largest aerospace and defence industry event celebrates aviation, aerospace and space. Our article, 'It's Showtime', highlights the extraordinary commitment by all concerned to showcase the efforts and achievements of the whole aviation community. In addition, we focus on one of the more unusual exhibits, the rocket-powered land-speed car *Aussie Invader 5R*.

We look forward with a focus on the development of sixth-generation future fighter programs and conclude our series on the fifth-generation F-35 JSF.

In an interview with *Wings*, Chief of Air Force, Air Marshal Stephen Chappell DSC, CSC, OAM expands on his intent – people, purpose and preparedness. For an industry perspective, we interview Lockheed Martin ANZ Chief Executive Warren McDonald AO, CSC.

Highlighting a diverse range of industries and capabilities, articles cover managing air traffic from space, flying cars, collaborative combat aircraft, flight test developments, training solutions and pathways, GPS security, and the first impressions of the Shark 600 Sports aircraft which will be displayed at Avalon.

Finally, *Wings* would like to acknowledge Air Vice-Marshal Neil Smith AM, MBE (ret'd), Managing Director of RAAFA Publications for the past 10 years. Neil hands over to Air Vice-Marshal Roxley McLennan AO (ret'd) following this edition. Thank you, Neil, for your leadership and welcome Roxley.

Rob Amos, Wings managing editor

EDITORIAL DEADLINES

Please send submissions and letters to **managing.editor@wingsmagazine.org**, including your name and details. Submissions maybe edited for length and clarity. We cannot guarantee all material will be published.

WINTER EDITION DEADLINE: 21 April

AIR FORCE ASSOCIATION

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A MESSAGE FROM
DIRECTOR GENERAL AIA25

WHO DOESN'T LOVE AN AIRSHOW?
Readers of *Wings* definitely love them! The Australian International Airshow 2025 (AIA25) is fast approaching and it promises to be an exciting and fascinating event.

However, AIA is more than just an airshow. The event provides Air Force, and the Australian Defence Organisation more broadly, the opportunity to conduct significant strategic engagement, defence industry and public engagement activities. Being the largest Defence aerospace exposition and public airshow in the southern hemisphere, the event will highlight how the Australian Defence Force (ADF) is transforming into an integrated force as outlined in the National Defence Strategy.

The 2025 event will be held between 25 and 30 March at Avalon airport in Victoria and consists of two components; the trade and Defence exposition held over the first three days, followed by the public airshow on the Friday, Saturday and Sunday. The 2023 airshow was a tremendous success with 248,000 people attending, including 56 foreign military delegations. Similar numbers are expected at the 2025 event.

AIA is a biennial activity coordinated and run by the AMDA Foundation with the ADF and other government agencies and non-government elements participating. Defence, with Air Force as lead, collaborates with AMDA to plan and coordinate ADF and foreign military participation at the event. Air Force has established Task Group 640.3 to plan and execute Defence participation, working closely with AMDA, Navy, Army and the other Defence groups.

AIA25 provides the ADF with an ideal opportunity to display its current capabilities and future concepts in a collaborative and integrated manner to government, military allies and partners, defence industry and the Australian public. Due to the international reputation of AIA, many dignitaries and senior officers from across the world will attend, providing them an ideal opportunity to meet with their Australian and foreign counterparts and industry representatives. The strategic engagement program is an important part of Air Force's participation and is the major strategic engagement activity for Chief of Air Force in 2025.

For members of the public, the ADF will have a range of static displays highlighting the integrated nature of the ADF, and the daily flying program will demonstrate the remarkable capabilities of its aviation fleet. Importantly, Navy, Army, space and cyber commands, ADF Careers, and cadets from the three services will also participate at Avalon, and a drone-racing program will be conducted. Aircraft from foreign militaries, including the US and from the region, will also participate. Acrobatic displays from several civilian aviators will round out an impressive flying display program. The public airshow promises to be a jam-packed and exciting event for the Australian public and overseas visitors, aviation enthusiasts, and the Defence community.

AIA25 will be an outstanding event for Air Force and all participants. I hope to see you there.

AIRCDRE Scott Winchester AM
Commander Task Group 640.3

ON THE COVER
Artist's impression of the Tempest, the UK's proposed GCAP crewed fighter. Image: BAE Systems.

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PRESIDENT'S DESK

WELCOME AGAIN TO *WINGS,* with this special Avalon edition. Hopefully everyone was able to enjoy a break with family and friends over Christmas and the New Year. First, I would like to congratulate all those recipients of Australia Day awards, including current serving Air Force aviators and veterans. I was pleased to see Ted Mildren's announcement as Townsville's Citizen of the Year – due recognition for over 34 years of continuous exemplary service to the RAAF Association in North Queensland. Also, congratulations to Bruce Townsend who recently celebrated his 100th birthday (and 74th wedding anniversary!) at RAAF Edinburgh. My thanks to leadership at AFA-SA and RAAF Edinburgh for honouring Bruce in this way.

But I also recognise the challenges many Australians have faced over the past few months through devastating fires and floods. As with many disasters in the past, it is the strength of local communities which makes the difference in recovery and assistance and is testament to the character of mateship.

This year we aim to enhance work on efforts to strengthen the connection and support between Air Force, the Air Force Association, veterans and their families. One significant outcome has been RAAFA WA securing more than $4.9 million through the Federal Government's Veterans' Acute Housing Program. This funding will be directed towards the Andrew Russell Veteran Living Program, providing crisis and transitional housing and support to veterans in need. My deepest gratitude and thanks to RAAFA WA for their continued pursuit of this initiative.

For those of you able to attend Avalon this year, I wish you a most enjoyable time. The exhibits and displays are certain to please everyone. You will find the AFA and *Wings* stand in Hall 4. We hope to see you there.

Finally, my personal thanks and congratulations to Air Vice-Marshal Neil Smith AM, MBE (ret'd) for his tireless devotion as Managing Director of RAAFA Publications these past 10 years. This edition of *Wings* will be Neil's last in that role, as he hands off those duties to Air Vice-Marshal Roxley McLennan AO (ret'd). Thank you, Neil, for your dedication and leadership.

Joe Iervasi
National President,
Chair of the AFA Ltd Board of Directors

To join the Air Force Association, visit **raafa.org.au** and follow the Membership link. For assistance, contact the Association by phone or email, contact details for the National Board and Divisions can be found on the website.

MANAGING DIRECTOR'S MESSAGE

THIS AIRSHOW EDITION marks the sixth year since RAAFA Publications was chosen by the AFA to publish *Wings*, its members' magazine since 1946. Our objective was to increase the quality of the editorial and presentation, creating a high-quality aerospace magazine, not only for members, but also for Air Force, industry and all aviation-minded Aussies.

In achieving our goal, the board of RAAFA Publications has been fortunate to have attracted two enthusiastic and talented managing editors, Ron Haack and Rob Amos, who have been supported by an experienced and talented designer, editor, salesmen and a group of volunteers.

It has been a pleasure and privilege to have worked with this wonderful team, and it's with a touch of sadness I announce this is my last edition as Managing Director. But this is a bumper edition, and it's satisfying to depart on a 'high'.

I will be replaced as MD by Air Vice-Marshal Roxley McLennan AO (ret'd), a man of considerable talent and aviation experience, whose distinguished RAAF career culminated as Deputy Chief of Air Force, and whose subsequent experience includes Defence Industry Adviser to the SA Government, Air Services Australia board member, Vice President Defence Rolls-Royce Australia and, for the past two years, a RAAFA Publications board member. I invite you to come and meet us at our AFA-*Wings* stand in Hall 4 at Avalon.

Air Vice-Marshal Neil Smith
AM MBE (ret'd)

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EDITED BY Bob Treloar

GHOST BAT PROGRESS

EIGHT PROTOTYPE GHOST BAT aircraft have achieved more than 100 hours of flight testing and 20,000 hours of testing in the digital environment. Designed to operate as part of an integrated system of crewed and uncrewed platforms and act as a force multiplier, the Ghost Bat will provide the RAAF with affordable mass and flexibility in its force mix, while reducing risk to existing crewed assets.

Boeing Defence Australia is currently producing three more Ghost Bat airframes, to be completed to the latest Block 2 standard by the end of 2025.

Source: Defence Connect

Four MQ-28A Ghost Bats, Woomera, SA. Photo: Boeing Defence Australia.

Interoperability with Indian Navy

AUSTRALIA AND INDIA signed an arrangement in November 2024 enabling the RAAF and the Indian Navy to conduct air-to-air refuelling (AAR) operations. Under the arrangement, RAAF KC-30A Multi-Role Tanker Transport will provide AAR support for Indian Navy P-8I aircraft, increasing India's reach and persistence in the Indo-Pacific region.

RAAF also conducts training and engagement activities with Indian Navy P-8I Neptune surveillance aircraft.

Source: Defence

Boosting SRI LANKAN AIR FORCE

A FORMER RAAF KING AIR 350 has been donated to the Sri Lankan Air Force. The aircraft, A32-673, will be supported in Sri Lanka for 12 months by Australia, before responsibility is handed over to the Sri Lankan Air Force.

It was fitted with an intelligence, surveillance and reconnaissance pod before delivery last October and will fly maritime domain awareness missions, complementing a King Air 360ER provided by the US Government in early October.

Source: ADM

ABOVE A32-673 in Sri Lanka following a flight from Aceh in Indonesia. Photo: Australian High Commission in Sri Lanka.

F-35B trials ON JAPANESE CARRIER

JS *KAGA* SUCCESSFULLY completed onboard trials for F-35B operations off California last October in preparation for Japan operating F-35Bs off Izumo-class destroyer carriers. The F-35B aircraft were assigned to the Air Test and Evaluation Squadron 23, with the test pilots coming from the F-35 Patuxent River Integrated Test Force.

Kaga's shipboard trials follow trials carried out by the Japan Maritime Self-Defense Force in 2021 with F-35Bs on JS *Izumo*, a sister ship to *Kaga*. Both ships were originally built as helicopter carriers but are being converted to operate F-35Bs.

The 42 F-35Bs in the Japanese Fleet Air Arm will operate alongside 105 F-35As in the Japan Self-Defense Forces.

Source: USNI News

ABOVE An F-35B Lightning II aircraft lands on JS Kaga. Photo: US Navy.

P-8A SUPPORTS NORTH KOREA SANCTIONS

AS PART OF THE United Nations Security Council sanctions against North Korea, a RAAF P-8A Poseidon maritime patrol aircraft deployed to Kadena Air Base, Japan last October under Operation Argos to monitor and detect illegal ship-to-ship transfers of goods in the region. Under Operation Argos, since 2018, RAAF maritime patrol aircraft have deployed 14 times and Royal Australian Navy ships 12 times.

Source: Defence Connect

Saab Drone SWARM FOR AUKUS

SAAB'S AUTONOMOUS SWARM technology featured in the AUKUS-led Project Convergence 2024 trials in the US last October. The trials involved a team of 40 specialists from BlueBear, a Saab subsidiary, along with the UK's Defence Science and Technology Laboratory, to demonstrate advanced interoperability by deploying artificial intelligence within swarms of uncrewed aircraft systems (UAS).

BlueBear's Centurion mission system enabled a single operator to control and manage a broad array of autonomous UAS in complex multi-domain environments.

ABOVE BlueBear drones. Photo: Saab.

JDAM-ER weapons to Ukraine

FOLLOWING THE RETIREMENT of the Mk 82 500lb (226kg) JDAM-ER glide bombs from RAAF service, Australia donated an undisclosed number of them to Ukraine in 2024.

Ukraine is using the weapons against hardened Russian targets, including bridges and command posts, and demonstrated the successful integration of advanced NATO weaponry with older Soviet-era aircraft. The first documented use of US-developed JDAM-ERs in Ukraine occurred in March 2023 with US-supplied variants deployed by the Ukrainian Air Force's modified Soviet-era MiG-29 fighter jets.

Source: Euromaidan Press

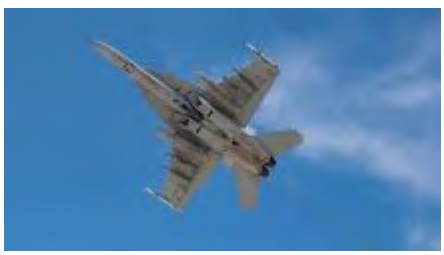
ABOVE A Ukrainian soldier attaches an American GBU-62 JDAM-ER under the wing of a Ukrainian Air Force MiG-29. Photo: Ukrainian Air Force.

LITENING POD TESTING

LAST OCTOBER, the US Navy completed initial flight testing of the Litening Advanced Targeting Pod on the F/A-18E/F Super Hornet. It replaces Raytheon's Advanced Targeting Forward-Looking Infrared (ATFLIR) pod which has been the US Navy's primary targeting pod since 2003. It continues to be carried by F/A-18C and D Hornets operated by Switzerland and Malaysia.

The RAAF has operated the ATFLIR on its Super Hornets since 2008, the only certified targeting pod then available for the Super Hornet, it was the US Navy standard. However, the RAAF continued to operate the Litening pod on Classic Hornets until their retirement in 2021. Some pods were retained after the Classic Hornets were retired, with the RAAF trialling them on C-130J transport aircraft.

Source: ADM



BELOW ADF Airbus EC135 T2+ helicopters at the Joint Helicopter School at HMAS Albatross. Photo: Defence.

HATS TURNS 10

MORE THAN 450 HELICOPTER aircrew have been trained for the ADF in the 10 years since the Helicopter Aircrew Training System (HATS) was established in November 2014.

The 15 Airbus EC135 T2+ training helicopters, maintained by Boeing Defence Australia (BDA), have flown 40,000 hours, comprising more than 27,000 individual flights, the majority of which have been for aircrew training. Under the HATS contract, BDA trains pilots, aviation warfare officers, remote pilot warfare officers, aircrewmen, sensor operators and qualified aircrew returning for instructor training, and delivers supply chain operations and program support services, along with engineering and maintenance of the EC135 T2+ fleet.

Source: ADM

BLACK HAWK TRAINING

THE ARMY IS RAPIDLY bringing its fleet of UH-60M Black Hawk helicopters into service, with the aircraft and crew flying more than 1,400 hours in support of introduction into service activities since the aircraft's arrival in 2023. Training on the aircraft includes activities with east-coast based Special Forces units. A formal test and evaluation program commenced in November and Army was aiming to achieve Initial operational capability for the type within months.

Ten Black Hawks have been delivered to Australia since August 2023, with a further two aircraft scheduled for delivery last November. In all, 40 aircraft are due to be delivered by 2030. The current fleet is assigned to the 6th Aviation Regiment, based at Holsworthy Barracks near Sydney while the 5th Aviation Regiment, based at Oakey, is expected to receive its Black Hawks this year.

ABOVE 5th Aviation Regiment Boeing pilot instructor Jim Crowe. Photo: Craftsman Luke Hollowood.

Chinook
AVIATORS ACHIEVE 3,000 HOURS

TWO AVIATORS RECENTLY achieved 3,000 flying hours in Chinooks. Aircrew operator technician with Army's C Squadron, Sergeant John Van-Vegchel, and instructor development officer Jim Crowe, join three others in the ADF to reach the milestone.

Sergeant Van-Vegchel began flying in helicopters after more than a decade maintaining them, switching from technician to aircrew operator technician in a trade transfer in 2014. Crowe is a Boeing contractor embedded with the CH-47F Chinook Wing at the School of Army Aviation, having previously served in the RAF.

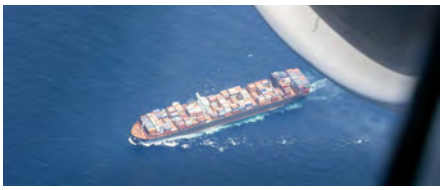
A former aircrew operator technician has the highest number of ADF flying hours in Chinooks with 5596.8 hours.

OPERATION GATEWAY CONTINUES

TWO RAAF P-8A POSEIDON maritime patrol aircraft were deployed last November to conduct patrols in the North Indian Ocean and South China Sea under Operation Gateway. Operation Gateway is Australia's longest running Defence operation and deploys RAAF P-8A aircraft to Royal Malaysian Air Force Base Butterworth each year.

The two countries are committed to a peaceful, secure and prosperous Indo-Pacific Region and Gateway is a key part of the Malaysia-Australia Joint Defence Program, which marked 40 years in 2021.

BELOW A merchant vessel monitored from a P-8A Poseidon during Operation Gateway 24-1. Photo: LAC Chris Tsakisiris.



The first RNZAF C-130J-300 Hercules to land in Antarctica is unloaded at McMurdo Station. Photo: NZDF.

RNZAF's first C-130 ANTARCTIC FLIGHT

THE ROYAL NEW ZEALAND AIR FORCE (RNZAF) took delivery of its first C-130J-300 in last September and in the same month it deployed a C-130J-300 Hercules to its Scott Base in Antarctica. Its fifth, and last C-130J-300 aircraft, arrived in December.

While the RNZAF routinely fly Hercules to Antarctica, it was the first flight by a C-130J to the continent and a milestone for the C-130J Transition Unit. The aircraft carried cargo to support scientific research programs at the NZ Scott Base and US McMurdo Station.

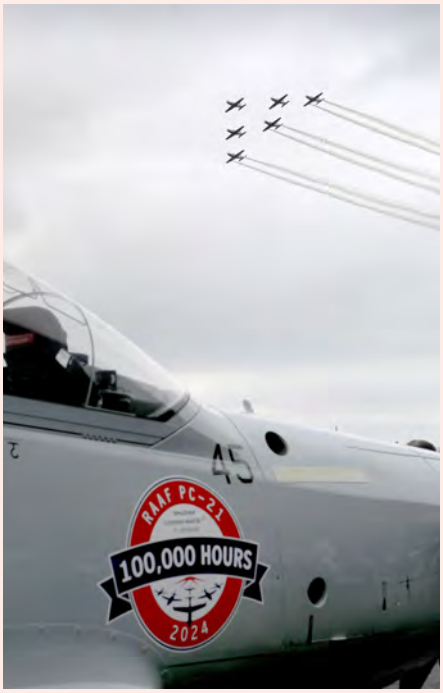
The C-130J was scheduled to make six trips over the summer season carrying passengers and cargo. The NZ Defence Force typically deploys about 140 personnel each year to Antarctica.

Source: Contact

Canada selects PC-21 for training

THE ROYAL CANADIAN AIR FORCE (RCAF) has selected the PC-21 for its Future Aircrew Training program with a request for 19 aircraft that will be stationed at Moose Jaw Air Force Base in Saskatchewan from 2026, to provide advanced pilot training. The integrated PC-21 training system includes mission planning and debriefing systems as well as training materials to support ground-based training.

The total fleet of PC-21s worldwide is just under 250 and includes air forces in Europe, the Middle and Far East and Australia. The Swiss Air Force adopted the PC-21 in 2008.



RAAF PC-21 MILESTONE

THE RAAF PC-21 FLEET has achieved a significant operational milestone surpassing 100,000 flying hours. With a fleet of 49 aircraft, the PC-21 is a cornerstone of the Air Force's pilot training system, preparing the next generation of ADF pilots for the challenges of modern air operations.

It bridges the gap between basic flight training and frontline readiness.

ABOVE PC-21 flypast during a ceremony marking the milestone. Photo: RAN.

LONG-DISTANCE RECORD

LAST NOVEMBER, a RAAF KC-30A tanker aircraft flew non-stop from RAAF Base Amberley, Qld to Jerez, Spain, in just over 23 hours. It was the longest non-stop RAAF flight on record and the aircraft was refuelled twice by a second RAAF KC-30A aircraft.

The flight carried 21 personnel, including five pilots, to share the flying task and fatigue load. It was part of a week-long exercise with the French Air and Space Force (FASF) during which the KC-30A provided air-to-air refuelling support for FASF Eurofighters.

On the return flight to Australia the RAAF KC-30A was refuelled by both a RAAF KC-30A and a FASF Multi-Role Tanker Transport.

ABOVE A RAAF KC-30A receives air-to-air refuelling to enable a record-breaking flight.

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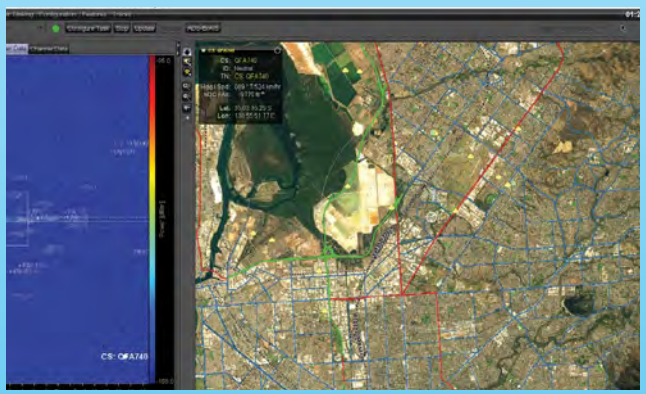

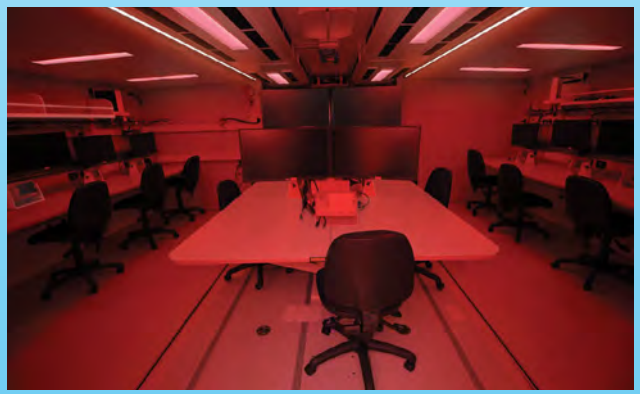

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ANZAC CHARITY CONCERT

COINCIDING WITH THE 80TH ANNIVERSARY of the end of Australia's involvement in WWII, the 'Allies of War' Anzac charity concert will be a 'Salute to all Australians who have served in the Defence Force'. It will include a tribute to the entertainers and radio legends of the 'Concert Parties' who performed during WWII and also songs from WWI, in the effort of boosting the troops' morale.

Performed by the Clarence Valley Orchestra & Chorus, conducted by artistic director and ex-RAAF musician Dr Greg Butcher, the concert will include WWII singalong medleys, the songs of Vera Lyn and Marlene Dietrich, and the Big Band sounds of Glen Miller and the Andrews Sisters. Guest artists include vocalist Maggie Britton and Coffs Coast Pipes & Drums.

Supported by Woolgoolga RSL sub-branch members, Allies of War will be held on Saturday 26 April 2025 at 2pm at the Wiilgulga Sports Complex, Coffs Harbour, NSW. Tickets are available online at events.humanitix.com/anzac-80th-anniversary-charity-concert.

Farewell and WELCOME

ON 21 JANUARY, Air Force Association (South Australia) hosted an informal reception at the Combined Ex-Services Mess, Torrens Parade Ground, Adelaide to farewell AIRCDRE Adrian Maso and welcome his replacement, AIRCDRE Grant Fifield, as Senior Air Force Representative in South Australia and Commander Air Warfare Centre (AWC).

Governor of South Australia, the Honourable Frances Adamson AC was guest of honour and provided a farewell speech to AIRCDRE Maso, acknowledging his leadership in refocusing the AWC in light of Australia's changing strategic challenges and Air Force's impressive leadership and contribution in community engagement in Adelaide. SA Minister for Veterans Affairs Joe Szakacs acknowledged AIRCDRE Maso's service and support in the veteran community in a separate speech. Other political dignitaries in attendance included: SA Minister for Defence and Space Industry Stephen Mullighan; shadow SA Minister for Veterans Affairs Adrian Pederick; Nicola Centofanti MP; Senator David Fawcett; Federal MP for Spence Matt Burnell; Adelaide Lord Mayor Jane Lomax-Smith; and Playford Mayor Glenn Docherty.

For the past two years, AIRCDRE Maso has served as Commander AWC, RAAF Edinburgh, the Senior ADF Officer Edinburgh Defence Precinct and the Senior Air Force Representative SA. He has helped ensure RAAF Edinburgh and the AFA worked together in commemorations, promoting and preserving Air Force heritage and veterans' support. He has been instrumental in highlighting contemporary veterans' needs, something AFA recognises as a key priority.

AFA-SA thanks AIRCDRE Maso for his support and wishes him all the best for his return to Canberra, and warmly welcomes AIRCDRE Fifield and his wife Megan.

ABOVE From left, AIRCDRE Adrian Maso, Hon Joe Szakacs, Her Excellency Frances Adamson, AIRCDRE Grant Fifield, Rod Bunten (Government House), Lawrence Ng, President AFA-SA.

Bomber Command commemoration

ON SATURDAY 31 MAY 2025, a Last Post Ceremony at the Australian War Memorial (AWM) will tell the story of an airman of Bomber Command recorded on the Roll of Honour. Book a free ticket via the AWM website, awm.gov.au/visit/plan.

The next day, Sunday 1 June, at 11am, at the AWM's Bomber Command Memorial, a ceremony will be held to pay tribute to the 10,000 RAAF aircrew along with ground staff and Women's Auxiliary Air Force members who served in and supported RAF Bomber Command from 1939 to 1945. The Bomber Command Commemorative Day Foundation (BCCDF) also recognise the 4,149 RAAF members who made the supreme sacrifice while serving across 132 RAF, RAAF, RNZAF and RCAF operational squadrons and operational training units of Bomber Command.

There will be a dinner on Saturday evening at the ADFA Officer's Mess and lunch following the ceremony on Sunday at Poppy's Café at the AWM. If you are interested in attending, contact the BCCDF.

For further details, see bccdf.org.au or email events@bccdf.org.au.

COFFEE4HEROES

AUSTRALIA'S FIRST NOT-FOR-PROFIT COFFEE, dedicated to supporting those who have served or are currently serving in the ADF and their families, was launched in September 2024 by Wounded Heroes.

Wounded Heroes exists to bridge the gap between ADF payments and the often-urgent needs of veterans in crisis. Its mission is to prevent veteran suicide and ensure no veteran, ADF member, or their family faces hardship alone. It offers immediate assistance, such as fuel and food vouchers, temporary accommodation and compassionate support. Its Ipswich Veteran Centre features an Op Shop and Jim's Café, where veterans and their families can connect and access care, while sharing a cup of great coffee.

Wounded Heroes relies entirely on public donations, sponsorships and event proceeds. Every bag of Coffee4Heroes

sold helps fund the charity's 24/7 crisis helpline, which provides essential support to veterans, serving ADF members and their families facing crisis, including financial hardship, mental health challenges and domestic violence.

Drop in to Jim's Café or visit the online shop at coffee4heroes.shop to purchase a range of coffee (including instant, pods and beans) selected from the world's finest coffee plantations.

Transition SEMINARS

TRANSITION FROM FULL-TIME SERVICE to a predominantly civilian life can be a time of change and uncertainty for ADF personnel and their families. Defence is committed to improving that experience.

The Joint Transition Authority (JTA) helps ADF personnel and their families make the first step on the journey with transition seminars. Delivered under the JTA's Defence Force Transition Program, the seminars explain more about the transition process and the supports available through Defence and the wider transition ecosystem. Seminars are delivered in person and online through the virtual-live (interactive) format. There are also opportunities to network and connect with organisations from Defence and the broader transition ecosystem at live and virtual exhibition stalls.

AIRCDRE Kaarin Kooij, Director General Joint Transition Authority says transition seminar's play an important role in connecting ADF personnel to localised support. "The JTA has an important role to play in every member's transition journey to ensure they are prepared to transition to a predominantly civilian life, and if support is required post transition, they have a smooth progression to external support," says AIRCDRE Kooij. "Attendance at a seminar can really demonstrate to our people that they are not alone in their transition journey. I think seeing that there is a room full of people and organisations there to support you can be really impactful."

Transition seminars run throughout the year and ADF personnel are encouraged to attend throughout their career to stay informed and up to date on transition requirements, supports and services. It is mandatory for ADF personnel to attend a transition seminar within 12 months of their transition date. ADF supervisors and managers are also encouraged to attend to become better informed about how they may support the welfare of ADF members who are separating or transferring from full-time service.

For more information about ADF member and family transition seminars or to register your interest in attending, visit defence.gov.au/adf-members-families/military-life-cycle/transition/seminars.

Genevieve Mulley,
Transition Engagement Manager

AUSTRALIA DAY HONOURS (AIR FORCE)

MEMBER OF THE ORDER OF AUSTRALIA IN THE MILITARY DIVISION (AM)

Wing Commander Cameron Murray Douglas For exceptional service delivering advanced integrated air and missile defence capability for the ADF and the USAF.

Group Captain Marija Jovanovich CSM For exceptional service to the RAAF in the provision of command and leadership within the Orion AP-3EW maritime patrol capability.

Air Commodore Matthew Robert McCormack For exceptional service in advancing the F-35A Lightning II air combat capability for the ADF.

Air Commodore Michael Joseph Reidy For exceptional service to the ADF in cyber and communications appointments.

Warrant Officer Vanessa Christine Schneider For exceptional service as a warrant officer in the RAAF.

MEDAL OF THE ORDER OF AUSTRALIA IN THE MILITARY DIVISION (OAM)

Warrant Officer Gary John Anderson For meritorious service to the ADF in joint leadership roles.

Group Captain John Sidney Price (Ret'd) For meritorious service as an inquiry officer and facilitator of the administrative inquiry capability in the RAAF.

CONSPICUOUS SERVICE CROSS (CSC)

Group Captain James William Blagg For outstanding achievement in ADF air capability sustainment contracting.

Air Commodore Anthony Phillip Jones (Ret'd) For outstanding achievement in the ADF as Director of the Indonesia Safety and Airworthiness Program.

Group Captain Darrell Robert May For outstanding achievement in space operations in Joint Capabilities Group.

Wing Commander Lachlan James Melville For outstanding achievement in leading and managing ADF acquisition of Integrated Air and Missile Defence capabilities.

Wing Commander Jamie Robertson Minor For outstanding achievement in ADF Air Operations planning for Operations Beech, Carnelian and Southern Discovery from January 2022 to December 2023.

Wing Commander Benjamin David Sawley For outstanding achievement as Commanding Officer No 1 Flying Training School, RAAF.

Flight Lieutenant Matthew Robert Thurling For outstanding achievement as the Aeronautical Life Support Mustering Capability Advisor in delivering a transformational change program to create an effective Tri-Service Life Support capability.

Wing Commander Janine Frances Tillott For outstanding achievement implementing Gender in Military Operations reform for the RAAF.

Group Captain David Trevor Torrington For outstanding achievement in the development and execution of C-27J Spartan operations for the ADF.

Squadron Leader James Alexander Wheeler For outstanding achievement in enhancing F-35 survivability and F-35 Mission Data collaboration for the RAAF and F-35 Program nations.

CONSPICUOUS SERVICE MEDAL (CSM)

Warrant Officer Rita Diana Coles For meritorious achievement as the Senior Air Operations and Air Force Liaison Officer, Defence Cooperation Program, Papua New Guinea.

Squadron Leader Luke Daniel Georgeson For meritorious achievement in modernising the RAAF Tactical Air Control Party, making significant contributions to evolving Air Force command and control capabilities and enhancing air land integration with the Australian Army.

Flight Sergeant Peter John Greentree For meritorious achievement in the application of exceptional skills, judgment and dedication as an Aircraft Technician and Maintenance Executive at No 36 Squadron.

Squadron Leader Ryan John Milsop For meritorious achievement as the Australian Liaison Officer at the United Arab Emirates Air Force Air Warfare Centre, located at Al Dhafra Air Base, United Arab Emirates.

Wing Commander Brad Anthony Sheldon For meritorious achievement in the development of the cyber-warfare workforce and the cyber-warfare capability of the ADF.

Corporal Simon Edward Tapply For meritorious achievement in the enhancement of adversary tactics analysis within the RAAF.

Citizen of the Year

TOWNSVILLE CITY COUNCIL has named Edmund 'Ted' Mildren its citizen of the year for his tireless dedication and leadership. A member of the Townsville Branch of the RAAF Association since its inception in 1990, Ted has devoted 34 years of continuous service to the organisation.

Acting Mayor Ann-Maree Greaney, in the presence of Qld Governor Janette Young and Premier David Crisafulli, presented the award, highlighting Ted's outstanding contributions to the Air Force Association and its members. "As a proud garrison city, it was a real honour to present this award to Ted, who has made an incredible difference to the lives of Air Force personnel and their families," she said.

Over the years, he has held numerous leadership roles with the Association, including: Townsville Branch President (1995–2000); Branch Secretary/Treasurer (2013–2019) and continuing as Treasurer; NQ Area Vice President (2013–2020); Division President (2020–2024) and Interim Branch Welfare Officer (since May 2024).


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Registrations for overseas

ANZAC DAY SERVICES

REGISTRATIONS ARE NOW OPEN for Australians who are planning to attend the Anzac Day Dawn Services in Türkiye and France in 2025, on the 110th anniversary of the landings at Gallipoli. The service in Türkiye will be held at the Anzac Commemorative Site, Gallipoli, followed by a mid-morning Australian Memorial service at Lone Pine Cemetery. The service in France will take place at the Australian National Memorial, near Villers-Bretonneux followed by an Australian service later in the day at the 'Digger' Memorial, Bullecourt.

Those who plan on attending either service can register for their free attendance passes now at *commemorations.teg.com.au/en*. Registration is essential.

RAAF Airfield Defence Guard

SERVICE IN VIETNAM

AIRFIELD DEFENCE ASSOCIATION OF AUSTRALIA HISTORIAN, Dr Sean Carwardine is researching the service of RAAF Airfield Defence Guards (ADGs) in Vietnam, focusing on their attachments to Army units during 1967 and 1968.

He wants to connect with Vietnam veterans who served with Base Support Flight or 1OSU in Vung Tau and have direct knowledge of ADGs being attached to Army units. He is particularly interested in an ADG attachment to 4RAR in July 1968, when a battle with Viet Cong forces occurred at the Horseshoe. An ADG was reportedly present when a 4RAR soldier was killed. Following the incident, discussions reportedly took place between the Army and RAAF regarding the ADG's bravery and actions in the battle.

Veterans with relevant information can contact Dr Carwardine, on 0400 703 565 or email carbs99@bigpond.com.

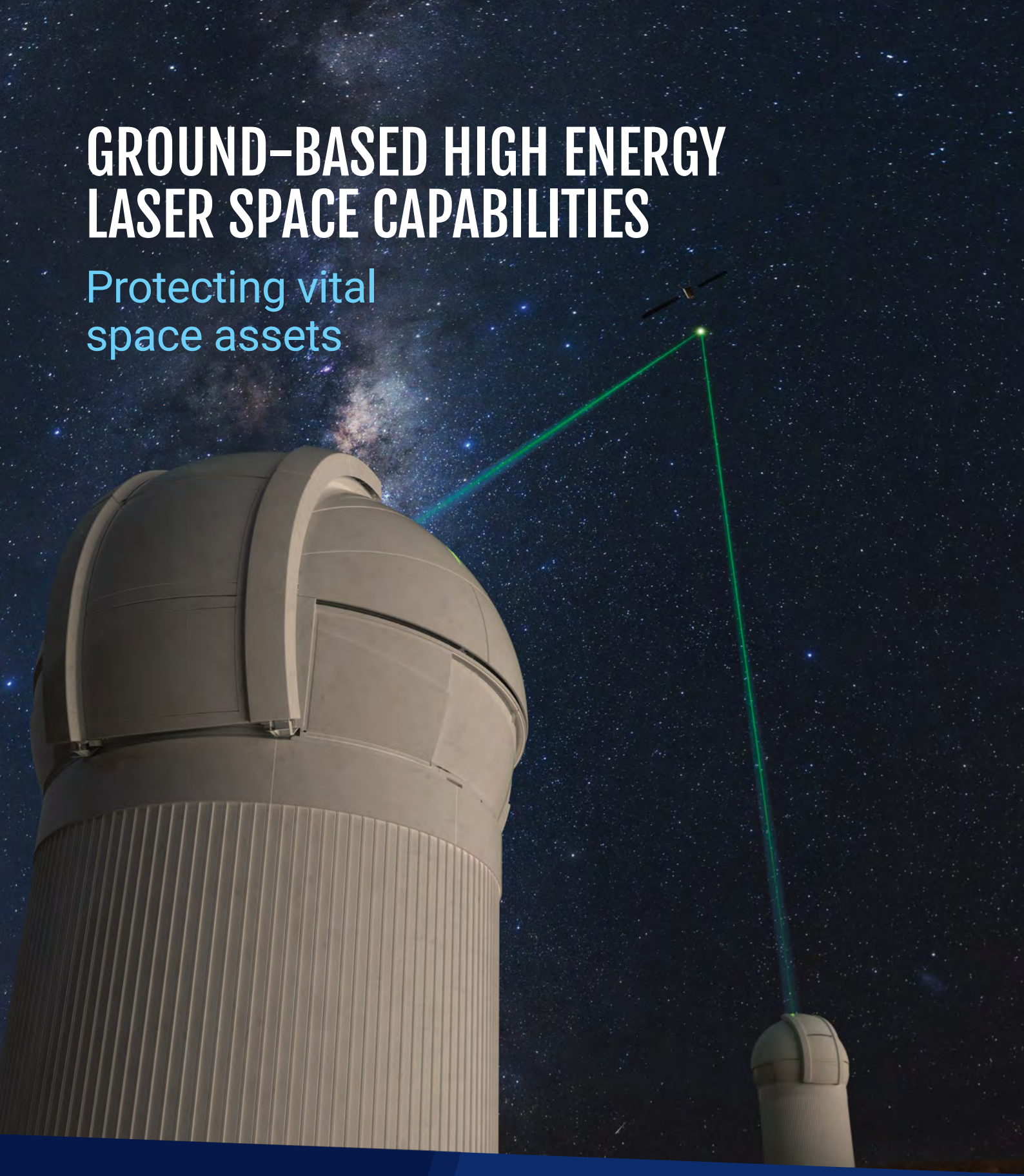
Afternoon Tea with Jack

ON 30 APRIL 2025, Fighter World, NSW will recognise the 50th Anniversary of the end of the Vietnam War with a special event.

Fighter World General Manager, Jack Fanderlinden flew the last Australian C-130 out of Vietnam and Fighter World is organising an "Afternoon Tea with Jack" to commemorate the event. Jack will talk about his experiences and afternoon tea will be provided.

The event is ticketed and limited to 150 guests. There is already much interest. For tickets and details, see *fighterworld.com.au* or phone 02 4965 1810.

Adjacent to RAAF Williamtown, NSW, Fighter World has been appointed by History and Heritage Branch – Air Force to perform the role of RAAF Williamtown Aviation Heritage Centre.



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EDITED BY John Kindler

Multi-billion-dollar GWEO BLUEPRINT

THE GOVERNMENT HAS officially unveiled its Guided Weapons and Explosive Ordnance (GWEO) Plan to accelerate domestic manufacturing. The $16-$21 billion GWEO Plan builds on the 2024 Defence Industry Development Strategy and is designed to enhance Australia's strike capability and preparedness.

It aims to provide certainty to the Australian defence industry on its role to boost the domestic manufacture of missiles and munitions and support the uplift of GWEO stockpiles in Australia and represents five percent of the Integrated Investment Program's total budget.

As reported in the summer edition of *Wings*, the government has already announced key capability investments set out in the 2024 Australian GWEO Plan, including:

- $850 million in partnership with Kongsberg Defence Australia to manufacture and maintain the Naval Strike Missile and the Joint Strike Missile from 2027 at a new facility being built at Williamtown, near Newcastle, NSW.
- $37.4 million in partnership with Lockheed Martin Australia to enable an initial batch of Guided Multiple Launch Rocket Systems (GMLRS) missiles to be manufactured in Australia from 2025.
- $7 billion agreement with the US to acquire the Standard Missile 2 Block IIIC and Standard Missile 6 long-range missiles.
- $142 million for the accelerated acquisition of the Joint Strike Missile, to be delivered from 2025.
- Up to $60 million over five years to develop hypersonic and long-range strike capabilities.
- $22 million over three years to seek options from industry to establish a manufacturing complex to produce rocket motors in Australia.

LEFT Test fire of a development Joint Strike Missile on the US Air Force's F-35 Joint Strike Fighter. Photo: Kongsberg Defence Australia.

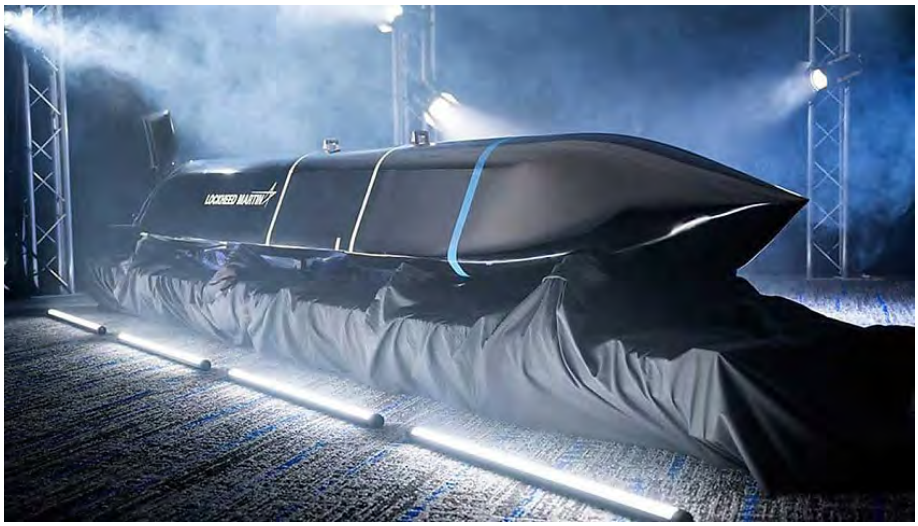
Announcing the plan, Minister for Defence Industry and Capability Delivery Pat Conroy confirmed that the Royal Australian Navy's Hobart Class destroyers would field the proposed 200 Tomahawk cruise missiles by the end of the year, providing a tenfold increase in the Navy's strike range. The minister also confirmed the government's commitment to an Australian manufacturing facility in partnership with Lockheed Martin Australia to domestically manufacture the GMLRS missiles.

The government has commenced site assessments, with plans for the facility to be operational by 2029, along with the capacity to manufacture a range of weapons and contribute production capacity to Australia's trusted partners in the region and beyond.

In December, a sod-turning ceremony marked the start of construction of the $850 million Williamtown missile factory at Astra Aerolab, Newcastle Airport. The government is building the factory on Newcastle Airport-owned land in partnership with Norwegian firm Kongsberg. It is expected to create 500 construction jobs during a fast-tracked two-year build and 100 ongoing positions once missiles begin production in 2027.

Source: Defence Connect; Newcastle Herald

ABOVE Sod turning, from left: Kongsberg Defence & Aerospace EVP missiles and space Øyvind Kolset, Minister Conroy, Paterson MP Meryl Swanson, Kongsberg Defence Australia general manager John Fry and Newcastle Airport CEO Peter Cock.



Next-gen 'extreme range' GUIDED MISSILE

LOCKHEED MARTIN (LM) has officially launched the AGM-158 eXtreme Range (XR) cruise missile, an evolution of the Joint Air-to-Surface Standoff Missile (JASSM) currently on order for service with the RAAF.

In response to the growing advancement and proliferation of anti-access/area denial and advanced air defence umbrellas across the European and Indo-Pacific theatres, the new AGM-158XR is designed to provide much needed range to the US and its allies. However, it is not officially on order with the US Air Force or the broader US military as yet.

LM's AGM-158XR concept draws on the experience and expertise developed over two decades of development and manufacturing of the JASSM and Long-Range Anti-Ship Missile Extended Range (LRASM), which is currently to be fielded by the RAAF F/A-18 E/F Super Hornet fleet.

The XR provides the warfighter a 450kg-plus warhead in a low observable missile capability with an extreme stand-off range in mass quantities, while maintaining compatibility with the same platforms that JASSM and LRASM have today, including the F/A-18 and the soon to be added F-35.

Source: Defence Connect

Panther fire trucks trialled

THE ADF PUT NEW Panther fire trucks acquired under Project LAND 8180 through their paces as part of a new capability demonstration at RAAF Base Amberley in October.

The initial operational test and evaluation activities included day and night aviation rescue and firefighting responses where firefighters from No 23 Squadron demonstrated their ability to employ the new capabilities in responding to simulated Category 6 aviation incidents.

The 19 new Panther fire trucks are equipped with a high-reach extendable turret that can produce a dual-agent attack at aviation incidents.

Air Force is the first aviation rescue firefighting organisation in Australia to have the new capability.

Source: Defence Connect

BELOW The Panther Fire Truck showcases its capabilities at RAAF base Amberley. Photo: Defence.

BAE Systems wins missile SENSOR CONTRACT

BAE SYSTEMS AUSTRALIA has signed a $160 million contract to triple production of its advanced passive radio frequency sensor (PRS) fitted to Kongsberg Joint Strike Missiles (JSM) and Naval Strike Missiles (NSM), taking production to more than 1,000 units over the next six years.

BAE Systems Australia Managing Director of Defence Delivery Andrew Gresham says the sensor is highly innovative technology designed, developed and built in Australia.

"It is a world leading capability and a critical enhancing component of the Joint Strike Missile," Gresham said.

NSM is a ship-launched cruise missile able to strike sea and land targets at ranges of more than 200km. It's been adopted by the US, Australia and other nations. JSM is the air-launched variant and is the only anti-ship missile able to be carried in the F-35 weapons bay.

JSM is entering service with the US, Australia and other nations.

JSM and NSM feature a multi-mode seeker with the PRS used to detect target radio and radar emissions.

BAE received funding in 2013 under the Priority Industry Capabilities program to support development of the seeker technology. A government-to-government agreement in 2015 formalised Australian-Norwegian collaboration on the JSM program.

Source: Australian Defence Magazine

TIGER RETIREMENT PLAN

THE ADF HAS laid out a three-stage plan to complete the upcoming retirement of the Tiger Armed Reconnaissance Helicopter fleet and ensure smooth transition to the AH-64 Apache attack helicopter. The two-seater Tigers, introduced into service in 2004, are expected to be withdrawn from service in 2027/2028.

Chief of Army Lieutenant General Simon Stuart outlined the plan during a Senate Estimates meeting last November. "First, we need that capability operating out to 2027, one for the capability and two for the transition plan onto the AH-64 Echo," he said. "Second, …there are issues and pressures in the fleet for spare parts, very similar to the underperformance of the Taipan system.

"Thirdly, …we are looking at stabilisation programs to ensure that we can keep that fleet operational until its withdrawal from service. It's a balance of relative risk."

Ukraine has expressed interest in the retiring Tiger helicopters. It previously requested access to the ADF's now-scrapped MRH-90 Taipan helicopter fleet but was unsuccessful.

Source: Australian Aviation

BELOW Army Tiger Armed Reconnaissance Helicopters conduct deck landing procedures on HMAS *Adelaide* as part of Exercise Keris Woomera 2024. Photo: CPL Janet Pan.

VTOL UAS FOR THE NAVY

PUERTO RICO-BASED RED CAT, via its Australian-based distributor Criterion Solutions, will provide a fleet of 12 FlightWave Edge 130 Blue systems for the Royal Australian Navy.

FlightWave, an industry-leading provider of vertical take-off and landing (VTOL) drone, sensor and software solutions, was acquired by Red Cat in September 2024, bringing the Edge 130 Blue into Red Cat's family of low-cost, portable unmanned reconnaissance and precision lethal strike systems.

The Edge 130 Blue is a military-grade tricopter unmanned aerial system (UAS) for long-range mapping, inspection, surveillance, and reconnaissance needs. Its size, weight and vertical take-off capabilities make the platform ideal for maritime operations and littoral environments.

Weighing 1,200g, the Edge has a 60-plus minute flight time in forward mode. Designed for government and military applications, the Edge 130 Blue can be assembled and hand-launched in one minute by a single user to capture high-accuracy aerial imagery with medium-range autonomy.

Red Cat is a drone technology company integrating robotic hardware and software for military, government, and commercial operations.

Source: Defence Connect


KONGSBERG
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Gilmour Space
SATELLITE BUS ORDER

LATCONNECT60 HAS SELECTED Gilmour Space to provide an ElaraSat 100kg satellite bus for its upcoming Short-Wave Infrared Imagery Satellite (SWIRSAT) mission.

"This 100kg prototype satellite will be a key milestone in LatConnect60's vision to deploy a LEO [low Earth orbit] constellation that will deliver vital Earth observation data and insights, starting with carbon-emissions monitoring, to both government and commercial customers," said Gilmour Space's Head of Satellites Mark Grimminck.

SWIRSAT will carry advanced sensors and an edge computer provided by Sydney-based Spiral Blue. Integration work will be completed by Gilmour Space in Queensland with Skyroot Aerospace in India set to launch the finished satellite.

SWIRSAT will pinpoint and quantify source-level carbon emissions at a high accuracy, filling a key data gap in the market from LEO.

Source: Australian Defence Magazine

ABOVE Adam Gilmour, left, CEO and co-founder of Gilmour Space, with Venkat Pillay, CEO and Founder of LatConnect60. Photo: Gilmour Space.

SATCOM innovation

THE ADF APPEARS to be rapidly filling the gap left by axing JP9102 after Fleet Space announced it had successfully tested two-way voice and data transfer via satellite.

The Australian company said it delivered advanced satellite communications with "reduced cost and added resilience" to support Defence's "space strategy priorities". The reprogrammed Centauri 6 which transmitted the data operates in a favoured low Earth orbit.

After the government axed the $3 billion JP9102 project to deliver a new military satellite communications capability for Australia, led by Lockheed Martin Australia (LMA), Defence Minister Richard Marles argued it was because multiple low Earth orbit satellites are more secure from attacks than a single geostationary spacecraft, as planned by LMA.

At the November MilCIS industry event in Canberra, Air Commodore Peter Thompson, a senior figure in Defence space capability, said JP9102 was changed because the threat from adversaries had altered. "JP 9102 is not dead … that money is still there," he said. "We're just working out the best way to use it in the current environment. Defence isn't going to waste money on something that is no longer the best use of our money."

Source: Space Connect

University and Defence
SENSOR CONTRACT

THE ADVANCED STRATEGIC CAPABILITIES ACCELERATOR (ASCA) has signed 21 contracts as part of an investment of more than $60 million with Australian universities and industry partners.

The contracts, made under ASCA's Emerging and Disruptive Technologies (EDT) program, aim to back local innovation in quantum and counter disinformation technologies to provide an asymmetric advantage on the battlefield. The EDT program is pushing scientific knowledge to advance the development of existing and new capabilities that help deter hostile acts against Australia and in the region.

Contracted companies and universities include Analog Quantum Circuits, Commonwealth Scientific & Industrial Research Organisations, Consunet, DeteQt, Diamond Defence, Infleqtion (ColdQuanta), Monash University, Nomad Atomics, Q-CTRL, QuantX Labs, Lockheed Martin Australia, University of Adelaide, University of New South Wales, University of Technology Sydney, University of South Australia and the University of Western Australia.

Source: Defence Connect

NEXT-GENERATION JAMMER

RAYTHEON HAS BEEN awarded a US$590 million ($908 million) contract to deliver Next Generation Jammer Mid-Band (NGJ-MB) ship sets to the US Navy (USN) and RAAF.

The NGJ-MB system consists of two pods, referred to as a ship set, which are mounted onto an EA-18G Growler aircraft. The system is designed to provide significantly improved airborne electronic attack capabilities against advanced threats in the mid-band frequency range through enhanced agility and precision within jamming assignments, increased interoperability and expanded broadband capacity for greater threat coverage against a wide variety of radio frequency emitters.

The contract includes 13 ship sets; nine for the USN and four for the RAAF. The RAAF sets are funded through US$185.9 million ($286 million) worth of RAAF cooperative development funds. The broader contract, to be completed January 2028, also includes spares, maintenance, and one-off engineering support.

Australia has been a cooperative development partner in the NGJ-MB program since 2017.

Source: Australian Defence Magazine

ADF parts manufacturing

BOEING DEFENCE AUSTRALIA (BDA) has received military production organisation approval (MPOA) from the Defence Aviation Safety Authority for the local manufacture of aerospace parts and components. This will speed up parts availability for ADF aircraft while driving down overall sustainment costs.

The MPOA permits BDA to bulk produce a range of aerospace-grade items, including: avionics electrical and mechanical appliances; electrical, wiring and structural harness parts; military display equipment, communication systems; and components for ADF aircraft. The first part to be manufactured under the authorisation, a plastic wire guard for a RAAF F/A-18F Super Hornet, was recently produced by BDA's team at RAAF Base Amberley.

Source: Defence Connect

WORDS Gregor Ferguson

FUTU

Artist's impression of the UK, Italian and Japanese GCAP aircraft. Image: BAE Systems.

FCAS, GCAP AND NGAD… THE START OF THE SIXTH GENERATION.

THE RAAF IS ONE of the first air forces in the world to field a genuine fifth-generation capability. And it could field a sixth-generation replacement for its fourth-generation F/A-18F Super Hornets and EA-18G Growlers by 2040, and elements of a broader sixth-generation capability much earlier than that.

Before exploring the sixth generation, let's be clear on what a fifth-generation air combat capability is. It's about stealthy fighters with lots of sensors. It's also about connectivity, about sharing situational awareness (SA) from the radars, electronic warfare (EW) equipment and infrared sensors on our F-35s, Super Hornets and Growlers, P-8A Poseidon maritime patrol aircraft and E-7A Wedgetail airborne early warning and control aircraft. It's also about secure communications links passing targeting and SA data between them and associated air, maritime, ground and space nodes (some of them headquarters, some of them carrying weapons or sensors, some of them merely acting as communications relays).

Terms like fifth and sixth generation refer to the force's overall capability and not just to one element of it, as the RAAF has proven in repeated operational deployments. However, technology, including manufacturing technology, is moving so quickly and the capabilities it enables are developing so fast that one simply can't afford not to contemplate the sixth generation.

While the world's leading air forces are contemplating their future needs, the US Air Force (USAF) is also contemplating re-engining the venerable B-52H Stratofortress to keep the aircraft flying into the 2050s and beyond, which would make the design more than a century old. At the same time, President Trump's government-efficiency tsar, Elon Musk, wants to see manufacture of the F-35 stopped and the money diverted to the manufacture of uncrewed aerial systems (UAS).

And on Boxing Day 2024, China unveiled the Chengdu Aerospace Corporation (CAC) J-36 stealthy, sixth generation fighter-bomber – J-36 is still a temporary designation – and a smaller Shenyang fighter-size design (possibly optionally manned and carrier compatible) that could also be a sixth-generation aircraft.

All of which confirms the view that the point of balance between large and small aircraft and between crewed and uncrewed aircraft is shifting, and hasn't settled as yet.

NEXT-GENERATION CAPABILITY

The broad characteristics of the sixth generation are:

- Crewed fighters or fighter-bombers with even more stealth than a fifth-generation aircraft
- Long-range to engage the enemy as far away as possible
- Optional crewing
- Very advanced active and passive sensors
- Enhanced man-machine integration to reduce the pilot workload
- Highly advanced digital capabilities, including AI, data fusion, EW and cyber warfare
- A systems architecture that includes Loyal Wingman-type UASs
- Low probability of intercept communications between aircraft and between them and other 'nodes' in space, in the air, at sea and on the ground
- Directed-energy weapons
- A friendly sensor environment, including HQs and reporting centres, that maintain SA in real time and gets target-quality data to appropriate weapons platforms extremely quickly
- Long-range air-air and strike weapons.

There are four principal sixth-generation development programs under way. The UK, Italy and Japan have formed a UK-based joint venture to support the design, development and delivery of the Global Combat Air Programme (GCAP). The French, Germans and Spanish (and eventually the Belgians) are jointly developing the Future Combat Air System (FCAS). The USAF is exploring Next Generation Air Dominance (NGAD), and the US Navy (USN) is contemplating its own F/A-XX NGAD program.

Meanwhile, the Russians are rolling out the Su-57 Felon and developing the sixth generation Su-75 Checkmate. The Chinese already have two stealthy fifth-generation fighters: the CAC J-20, which has been widely reported, and the more recent Shenyang FC-31. China has also revealed two new sixth-generation aircraft, the triple-engined CAC J-36 and the twin-engined Shenyang design which, at the time of writing, had no designation.

Artist's impression of GCAP future fighters. Image: BAE Systems.

TOP MQ-28A Ghost Bat. Photo: Defence.

ABOVE Artist's impression of the US Navy NGAD F/A-XX. Image: Boeing.

India is also contemplating rival fifth-generation designs for its air force and navy (it can't afford both). The Republic of Korea is developing the fifth-generation KAI KF-21 Boromae (Fighting Hawk) fighter, which is now in flight testing; and in Turkey, TAI is flight testing the Kaan fifth-generation fighter. So potential threats and friendly aircraft abound.

What the four major allied sixth-generation programs have in common is a crewed aircraft at their heart and the stated intent of using what the Americans call a collaborative combat aircraft (CCA). These will be autonomous, semi-stealthy aircraft with fighter-like range and speed. They will add mass to the airborne force, putting relatively long-range sensors and effectors in useful numbers on semi-attritable platforms and keeping human aircrew out of harm's way, at least some of the time. Semi-attritable? Most operators would prefer to risk losing a middling expensive, semi-stealthy UAS to losing a very expensive crewed fighter and its pilot.

These sixth-generation capabilities are a response to two things: most visibly, to the emergence of stealthy, long-range crewed Russian and Chinese platforms in significant numbers and stealthy, high-speed, long-range air-to-air and surface-to-air weapons.

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Artist's impression of the Tempest, the UK's proposed GCAP crewed fighter. Image: BAE Systems.

However, the allied sixth-generation programs also maintain national aerospace, AI, communications, quantum science and stealth research and development (R&D) programs, as well as a manufacturing sector that's able to produce equipment embodying these technologies.

Manoeuvrability and agility remain important in a sixth-generation fighter, though most air combat now takes place at stand-off ranges so stealth, an excellent ceiling, good sensors, long range and long-range missiles matter relatively more in a manned fighter than agility. That said, the F-22's agility (aided by thrust-vectoring engine nozzles) is significant; agility seems to be relatively less important in the F-35.

Like the F-22 and F-35, once a highly complex and expensive sixth-generation fighter design reaches the 'lines freeze' milestone, it's impossible to enhance or change its acoustic, infrared and radio frequency signatures significantly. All the subsequent development work will go into its sensors, effectors, communications systems, cockpit systems and propulsion, and maybe into its surface coatings. Which is why it's so important to get the manned platform right: once you've got it, you're stuck with it.

It also means that flight-critical software must be kept separate from sensor and weapon software. The latter may need to be changed relatively quickly and operators don't want a lengthy, painstaking platform integration program with every update in combat capability, nor the expensive vendor lock-in that seems to go with it.

The R&D workload will be massive because, at least for the first iteration of each family of crewed aircraft, its sensors, effectors, communications and propulsion systems must be considered in parallel with the platform itself. Furthermore, there is no point in fielding an exquisite, crewed sixth-generation aircraft without a supporting fleet of CCAs – so the R&D necessary to develop the CCAs needs to be considered also.

This all suggests a much more intimate relationship between industry and end users: an environment that enables a rapid exchange of views and information and rapid iteration of new technologies.

What is Australia's interest in a sixth-generation air combat capability? The life of type of Super Hornet and Growler will be 2040, according to a Defence spokesperson. "Both capabilities will receive lethality and survivability upgrades, while maintaining their interoperability with the United States and other key partners," the spokesperson says.

"The F-35A continues to be Australia's most capable and survivable aircraft for conducting air-to-air combat missions against advanced threat aircraft and air surface missions against well-shielded targets. Continued investment in the F-35A fleet will provide incremental improvements to the aircraft's capabilities for decades to come."

So we may see a sixth-generation fighter enter RAAF service from around 2040-ish. What about CCAs? The RAAF could buy an American or European CCA, simply to reduce integration, project management and supply chain challenges and expense. But the RAAF is still looking closely at the Australian-developed, semi-stealthy Boeing Defence Australia MQ-28A Ghost Bat.

In February 2024, Defence announced the allocation of an additional $399 million for the ongoing development of the Ghost Bat. That will see the delivery of three Block 2 aircraft with enhanced design and improved capabilities as well as enable further development of the MQ-28A mission payloads, integrated combat system, and autonomous systems. It also includes a series of events throughout 2025 to demonstrate operational integration of these capabilities with in-service assets, according to Defence.

Each of the major sixth-generation programs is highly classified and only artists' impressions of the crewed fighters, and even some of the CCAs, exist.

GCAP

The UK-Italy-Japan GCAP, formerly a UK-led program based on the Anglo-Italian Tempest and Japanese F-X sixth-generation projects, is currently scheduled to enter service as a replacement for UK and Italian Typhoon and Japanese F-2 fighters in about 2035. The supersonic technology demonstrator (of which no images exist) passed its critical design review in mid-2024. It will use the UK Pyramid open-architecture avionics system to hasten and simplify capability upgrades.

The CCA will be provided by the UK Ministry of Defence (MoD) under the Lightweight Affordable Novel Combat Aircraft (LANCA) program. A first attempt to build a CCA under Project Mosquito was cancelled in mid-2022 when the MoD announced more beneficial cost-effective alternatives were available, but it hasn't expanded on those.

TOP Artist's impression of the US Navy NGAD. Image: Northrop Grumman.

ABOVE Airbus model of its CCA.

Scan to learn more

GENERAL ATOMICS
AERONAUTICAL

NGAD

The USAF is currently re-thinking the crewed fighter portion of its NGAD program, which is designed to start replacing the F-22 Raptor in around 2030. Cost is a major consideration. The USAF is simultaneously developing the B-21 Raider and a replacement for the Minuteman III ICBM.

The service is now seeking a crewed fighter at a much lower price, comparable to the F-35. So, the USAF may consider 'disaggregating' major subsystems such as the radar or weapons of a crewed fighter and moving them to other platforms such as CCAs. Likely airframe contractors (at this stage) are Lockheed Martin and Boeing. Northrop Grumman withdrew from the contest in 2024. Meanwhile the NGAD's variable cycle Next Generation Adaptive Propulsion (NGAP) program continues, with the General Electric XA-102 and the Pratt & Whitney XA-103 competing.

At the time of writing, the USAF was deferring decisions on the future of its NGAD until after the Trump administration took over in late-January.

Meanwhile the USAF CCA program continues and currently sees Anduril, with a version (probably) of its Fury UAS, competing with General Atomics with its XQ-67A UAS. Future iterations of the program would allow other players to submit CCA designs also.

F/A-XX NGAD

The US Navy (USN) is working independently on its own NGAD program which includes a new, multi-role F/A-XX 6th generation fighter which is due to replace the service's F/A-18 Super Hornets and EA-18G Growlers from some time in the 2030s. Airframe primes will be chosen from Boeing, Lockheed Martin and Northrop Grumman. The program is fighting with the Virginia-class submarine program for finite funds, but the crewed fighter could achieve Milestone B and move to engineering and manufacturing development as soon as late-2025.

The F/A-XX is designed explicitly to work with CCAs, the first of which will likely be the semi-stealthy Boeing MQ-25 Stingray Carrier-Based Aerial Refuelling System which may also be the platform for stealthier intelligence, surveillance and reconnaissance (ISR) and kinetic CCAs.

Artist's impression of a FCAS future fighter and CCAs. Image: Airbus.

TOP Anduril Fury UAV on which its USAF CCA will likely be based.

ABOVE General Atomics XQ067A, the other CCA selected by the USAF. Image: General Atomics.

FCAS

The France-Germany-Spain FCAS program aims to replace those countries' Eurofighter Typhoons and Dassault Rafale Cs by around 2040. Phase 1B, which will define the technologies to be incorporated in FCAS, as well as the ratio of CCAs to crewed aircraft, is under way after some wrangling over workshare. Phase 2 should begin in mid 2025 with a decision on the configuration of the crewed fighter slightly ahead of that.

The FCAS team members are keeping their cards close to their chests. However, the team says the so-called remote carriers (or CCAs) must cost a fraction of crewed fighters because they will be the primary risk-takers and will face higher attrition rates. It wouldn't be hard to imagine a force of CCAs flying well ahead of manned aircraft, or supporting land or sea-based weapons platforms, to conduct ISR missions, providing or confirming targeting details for weapons with ranges of several hundred kilometres, and conducting other EW-related missions.

And it's no coincidence that EW is one of the six technologies identified as a priority in AUKUS Pillar 2, along with advanced cyber, AI and autonomy, quantum, and hypersonic and counter-hypersonic capabilities. These are all an indivisible part of a sixth-generation air combat capability, and they are the technology challenges facing both operators and innovators.

MBDA

DELIVERING UNIQUE CAPABILITY EDGE

THROUGH KNOWLEDGE AND TECHNOLOGY TRANSFER.

MBDA is a proven, sovereign partner for the delivery of self-reliance for Australia and key allies in guided weapons and explosive ordnance. MBDA is a unique champion of defence co-operation, with a track record of technology transfer to Australia and a worldwide strategy of local manufacture to enable a capable and competitive sovereign industry base across over 90 armed force customers around the world. MBDA stands mission ready as a viable, complimentary alternative to deliver accelerated missile systems capability to the ADF and to foster domestic innovation and a long-term sustainable GWEO enterprise.

An unmanned FUTURE

GENERAL ATOMICS AERONAUTICAL SYSTEMS BELIEVES IT HOLDS THE KEY TO RESTORING AIR SUPERIORITY.

AEROSPACE LEADERS ARE gathering in Australia for the Avalon Airshow against a backdrop of ever-growing uncertainty about the outlook for world security. One thing is certain, traditional ways of doing business won't work anymore.

Advanced nations are slowing – even pausing – efforts to develop new generations of crewed fighter aircraft. Those platforms and the big expensive programs behind them have become so cumbersome and costly, against an increasingly unpredictable threat environment and uncertain returns on investment, that even the US Air Force (USAF) has been forced to reconsider.

How will tomorrow's adversaries fight? With technology changing so quickly, what's the best design for a fighter today that will not fly for many years? Is building one the best use of tight defence budgets? General Atomics Aeronautical Systems, Inc (GA-ASI) thinks there's a better option. It is developing the Collaborative Combat Aircraft (CCA), a large, highly autonomous armed jet that can operate independently or with other uncrewed and crewed aircraft. The company says an individual aircraft is already an effective platform for air warfare, but working in large formations, it has the potential to redefine airpower strategy.

With air-to-air munitions onboard, CCA is designed to be as effective against hostile aircraft as a legacy fighter. With a high degree of independent operation thanks to its onboard autonomy, it doesn't need an always-on satellite or radio data link to be controlled by a remote human pilot. That enables it to operate in contested environments, even where communication networks are compromised.

With no human pilot on board, CCA can take risks that wouldn't be possible for legacy crews – especially in an era when fighters and pilots are more difficult to replace than ever. It can patrol ahead of manned units, establish first contact and, if necessary, fire the first shots, keeping human aircrews out of harm's way.

CCA's advanced capabilities are complemented by its inexpensive mass. Additionally, the aircraft can be produced rapidly in large quantities. GA-ASI's CCA features a common core design, like an automobile chassis, that can be adapted to meet specific customer needs, whether as a baseline model or a highly customised platform. That means allied air forces can procure CCAs in large quantities and incorporate the specific refinements or upgrades they require. Its software and modular design make onboard upgrades easy, ensuring the aircraft is scalable, versatile and future-proof, unlike a conventional fighter.

In February 2024, GA-ASI successfully conducted the maiden flight of the XQ-67A CCA prototype aircraft validating the "genus/species" concept pioneered by the US Air Force Research Laboratory as part of the Low-Cost Attritable Aircraft Platform Sharing program. Since then, the prototype CCA has successfully completed two additional test flights, laying the groundwork for a successful production and flight test program.

"Throughout our 30-year history, GA-ASI has been at the forefront of rapidly advancing unmanned aircraft systems [UASs] that support our warfighters," said GA-ASI President David R. Alexander. "The USAF is moving forward with GA-ASI due to our focused commitment to unmanned air-to-air combat operations and unmatched UAS experience, ensuring the production of the CCA aircraft at scale to deliver affordable combat mass for the warfighter."

Source: GA-ASI.

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FOLLOWING HIS APPOINTMENT AS CHIEF OF AIR FORCE (CAF) ON 3 JULY 2024, **AIR MARSHAL STEPHEN CHAPPELL DSC, CSC, OAM** CONDUCTED ENGAGEMENTS ACROSS EVERY RAAF BASE IN AUSTRALIA. *WINGS* SPOKE WITH HIM ABOUT THE CHALLENGES FACING AIR FORCE AND DEFENCE.

PEOPLE, PURPOSE & PREPAREDNESS

Since becoming CAF, have there been any surprises, has your vision for Air Force changed, and what do you see as your greatest challenges?

I wouldn't say I have had any major surprises since I took on the role in July. While I have been in the joint-space for a number of years, I have been able to keep in close contact with Air Force. My understanding has been further enhanced during my first 100 days in the role as I conducted over 100 town hall engagements across every RAAF Base in Australia with our Warrant Officer of the Air Force.

In my incoming CAF speech, I noted we are in a period of strategic autumn, facing a volatile regional security environment with increased competition between great powers. In this context, Air Force's role, as part of the integrated and focused force, is to deter – in the minds of malign actors – decisions which would lead to further deterioration. I tested this message and the focus of my intent – people, purpose and preparedness – with our aviators over my first 100 days of base visits. I was pleased to see that messaging resonated with our aviators who are already generating and delivering highly effective air power.

The two major challenges I see are developing our vision of Air Force beyond the current generation of capabilities, and driving the organisational cultural change that Air Force must go through in light of Australia's more complex and challenging strategic reality.

The wars in Ukraine and the Middle East continue to demonstrate that air power is evolving at a rapid pace. We need to contextualise these lessons to ensure we take forward those most relevant for Australian air power in the Indo-Pacific.

We should also acknowledge a foundational air power lesson on display in the conflict in Ukraine. Russia should have been able to gain and maintain air superiority over Ukraine from the opening days of their illegal and immoral invasion. They did not and have not. Why? To put it simply, the Soviet Union, like Nazi Germany, took different air power lessons from the Spanish Civil War than the Commonwealth and the United States. They focused almost exclusively on tactical air power, subordinate to their continental land forces. They never developed the level of independent professional mastery – with coherent doctrine, capabilities, plans and tactics, techniques and procedures (TTPs) to deliver the air power effects needed to set up their operational plans and surface domains for success. Russia inherited this approach following the collapse of the Soviet Union and never altered that vector for their conventionally armed air force – despite a modernisation effort from 2008, and portraying itself as a peer competitor to the US and other modern air forces.

Closer to home, regional militaries are investing in new and novel technologies, challenging the Western approach to air power that has been effective since the end of World War II. We know we must also evolve and change our approach and technology to

ensure Australian air power in the future remains highly effective and suited to our national requirements. And we are prepared. A challenge is that air power and the technology upon which it is so heavily dependent is rapidly evolving. Long-term decision making in this dynamic period requires us to establish the principles of Australian air power which will guide our capability development and organisational change processes into the future. These principles must provide us clear vision and direction, yet be sufficiently adaptable that we can respond to opportunities as they present themselves.

Air Force's organisational culture is built on a foundation of tactical excellence and professional mastery; it is what has enabled us to become one of the world's best air forces. But as the strategic environment changes, we need to ensure that our people are mentally and physically prepared for future challenge. We cannot and should not expect individuals to make this shift in mindset and preparedness in isolation – it must be a cultural change across Air Force. Generating and sustaining that change will not be easy. We must find the balance between prudent preparation and counterproductive alarmism. This will require active leadership at all levels of Air Force.

What is the impact of the Defence Strategic Review (DSR) and Integrated Investment Program (IIP) on the future challenges facing Air Force?

The 2023 DSR and the 2024 National Defence Strategy (NDS) have sparked significant and necessary change in the ADF. The NDS details the government's approach to address Australia's most significant strategic risks based on the concept of National Defence, and is making a generational reinvestment in the Defence Force's posture, capability and structure. From an air perspective, the NDS and the 2024 IIP provided the direction necessary to prioritise Air Force's capabilities, including in ISR and long-range strike. The focus the NDS provides is very welcome. It validates the world-leading human and technical capabilities we have invested in over the years, the ongoing development 'flightpaths' those capabilities are on, and the future capabilities we require to provide potent and relevant air power as part of the integrated, focused force. We have been working for some years to develop and implement an agile approach to air operations that improves our ability to exploit the airbases across our north. We are continuing to explore the future of autonomous air power through such programs as the MQ-28A Ghost Bat and similar programs for smaller uncrewed systems. We will continue to evolve our organisational structures to ensure they are optimised to generate and sustain air operations in the event of conflict.

Where the DSR, NDS and the IIP really shapes our approach is in the shift from service-centric joint to domain-centric integration. This may appear to be a subtle difference, but its impact can be quite profound. For example, we don't see the challenges of airbase defence as exclusively an Air Force problem to solve. The successful defence of an airbase will see us leverage the Integrated Air and Missile Defence System (IAMD) capabilities of air power, naval surface combatants and land forces; the force protection capabilities of air force, land forces, and emergency services; and the base management expertise and relationships of Security and Estate Group, as well as whole-of-nation partners at local and state levels. As we seek to address the challenges of the future operational and tactical environment, this integrated approach will increase our options and enable us to identify more effective solutions across all domains.

The Air Force has participated in a range of exercises and operations in Australia and overseas. Does Australia achieve good value for money from them?

Air Force participates in numerous exercises, operations and activities, which are prioritised in accordance with three key requirements. The first is the Joint Collective Training and Operational requirements, the second is Force Generation and Preparedness requirements, and third are our International Engagement activities with key partners and allies.

The greatest benefits and value for money are achieved by balancing these three key priorities in a way that optimises government's directed strategic effects in the most cost effective manner. We will continue to achieve this by ensuring we are aligned with the NDS and apply these prioritised requirements to all of our activities.

Air Force has been the launch customer for the E-7A Wedgetail and the KC-30A air-to-air refuelling multi-role tanker. Both are now being ordered by other nations. How significant has Australia's involvement been and do we reap adequate dividends from our early investments?

I think it is important to note our objectives around innovation and collaboration. Defence works closely to foster collaboration between industry, academia, and government. By cultivating a culture of innovation, we provide clear direction and support, especially in emerging technologies.

In the case of the E-7A and KC-30A, Australia chose to forge ahead with ambitious solutions by ourselves to meet each of the respective capability needs, after carefully assessing the available capability options for both the Advanced Early Warning and Control (AEW&C) and refuelling tanker. The resultant products for both of the E-7A and KC-30A have provided a significant capability dividend for the Air Force and Australia. Both are world-leading capabilities, acknowledged by allies in operations and exercises since their introduction.

While each of these programs experienced development challenges that added to both their cost and delivery schedule, Australia continues to reap benefits from our early investment in both E-7A and KC-30A. This includes increased skills and experience for both Air Force and industry personnel as well as opportunities to influence the direction of next-generation capabilities in development.

The F-35A Lightning II Joint Strike Fighter (JSF) is the ADF's first fifth-generation air combat capability. Australia has acquired the F-35A as part of an international cooperative program led by the US and, along with other international partners, contributed to the development and management of the F-35 air system. How do you see the program continuing to evolve?

I am very pleased the final nine of our F-35A Lightning II aircraft arrived in Australia at the end of last year. These aircraft contribute leading edge air combat capabilities as part of the integrated force.

Maintaining this capability involves building capacity support, by maturing the F-35A Lightning II logistics and support infrastructure to grow the operational capacity of the F-35A Lightning II force.

In turn, we need to keep developing the human capability, our people. Through operationally relevant training and with ongoing development of the knowledge, skills and experience of the F-35A Lightning II technical, supporting and pilot workforce, the program will continue evolving.

Finally, we must preserve the technical capability edge. This is done by maintaining through life system upgrades and modifications, via Project AIR 6000 Phase 6, with complementary investments in F-35A Lightning II weapons and other supporting systems.

Under the JSF cooperative agreement, partners bid for and win work on the global program on a best-value basis. Australian industry has been awarded over $4.1 billion worth of contracts with more than 70 companies involved. How critical has this industry support been and has Air Force been able to work effectively with industry?

As we know, a strong sovereign aviation capability underpins national security and offers direct economic benefits to the Australian economy.

To date, Australian industry has secured over $4.8 billion worth of contracts in the F-35 program across production and sustainment, supporting an expected global fleet of over 3,000 aircraft.

Australian suppliers are now bringing online component Maintenance, Repair, Overhaul and Upgrade (MRO&U) capabilities, which will support aircraft operating outside of the US through to the late 2080s.

Approximately $100 million of funding is allocated from the AIR 6000 Phase 2A/2B approved scope to support Australian companies in developing new and improved capabilities that will increase their chances of securing contracts in the global F-35 Program.

Under Project AIR 6000 Phase 6, F-35A upgrades will be conducted at the Australian MRO&U facility, utilising industry resources procured through F-35 Joint Program Office (JPO) contracts with Lockheed Martin. This will provide a constant income stream for Australian industry through life, while providing critical new capabilities for Air Force.

The government, in conjunction with British Aerospace Systems Australia (BAESA), will deliver an Aircraft Coating Facility (ACF) for Australia's F-35A Lightning II aircraft. The establishment of an Australian F-35 ACF will maintain the capability and deliver enhanced military preparedness and resilience through a strengthened national industrial base.

BAESA is also expanding the F-35 Air Vehicle depot in Williamtown – from three to up to 13 bays. This expansion

AIRMSHL Chappell speaks with aviators at the Officers' Mess during a visit to RAAF Base Amberley, Qld.

will accommodate repair work on Australian and allied F-35 aircraft operating across the Asia Pacific Region.

Defence has been communicating early and often on these contracted MRO&U services, which will enable Australian industry to plan, deliver, and grow the skills and supplier networks needed to achieve our MRO&U outcomes over the decades to come.

Defence Industry provides significant support for a wide range of Air Force capabilities, including the JSF, P-8A Poseidon, etc. What are the challenges in keeping Air Force's capabilities serviceable and updated?

Air power systems are typically quite complex and reliant on a substantial base from which to operate. This support base is often inclusive of an airfield, access to technical servicing and replenishment services.

Airbases are, however, often isolated facilities which rely on a complex supply chain typically using elements of the national support base – be it our own or that of a host nation. This forms a dependency on civilian organisations – and particularly defence industry – as a part of that support base.

Where an airbase is geographically dispersed from regional centres with an established industrial base, establishing and maintaining a skilled workforce with appropriate facilities becomes more challenging. Some of the ways we manage these challenges are building new purpose-designed facilities, having mature and flexible workforce contracts with defence industry, and locating resource intensive maintenance activities (such as deep maintenance) at major regional centres.

To keep our Air Combat Capabilities updated and relevant, all major projects will contain options for ongoing upgrades over the life-of-type of that combat system. These upgrades are often developed in close collaboration with the original equipment manufacturer and supplying nation (e.g. Lockheed Martin and the USAF for the F-35A platform).

The integration of our fifth-generation systems is the foundation of our capable and effective force, and it is inherently complex and technology continues to advance. It is essential for us to maintain pace with these

advancements so that we can continue to generate and deliver highly effective air power.

Our people are central to this. Our Air Force personnel, APS personnel and industry partners – our air domain team – provide a wealth of experience that enable us to keep these highly complex systems serviceable and up-to-date. Philosophies like 'minimum-viable-capability' support our efforts in delivering air power as a focused-force, but it is ultimately the initiative and ingenuity of our people that keep our systems potent.

Fostering the continued growth of our people is a challenge. How do we, as a nation, develop our people to not only support the Air Force of 2030, but the Air Force of 2050? The aircrew, engineers, technicians and scientists that will operate and maintain those systems are being born today. This requires a whole-of-nation approach and eager, inquisitive minds to solve this problem. The NDS guides us on this endeavour.

Defence has identified seven Sovereign Defence Industrial Priorities (SDIPs), which represent the industrial capabilities Defence requires in Australia.

One of these SDIPs is the ADF aircraft MRO&U capability, which is critical to optimising aircraft availability and ensuring it is not compromised especially during times of conflict.

It is essential to grow and guide Australia's emerging MRO&U capability in order to increase supply chain security and resilience, expanding capacity needed to support Australia and our trusted partners during times of conflict. Facilities such as the recently commenced Deep Maintenance and Modification Facility at RAAF Base Edinburgh will be pivotal to allow MRO&U to grow within Australia and importantly to support our regional neighbours and allies.

A program of MRO&U is being undertaken by Capability Acquisition and Sustainment Group (CASG) that will support Air Force by bringing more maintenance activities back into Australia. This enhances resilience, contributing to a stronger defence industry and greater interoperability with allies and partners.

Do you have any advice for industry wishing to partner with Air Force?

Australian industry is at the forefront of Defence, and we continue to support and provide opportunities for small to medium enterprise (SME) in a variety of ways. This includes the Office of Defence Industry Support (ODIS), whose aim is to provide a seamless experience for SMEs to engage with Defence. ODIS should be seen as the trusted link for Australian SMEs looking to enter or expand their footprint in the defence industry.

The core function of ODIS, through its industry engagement teams around Australia, is to provide advisory, guidance and mentoring services to SMEs. They also work closely with state and territory agencies, industry associations and Defence business partners to help deliver capability that equips and sustains the ADF.

The Team Defence Australia (TDA) program is another support mechanism for Australian defence industry. TDA is the premier national platform for export-capable Australian defence and dual-use companies to showcase their goods, services, technologies, and solutions at international trade events. Australia's defence industry exports are vital to growing the resilience of the Australian defence industrial base.

Additionally, Defence Industry Development Grants provide tailored support to Australian businesses in the areas of industry priority. This process is now more streamlined, offering more than $150 million over four years. Eligible businesses can apply through a single portal for the four streams: sovereign Defence industrial priorities, export opportunities, technical skills, and security uplift.

Defence has been reforming procurement, providing easier, faster and more cost effective processes via reforms to the AUSDEFCON suite.

Some of our industrial innovative talent are at the leading edge of global niche capabilities but often suffer from a lack of marketplace credibility because of a perceived rejection by the ADF. Do you think Air Force could do more to develop and support innovative Australian sovereign capabilities?

Air Force recognises the importance of innovative Australian sovereign capabilities in the rapidly evolving technological environment. We are working to achieve this innovation in a variety of ways, including enhancing collaboration through partnerships with small to medium enterprise (SMEs) and start-ups, providing clearer direction with simplified procurement processes and research support, and looking to invest in emerging technologies, including artificial intelligence (AI), quantum computing, and advanced materials. Additionally, I am eager for us to continue to foster a culture of innovation through personnel training, experimentation, and recognition of creative and innovative ideas.

It's a new dawn for TAOT

We're now completing mid-life upgrades to the Transportable Air Operations Towers, having delivered the capability more than 10 years ago as prime systems integrator.

These upgrades ensure the RAAF has the latest technology to support deployed operations in defence of Australia for years to come.

PROTECTED. CONNECTED. TRUSTED.

ROHDE&SCHWARZ

Make ideas real

Over the past 10 years Air Force directly developed and supported innovative Australian sovereign capabilities, many from SMEs, through the Jericho Disruptive Innovation (JDI) directorate, originally known as Plan Jericho. JDI, in collaboration with Australian industry, academia, other ADF innovation units, Defence Science and Technology Group and most recently the Advanced Strategic Capabilities Accelerator (ASCA) – continues to seek out and develop capabilities. This now includes AI and machine learning, which provides an opportunity for asymmetric advantage.

More broadly, Air Force's best foot forward in fostering 'industrial innovative talent' is to identify those talents/niche areas and advocate for ways to support and grow them (where there is direct relation to enhancing military capability and Australian Industry Capability).

As we develop and communicate a better understanding of what the future of Australian air power could and should be, this will necessarily include considerations of sovereign capability development. The exact form and character of that sovereign capacity will ultimately be a decision for government; however, we in Air Force can lay the conceptual foundations that provide the space for Australian industry to grow into. We can already see this with the development of the MQ-28A for example.

Do we have, or could we achieve, sufficient offensive combat power to maintain a credible deterrent element in our national defence?

The 2024 NDS describes a Strategy of Denial as the cornerstone of Defence planning. This approach aims to deter any conflict before it begins.

Force contributes to deterrence by signalling a credible ability to deliver effective air power, with a high degree of lethality and survivability.

The IIP includes investments of $28-$33 billion in capabilities that will enable Air Force to undertake air operations to defend Australia and project force into our primary area of military interest. These capabilities will contribute significantly to our Integrated Air and Missile Defences; provide aerial surveillance of our maritime approaches; and hold at risk, at extended ranges, potential adversary forces that could target our interests during a conflict. All of this substantially contributes to deterring attempts to project power against Australia.

The Strategy of Denial involves us working with the US and other key partners. Australian air power is a highly capable and effective offensive and defensive element of Australian military power. Air Chiefs from around the world speak with admiration of the capabilities that the RAAF can bring to bear against any actor that threatens Australia or its interests. However, we are a middle power nation with a significant area of strategic interest. Generating and sustaining combat operations in the primary area of military interest will challenge us, as it would any force of comparable or even larger size. The NDS makes clear that we should work with the US and key partners to achieve this. When we exercise air power with international partners in Australia and around the region, we demonstrate the credibility and offensive potential of combined air power in defence of shared national interests. This further contributes to the deterrence effect in the minds of any potential adversary.

Air Force support for the Avalon Australian International Airshow is quite extensive. What makes supporting the biennial Air Show so important?

The Australian International Airshow is the largest defence aerospace exposition and public airshow in the southern hemisphere. It's important for Air Force and the ADF more broadly to leverage from the strong international reputation of this event to continue to strengthen our engagement opportunities. It's a unique event where Air Force can conduct significant strategic leadership, defence industry and public engagement outcomes within a busy week.

I have extended an invitation to many of my foreign Air Force Chief counterparts, as well as other important officials, to attend. The week provides us an opportunity for an extensive program of meetings to discuss common challenges, important initiatives and opportunities, while continuing to strengthen our working relationships with allies and like-minded nations, as well as other government departments.

Meanwhile, with nearly 800 companies participating at the last airshow in 2023, and a similar number expected at AIA 2025, the three-day trade exposition also provides the ideal environment to meet with defence industry leaders, view emerging technologies and discuss defence industry related matters with key stakeholders.

We know industry is excited to be part of the Avalon airshow, and the extensive trade exhibits afford them an excellent opportunity to demonstrate how industry contributes to national defence. I, for one, am excited to see the whole event, including the three public days that allow our tremendous aviators to showcase our Air Force, and inspire the next generation of young Australians considering a career in Air Force or Defence.

What would you say to young people seeking a challenging and satisfying career in the Air Force?

That you would be hard pressed to find a career anywhere else that gives you such opportunities to operate or enable some of the most technologically advanced kit in the world alongside an amazing and motivated team of people, and be quite well paid for doing so. There are so many career opportunities available in Air Force. In fact, there are around 300 across the ADF – from chefs, to clerical jobs, to personal trainers, to pilots – just to name a few! I would encourage young people, and maybe the not so young, to visit the ADF Careers website (adfcareers.gov.au) and take a look at the multiple options available to join our Air Force team.

What are the greatest challenges facing Air Force recruiting in an environment of technological advancements and or skill set requirements?

Achieving an Air Force workforce of the right size, experience and skills mix is an ongoing endeavour. While our Air Force is the largest it has been since 1998 and continues to increase in size, we need to expand while being able to absorb that growth and maintain experience at levels consistent with our current healthy separation rate.

There's no doubt that the kind of people we want to become our future aviators are very attractive to other organisations. We are actively working with key stakeholders to help enable and deliver Defence initiatives to continuously improve recruitment, training and retention strategies supporting our workforce.

AIRMSHL Chappell and Warrant Officer of the Air Force Ralph Clifton at a live Explosive Ordinance demonstration at the Defence Explosive Ordnance Training School, Orchard Hills, NSW. Photo: ACW Mikaela Fernlund.

LIGHTNING HAS A NEW FORMATION.

We're using 21st Century Security to give you a clear view through the combat cloud. With defence tech capabilities like cross-nodal connection, Lightning moves fast, and thinks faster.


LOCKHEED MARTIN
AUSTRALIA

AN OVERWHELMING ADVANTAGE

INTRODUCTION BY Bob Treloar

Our third and final article on the F-35 Lightning II looks at how the F-35 has changed the whole air force. It covers the flight-test regime, the ubiquity of the aircraft when evaluated during Red Flag exercises, the introduction of the F-35 into global service and the Australian perspective. The article has been drawn from F-35 The inside story of the Lightning II *(Skyhorse Publishing, New York).*

The four authors are: Tom Burbage, a Naval aviator in a previous life and Executive Vice-President and General Manager of the program for the first decade of the project; Adrian Pitman, Director of Acquisition Engineering Improvement in the Australian Defence Materiel Organisation, and Betsy Clark, who both participated in nine separate reviews of the F-35 program; and David Poyer, a noted writer of American sea fiction.

THE F-35 HAS RAPIDLY BECOME THE CENTERPIECE OF THE AIR FORCE FOR THE FUTURE.

FLIGHT TEST PROGRAM

Operational test and evaluation (OT&E) is conducted by independent agencies within each military service using realistic combat scenarios. Their objective is to determine if a system is effective and suitable for its intended missions. In layperson's terms, ready for combat.

To help insulate the process from service politics, US Congress directed that the Director OT&E also separately report to them. This added another step to the approval process, often an extensive one, to carry out a thorough evaluation, write a report and review it before release to the public.

The scale of the F-35's flight test program was unprecedented. Previous designs had been evaluated at a single site. The Lightning II would operate from three primary sites and 10 secondary sites designed to test very specific aspects of the airplanes. Where older planes had dealt with a single test organisation, the new plane had to coordinate with several, including those from the partner countries. While historical programs had to certify one platform, the F-35 had three airframe variants and "two and a half" engine variants: the CTOL/CV engine, the STOVL engine, the lift fan, and the integration of the fan and the basic engine. While traditional programs had typically scheduled 2,000–3,000 flights and 3,000–4,000 flight hours, the F-35 had 7,000 flights and 12,500 flight hours. The biggest previous programs had flown seven to nine instrumented test airplanes. The F-35 would fly 15. Most unusual of all, the tests would be managed by Lockheed Martin (LM), the prime contractor, not by the government.

When an audience of pilots from all three US services and the eight other international partners were asked: "How many of you have flown a fifth-generation fighter?" Only a few raised their hands. "How many have flown against a fifth-generation fighter?" Most raised their hands. "How did you like the experience?" The response was unanimous: It wasn't a fair fight. Achieving that overwhelming advantage was due, in large part, to the engineering expertise and raw personal courage of the test pilots.

EXERCISE RED FLAG

Situational awareness is the clear perception of a surrounding environment with respect to both time and space. In other words, an accurate understanding of current and projected threats, along with an understanding of where they're heading. Historically, this required the pilot to integrate multiple sensors and displays in his or her head. In the Lightning II, the pilot has the luxury of watching the "movie" unfold on their helmet mounted display.

LEFT
A high-speed pass during the Oregon International Airshow 2019. Photo: USAF Senior Airman Alexander Cook.

RIGHT
F-35s from the RAF, RAAF, US Navy and US Marine Corps on the line during on Exercise Northern Edge 2023. Photo: UK MOD.

In Exercise Red Flags of the past, when different services would fly together in a strike package, communications barriers frustrated cooperation. Squadrons had different airplanes, or different configurations of the same airframe with different electronic systems. That limited everyone's effectiveness in combat, sometimes to a dangerous degree, and offered loopholes an adversary could exploit. When they were brought together back then to operate as a "seamless" force, those seams sometimes tore. Called on to further integrate with allied participants, the rips grew even wider. But the game was about to change.

The first combat exercise with both Air Force F-35As and Marine Corps F-35Bs operating simultaneously occurred during Exercise Red Flag 17-3, a special US-only event. For the first time, the Air Force and Marine Corps validated joint tactics, training, and procedures. The team executed suppression of enemy defenses, attack operations, and defensive counter-air.

The exercise proved the F-35's ability to act as a force multiplier for older fourth-generation aircraft such as the F-16. Their ability to share sensor fusion information with legacy aircraft provided what one pilot called a "God's-eye view" of the battlefield.

GLOBAL SERVICE

As NATO air forces move from the F-16/F-18 to the F-35, their roles and missions are also evolving. While differing older allied configurations and tactics limited their participation, all are now able to participate on day one with the F-35. Allied forces have historically been led by US military commanders, but now there is a real opportunity to share the burdens of combat on a more equitable basis. The roles and the missions of the alliance itself remain under continuous revision. As new nations such as Finland, and Sweden join NATO, they're also joining the common F-35 user family.

INDO-PACIFIC

In the Indo-Pacific region, there is no NATO-like formal alliance system. There are security partners. Australia has been a principal partner since the start. Japan is now building F-35s in their own final assembly and checkout facility in Nagoya. The Republic of Korea is now building major assemblies as they prepare to take delivery of their F-35s. Singapore, one of the original security cooperative participants, has begun the process to become the fourth F-35B operator.

Singapore has the unique operational environment of being a territorially minuscule state with essentially no large airports. Their interest in the F-35B model offered the potential to use highways for takeoff and landing in the event the airports were unusable in a conflict.

LEFT
An F-35C Lightning II comes in for a landing on USS *George Washington* during F-35C Development Test III. Photo: Michael D. Jackson/Lockheed Martin.

BELOW
F-35 helmet. Photo: Lockheed Martin.

UNITED KINGDOM

The US Marine Corps and the Royal Air Force (RAF) had been allied operators of the AV-8 Harrier for decades. The Royal Navy's (RN's) aviation division, the Fleet Air Arm, had flown the Sea Harrier since it was introduced into service in 1980. By 1983, the UK's Harriers were growing weary from the high flight hours pulled during the Falklands conflict the year before. Both the Marine Corps and the RAF/Royal Navy Fleet Air Arm needed STOVL capability to operate from their small-deck carriers. (This class of ship had neither the power, nor space, for catapults and arresting gear.) The first phase of this work, done under contract with the Defense Advanced Research Projects Agency (DARPA) evaluated different powered lift concepts and concluded that none were satisfactory. They then approached Lockheed's Skunk Works in an initiative to develop a powered lift concept to meet the requirements as a covert part of a Phase II study of the ASTOVL program. [In 2023 the RN began consideration to retrofit a catapult launch system and an arresting system to HMS *Queen Elizabeth*.]

To quote the First Sea Lord [Admiral Sir George Zambellas, 2013- 2016]: A carrier without jets is nothing! The RN/RAF F-35 partnership is an operational necessity, but the RN/USMC partnership is strategic, and a game-changer.

In January 2021, the UK Carrier Strike Group declared IOC. Later that year, the HMS *Queen Elizabeth* deployed on her maiden combat cruise, with 10 USMC and seven UK F-35Bs, bringing the vision of Allied integrated combat operations created some 10 years earlier to life.

In November, on HMS *Queen Elizabeth*'s return trip through the Mediterranean, two Italian Navy F-35Bs joined the embarked air wing for a day of operations. The flights by the Italians meant the new carrier had hosted jets from three different countries since leaving home in May, with the Italians the first European partner to land on the UK flight deck.

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LEFT
More than 300,000 parts from aerospace leaders across the industry go into the F-35's assembly at Lockheed Martin's production facility, Fort Worth, Texas.

FAR LEFT
USMC F-35B aircraft conducting air-to-air refueling during Exercise Vigilant Storm 23-1. Photo: No 33 Squadron.

CANADA

Twenty years after signing the agreement to join the JSF program, the Canadian F-35 saga can best be summed up by André Deschamps: "I think the Canadian chapter should be titled 'Politics, Damn Politics' because it's always about the politics of defense and not about security itself."

But in early 2022, the world changed dramatically when Russia invaded Ukraine. Suddenly the Arctic alliance became a critical part of a new realignment of priorities for the Arctic nations, Northern Europe, and NATO. On 28 May 2022, Canadian Minister of Defense Anita Anand announced that Canada had selected the F-35 as its future fighter. She said the decision to pick the F-35 was done without political interference. "We're living in a new reality," she said, referring to Russia's war in Ukraine. When the threat becomes real, security sometimes trumps politics.

AUSTRALIA

Once Australia had partnered up, a team was embedded in the JSF Joint Program Office (JPO) in the US. The country was wearing two hats, one as a cheerleader and participant helping the program succeed, and the other as a customer, ensuring Australia was getting what it wanted.

In 2007, the Minister for Defence, Brendan Nelson, made the decision to retire all the F-111s in 2010. In the meantime, the Defence Science and Technology Organisation (DSTO) was conducting structural analyses to forecast how long the old "Classic" Hornets could safely fly. As a result, the F-18's retirement was postponed from 2012 to about 2020.

In 2009, the RAAF received government approval to buy fourteen F-35s. Two were to be delivered up front, followed by an option for 12 more. Once the first F-35As had been ordered, the next decision point was to buy an additional 58, which would bring the total to 72.

Geoff Brown [Chief of Air Force] came up with a masterful solution to protect the F-35 buys while augmenting the force for the near term. He proposed that the RAAF buy 12 Growlers which are Super Hornets modified to suppress enemy air defenses. Brown also initiated Project Jericho to create a fifth-generation air force by extending the interoperability concept. It would no longer be the F-35 with other allied F-35 air forces. It would now encompass the entire Australian Air Force, leveraging the new advanced capabilities of the F-35. Of equal importance, the Growler purchase did not detract from the eventual planned purchase of F-35s. Defence Minister Stephen Smith agreed and announced the purchase.

The F-35 changed the whole air force. The constant reference now is moving up to a fifth-generation air force and making sure that everything that wraps around the F-35 is up to the mark as well. It really has become the centerpiece of the air force for the future.

The Department of Defence and the Department of Industry and Tourism formed the JSF Industry Advisory Council to help the country participate. The council consisted of representatives from a number of Australian businesses, large and small to educate prospective participants on the new requirement to compete for contracts on the basis of best value. Lockheed Martin, along with BAE Systems and Northrop Grumman, made several visits to identify candidate companies.

Lockheed Martin put two programs in place that helped small companies stay competitive. One was a right-to-buy agreement allowing the smaller suppliers to buy bulk materials from the US, at the same discount a competitor ten times their size might pay. The second program was mentoring.

By 2021, more than 50 Australian companies had been awarded contracts for development, production, and sustainment worth more than $2.7 billion. And they're typical of the contributions of other companies in all the partner countries.

Such success stories go largely unnoticed outside the industry. But small and medium-sized local companies employing thousands of skilled people around the world contribute mightily to the participating countries' economies. They are a vital if unsung foundation of the F-35 global partnership.

SECURITY OVER POLITICS

The Joint Strike Fighter partnership started as a tight alliance of the three US Services and eight close allies that had traditionally flown our aircraft and fought side by side with us. Recognising that no service and no nation fights alone anymore (unless they are very badly led), the program was meant to replace the ageing air forces of our closest allies as well as our own.

The revived specter of a hot war has dramatically reinforced this coalition dynamic of the program. The Northern European countries of Belgium, Finland, Switzerland, Germany, Poland and the Czech Republic have all recently joined. Even Canada, the "reluctant partner", has finally seen the light.

STRONG LEGACY
RELENTLESS INNOVATION

Australia is embarking on its largest and most important industrial mobilizations in two critical areas.

The first is the AUKUS nuclear-powered submarine program among Australia, UK, and U.S. The second is Guided Weapons and Explosive Ordnance (GWEO) Enterprise.

In this Q&A with Lee Davis, defence and space leader for Honeywell Australia, we'll explore Honeywell's 60-year legacy in Australia as well as its involvement with the two programs mentioned above.

Lee Davis:
Honeywell started operations in Australia in 1962 and now operates in every state and territory.

Lee Davis is the defence and space leader for Honeywell Australia.

We employ over 1,700 people in-country across 25 locations, which is quite diverse for an international footprint. We have a lot of capability on the ground and a long history of partnering with local industry.

In defence and space, the products we support are varied and include technologies such as navigation, guidance, actuation systems, power thermal technologies, wheels and brakes, avionics, oxygen breathing systems, and I could go on and on.

As a large industrial with over 160,000 products, we have a lot of content in air, land, and sea assets in Australia supporting the Royal Australian Air Force and Navy and Australian Army.

What are your thoughts on the role Honeywell Australia can play on AUKUS?

The AUKUS program is interesting because it's the largest industrial endeavour ever in Australia in terms of complexity, dollars, and scale.

Like with the Abrams, when people think submarines they don't necessarily think of Honeywell. However, we're uniquely positioned because we have defence and space operations in all three AUKUS countries and support existing submarine programs in each. We have content in submarines from navigation and actuation systems to power and thermal management. The things we do in aircraft and aerospace we do in submarines.

We also do nuclear stewardship. We secure all of the nuclear defence sites in the U.S. with our infrastructure security architecture. We've been supporting the nuclear mission in the U.S. for over 75 years, including a focus on industrial security and supply chain excellence.

Given that combined heritage of nuclear stewardship and submarine component production, we are looking to support the Australian customer in the following areas: infrastructure security for existing and new submarine bases and sites that will control technology related to the submarines and nuclear propulsion system; industrial base development by working with the Australian industrial base to develop secure, qualified suppliers and managing them to provide critical components into those programs; and nuclear waste support, where we've been involved in nuclear waste management and remediation programs in the U.S. for a long time.

If AUKUS is the top industrial venture, then guided missiles under GWEO is second. What are your thoughts for how Honeywell Australia can support that effort?

In the guided weapons space, we see a common theme between the content that we have in an airborne platform, a submarine, and a missile. That includes control and actuation systems for guided weapons, air data computers, antennas, precision sensors, flight-control systems, guidance and navigation systems, mission processing, precision valve control, protective technologies, radar altimeters, RF units and inertial measurement units – all the key piece parts that go into a guided weapon.

Looking at Australia's inventory and what's being procured, there's Honeywell content in over 80 percent of those platforms, including both Lockheed Martin and Raytheon missiles. Both companies have been announced in Australia as the strategic partners for the guided weapons enterprise. We want to see where we can transfer those technologies that I just talked about to support and sustain them locally.

What are Australia's needs in space and UAS, and how can Honeywell help?

Honeywell has a deep history in both areas. We've supported the U.S., in particular NASA, on every crewed space mission since the early Apollo program. We've got a deep history and heritage in space from satellite components through to life support systems on the International Space Station. We certainly would be looking to leverage that capability locally.

Like our work in airborne assets and missiles, we manufacture similar components in space and unmanned aerial systems (UAS). In addition to those capabilities, we also have developed a high-altitude LiDAR atmospheric sensing (HALAS) system, a remotely operated, ground-based weather information system that provides near real-time, high-altitude atmospheric measurements in as little as three minutes. This type of detection capability is critical for any nation looking to increase its ability to safely conduct sovereign space launches and is currently supporting the U.S. space mission.

In UAS, the marquee program in Australia is the Ghost Bat development program by Boeing. Again, we're supporting Boeing with a range of components for their program.

Images provided by Honeywell Australia.

WORDS Gregor Ferguson

COUNTERING UASs

DEFENCE IS ON THE HUNT FOR A PARTNER TO HELP IDENTIFY AND DISABLE SMALL UASs AS QUICKLY AND CHEAPLY AS POSSIBLE.

IN AN ERA where uncrewed aerial systems (UASs), have proliferated and flourished on battlefields from Europe to the Red Sea, the technical challenge now is not so much to weaponise UASs, as to eliminate them effectively and cheaply. Hence Defence's Project LAND156 – Counter Small Uncrewed Aerial Systems (C-SUAS), which is now under way.

Defence's aim is to identify and then disable or destroy small UASs on the battlefield as quickly and cheaply as possible. That means without using expensive anti-air or anti-missile missiles unless absolutely necessary.

LAND156 went live on 21 November 2024 with an invitation to register (ITR) for a C-SUAS systems integration partner (SIP). The ITR closed on 20 December and an undisclosed number of industry respondents were due to receive a request for tender in late-January with a SIP to be selected by mid-year. At the time of writing three companies had confirmed a response to the ITR: DroneShield, Anduril Australia and Nova Systems.

The project's timeline would see the SIP providing a baseline C-SUAS capability by the end of this year and a complete minimum viable capability by the end of 2030. The SIP will be Defence's strategic partner and must deliver a developmental command and control system (C2), including the vital situational awareness (SA), that is capable of integrating all of the sensors and effectors acquired by the end of this year under what Defence terms a Capability Target State 1. The C2 system must also be able to integrate any sensors and effectors acquired subsequently, at least to the end of 2030.

The main threat is Group I and II UASs with a maximum weight of about 25kg and a maximum speed of about 250kt. A UAS that size can conduct intelligence, surveillance and reconnaissance missions or attack anything from individual tanks and vehicles to flight lines with aircraft worth multiple millions of dollars. Defence wants a low cost per kill, with a very low chance of fratricide and an ability to integrate the C-SUAS system with short-range ground-based air defence and integrated air and missile defence systems, both the ADF's and those of its allies.

Australian counter-UAS and SA specialist DroneShield, founded in 2014, believes it can be a strong, sovereign SIP based on what it reckons is the world's biggest C-SUAS development team, most of whom are based in Sydney.

Nearly 80 percent of SUAS can be disrupted by electronic jamming, and that's what DroneShield specialises in. Its passive omni-directional RfPatrol Mk 2 detects SUAS out to a range of 4km while its directional DroneGun Mk4 jams the wi-fi or global system for mobile (GSM) control and navigation signals controlling

hostile SUASs out to a range of 1km (a bigger version has a range of 2km). The DroneGun Mk4 can also handle swarms of SUASs because its effects are not focused on a single target; anything within its operational range and field of regard is affected equally.

Depending on their pre-programmed control logic, and as long as the jamming signal is maintained, the UASs would probably either fly autonomously back to their launch site or simply sink to the ground. An agile force can exploit either outcome.

The SA tools deployed by DroneShield are based around the DroneSentry-C2 Enterprise Command and Control (C2) system, which can handle multiple sites, RfPatrol Mk2 and the DroneSentry-X Mk2 radar. That tool set helps build up a real-time picture of UAS activity in a specific area, even if the UAS concerned don't use RF signals for guidance and detonation, and it can integrate other sensors and effectors as these become available.

The key to DroneShield's bid for the first phase of Project LAND156 is its research and development (R&D) work on SA, C2 and 'soft kill' effects, which is carried out in Sydney. While the company's hardware has attracted considerable attention worldwide, DroneShield describes itself as a software company that is enabled by hardware. All of its C2 comes from the company's own R&D and expertise. The company employs about 200 staff, 150 of them engineers, and most of its R&D is focused on C2, systems integration and jamming hostile UASs. Its business model means it has sovereign control over its own software, can integrate new capabilities quickly, wherever they come from, and can therefore respond quickly to emerging threats and contingencies.

However, the company has also integrated seven other sensors with a further six on its roadmap. To extend its SA capability, its future roadmap includes the world-leading CEA Technologies' CEAFAR radars and the Silentium Defence passive radar, both of which have been integrated with the RAAF's Project AIR6500.

The evolution of UAS warfare is making 'hard kill' systems essential. DroneShield says it can integrate systems such as the M230 Bushmaster 30mm cannon and High Energy Laser from EOS Defence's Titanis, and the AIM Defence Fractl high-power anti-drone laser. These can counter UASs that don't employ wi-fi or GSM communications control signals. A growing number of relatively short-range UASs are also using wire guidance, similar to a Milan or Tow anti-tank missile, to avoid radio emissions and interference.

DroneShield has a capacity of about 3,000 RfPatrol units and DroneGun Mk4s per year. About 95 percent are exported. They are used by the US Department of Defense, the UK Ministry of Defence, French Army, NATO and, of course, Ukraine which at the time of writing had more than 1,000 DroneGuns and RfPatrol systems in service.

Boeing and Northrop Grumman have confirmed they're not pursuing LAND156 as a SIP, although they have specific capabilities of direct interest to the eventual SIP; and Anduril Australia had confirmed it is. Defence hasn't disclosed who responded to the ITR so the status of companies such as Lockheed Martin, BAE Systems, QinetiQ and Thales is unknown.

Being a non-ITAR product, and so not severely restricted by the US State Department, DroneShield is able to work directly with end users and introduce rapid software updates in response to things like RF frequency changes in enemy UAS control systems and other contingencies.

However, the ADF has signed a three-year contract with DroneShield's rival Anduril to trial its C-UAS system at RAAF Base Darwin. Anduril's offering is based on the capability-as-a-service business model it is using as SIP in the US Special Operations Command CUxS program. Delivered in just 15 weeks, Anduril's Darwin system is powered by the company's well-understood Lattice OS open architecture software platform which lies at the heart of other capabilities such as the Ghost Shark XL-AUV it is developing for the Royal Australian Navy in Sydney.

DroneShield is offering a similar C-SUAS-as-a-service enabling lower capital costs because the service can be funded from the RAAF's sustainment budget. The company reckons it could deliver Anduril's functionality at a significantly lower price. It is negotiating an agreement with services company Ventia to conduct 24/7 monitoring and believes it could deliver base solutions within six months of contract award and complete the roll-out to as many as 104 separate ADF bases in 18-24 months. DroneShield itself would integrate, install and maintain the C2 system and C-SUAS sensors and effectors.

DroneShield has already completed work for Army clients such as Special Operations Command under projects such as LAND1508. Project LAND156 is its opportunity to showcase its C2 and product credentials and also to enhance market recognition of its software expertise.

OPPOSITE PAGE
DroneGun Mk4.

FAR LEFT
DroneSentry-X.

LEFT RfPatrol.

THE ROULETTES

WINGS VOLUME 77 NO.1

The RAAF Roulettes performing at Avalon 2023.

It's showtime!

AVALON IS GEARING UP FOR ONE OF THE WORLD'S GREAT AIRSHOWS.

THE AVALON AUSTRALIAN International Airshow, Australia's largest aerospace and defence industry event, will return to Avalon Airport in Victoria in March, with a six-day program of displays, exhibition and conferences across the spectrum of civil and military aviation.

Held every two years, Avalon is Australia's equivalent of the legendary Paris and Farnborough airshows, with numbers to match. Avalon 2023 saw 794 participating exhibitor companies, about 280 official industry, government and scientific delegations from more than 30 countries, 59 conferences and more than 390 aircraft on display in the air or on the ground, from home-built light aircraft to heavies such as the Boeing C-17, and fast jets including the Lockheed Martin F-35 Lightning II and F-22 Raptor. It attracted more than 48,000 attendances across the event's industry-only days, with the weekend public airshow swelling the number to about quarter of a million.

The event is a split-personality celebration of aviation, aerospace and space. The first three days are industry-only exhibition days, devoted to business. Day four becomes a hybrid business and public day, with gates opening to the general public in anticipation of the world-famous Friday Night Alight evening airshow, featuring an afternoon and twilight flying program with aerobatics performers, fireworks and the renowned Wall of Fire.

Across the weekend, the event continues as a spectacular public airshow, featuring extensive air displays from the latest thundering jet fighters, strike aircraft and heavy-lift giants, joined by the RAAF's Roulettes precision aerobatics team and the US Air Force F-22 Raptor Demonstration Team. Visiting international military aircraft, vintage and veteran, warbird and modern military machinery will share the display with civil aerobatics teams, parachutists and helicopters.

OPEN FOR BUSINESS

With the latest military aircraft, business jets, commercial aircraft, helicopters and light aircraft displayed on the flight line, industry promotes its products and services in the exhibition halls and external display areas. Major international household names exhibit alongside smaller companies and start-ups with a

big idea, offering industry at all levels a unique opportunity to connect with potential customers, suppliers and partners. It is Australia's signature aerospace industry event, respected for the engagement opportunities created by the sheer concentration of industry, government, Defence and academia.

As exhibition space sold out in 2023, the exhibition footprint has been increased by a third for Avalon 2025, with the addition of a fourth exhibition hall. It will be complemented by updates to external exhibition spaces, a new Executive Business Unit product for industry and a repositioned corporate chalet line to improve links to the industry exhibition halls. This is where chance conversations can and have led to multi-million-dollar contracts and the smart small company can be noticed by the big end of town.

Avalon is an industry melting pot for sales, product launches, customer relationship development and market research, for seeking out potential suppliers and for studying major competitors.

The industry exhibition is complemented with a conference program on a cross-section of issues across industry, defence and government. The 2025 program will include presentations by the Australian Chief of Air Force, Australian Association for Uncrewed Systems, Australian Space Agency, Royal Aeronautical Society, Department of Defence, CSIRO, RAAF and more than 50 other organisations from airport design companies to flight test and engineering societies.

AIR FORCE ON SHOW

Avalon provides a unique interface between Defence, industry and the public, with international delegations and dignitaries from air forces around the world interacting with the RAAF on programs that improve mutual communication with our allies and international partners.

Avalon plays a critical role in how Air Force communicates with the industry that provides its capability, with the defence forces of international allies and with its principal stakeholders, the Australian Government and the Australian taxpayer. It is also a major recruiting tool and a large-scale deployment exercise in itself, expected to involve up to 2,000 ADF personnel in 2025.

Past Avalon airshows have seen the public debuts of Air Force's most sophisticated new aircraft, including the Lockheed Martin F-35A Lightning II strike fighter, the Boeing EA-18G Growler electronic warfare platform, Boeing P-8A Poseidon maritime patrol aircraft and Alenia C-27J Spartan battlefield transport, all vital nodes in a networked, deployable force that leverages modern technology and traditional professionalism to deliver Australia's defence edge.

The spectacle, noise and excitement of the air displays also serve another purpose. A fighting force's most important capability is its people and the ADF as a whole, and Air Force in particular, use Avalon as an important recruiting tool. The static and flying displays are awe-inspiring, but the ADF's support for Avalon's science, technology, engineering and mathematics (STEM) and careers and skills outreach activities is equally important, to find the next generation of tech-savvy people to operate, maintain and command its increasingly sophisticated inventory of platforms and systems.

MARKING MILESTONES

Avalon 2025 will mark the centenary of the first flight of the legendary de Havilland Moth. On 22 February 1925, Geoffrey de Havilland flew the first DH-60 Moth from the company's headquarters at Stag Lane, North London. Considered by some as the first practical mass-produced private aircraft, it was the first of a series of monoplanes and biplanes marketed under the Moth family name. Moth light aircraft and military trainers, include the Fox Moth and Hornet Moth biplanes and Swallow Moth and Leopard Moth monoplanes.

In the 1930s, the monoplane Puss Moth broke long-distance records at the hands of such famous names as Bert Hinkler, CJ Melrose and Jim and Amy Mollison. Meanwhile the two-seat open cockpit Moth biplane was modified to pursue a Royal Air Force training contract, and the ubiquitous DH-82 Tiger Moth, the most famous Moth of all, was born.

As the Moth's British birthplace will

OPPOSITE Skyaces Aerobatics Display Team during AIA 2023.

RIGHT Visitors enjoy the chance to see inside a US Air Force KC-10 Extender tanker.

BELOW RIGHT Matt Hall Racing's Extra 300L in front of a Royal Malaysian Air Force Airbus A400M.

be in the depths of winter, Avalon may see the first flying tribute to the Moth for its centenary year. UK celebrations are scheduled for the northern summer. According to Justin Giddings, CEO of Avalon organiser AMDA Foundation, the Moth's contribution to Australian aviation history make that entirely appropriate.

"From training Royal Australian Air Force, Empire Air Training Scheme and Navy Fleet Air Arm pilots, to being employed as agricultural and flying club aircraft in the 1950s and 1960s, the Tiger Moth has played a part in both military and civil Australian aviation history," he says.

"Australia built more than a thousand Tiger Moths at Mascot near Sydney and made the engines at Fishermans Bend in Melbourne. Even after a century, the aircraft is still making a living today operating scenic and air experience flights and training pilots across Australia."

ACROSS THE SPECTRUM

Avalon will highlight historic and modern general aviation and airsport aircraft of all types, from home-built to light aircraft from major manufacturers such as Cessna, Tecnam, Cirrus and Jabiru. At Avalon 2023, general aviation aircraft made up more than a third of the 396 aircraft on display.

"We hear a lot about innovations with commercial and military aircraft, but the general aviation and airsport sectors have been pioneers of new technologies, in everything from materials to avionics, alternative fuels, licensing and construction," says Giddings. "We want to feature general aviation and airsport and show the general public that this sector of aviation is exciting, innovative and accessible.

"This is still the sector of aviation that often provides the general public's first connection with an aircraft, the first spark that leads someone to pursue aviation as a hobby or even a career. So it is an important part of the future development of the Australian aviation community."

Between display flights visitors can take a closer look at commercial, vintage and military aircraft on the ground, with the chance to climb into a few cockpits and cabins. In the exhibition halls they see the latest and the best from an incredibly diverse industry base: everything from flight simulators and night vision goggles to uncrewed aerial vehicles and the latest all-composite aerostructures.

LEFT
United States Air Force F-22 Raptor.

BELOW LEFT
The Hawk Cockpit Demonstrator.

NEXT GENERATION

Avalon also contributes to finding and encouraging the next generation of products and people. Organisers ensure there is something for everyone, young and old, with roving entertainment, carnival rides, live performances, activities, simulators and games.

Kids can ride the huge range of carnival rides all weekend for free, and the Avalon Eye Ferris Wheel offers a bird's eye view of the airshow. Kids Zone is a dedicated space with interactive entertainment, games and aviation themed activities in an undercover pavilion.

For many younger people the event sows the seeds of a lifetime career, encouraged by aviation training schools, airlines and air force recruiters who attend Avalon to engage with the great pool of next generation talent that is naturally drawn to one of the world's great airshows. Avalon 2025's official Careers Day will include more than 4,500 students, from Year 7 to university, with a program including industry and defence speakers, flight simulators and training information, a RAAF tour program and professional development for teachers and other educators on STEM and aviation and aerospace as a career.

"The week of Avalon has a special atmosphere, a feeling of being involved in something quite out of the ordinary," says Giddings. "There's a sense that the entire aviation community, including the Royal Australian Air Force, major aviation-related government departments, support organisations and industry associations are in residence at Avalon for that week. People are of course promoting their own aircraft, products and services, but there's also a collegiate community atmosphere, with Avalon acting as a barometer for the health and future of the whole industry.

"All this happens with regular flying displays demonstrating some of the most advanced civil and military aircraft in the world."

The Australian International Airshow will be held from 25-30 March 2025. See airshow.com.au for programs and tickets.

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LAND SPEED CHALLENGER

ONE OF THE MORE UNUSUAL EXHIBITS AT AVALON 2025 WILL BE THE ROCKET-POWERED LAND SPEED CAR AUSSIE INVADER 5R.

AN EYE-CATCHING AND UNUSUAL EXHIBIT at the Australian International Airshow at Avalon this year will be Rosco McGlashan's liquid rocket-powered land speed car, *Aussie Invader 5R*. While not technically an aerospace vehicle (we hope), the car is capable of accelerating to 1,000 mph (or Mach 1.3) – a far higher speed than most aircraft types are capable of airborne. However, as could be expected, the car also features advanced aerodynamic and structural engineering equal to anything else visitors will witness at the airshow.

The car was featured in the spring 2021 edition of *Wings,* which described its innovative, leading-edge technology:

- A 12m long centre section which is a 900mm tube formed and seam welded from a single sheet of 10mm thick steel by a Western Australia fabrication company. The centre section alone weighs 2.5 tonnes.
- Four all-metal wheels, each of which is machined from a solid billet of 7050 aluminum and capable of withstanding the 50,000G centrifugal loading at the rim at 1,000mph.
- A matched set of four super-precision high-speed, uniquely lubricated wheel bearings for each wheel, produced exclusively for the car by SKF in Italy.
- A "floating canard" wing that innovatively uses the known aerodynamic effects of delta wing planforms to alleviate the downward force on the front wheels which increases with increasing speed.
- A NASA/HMX liquid rocket producing 62,000lbf thrust to theoretically accelerate the car from 0 to 1,000mph in 22 seconds.
- A locally designed, innovative fuel supply system to supply the two individual fuel components to the combustion chamber where they spontaneously ignite on mixing.
- A Tait-supplied, military-grade telemetry system to monitor a host of data transmitted to a control cabin where Rosco's team will monitor the car during each run.

TOP *Aussie Invader 5R.*

ABOVE The Pilbara Heavy Haulage Girls Group transported *Aussie Invader 5R* to Avalon.

More detailed information about Rosco and his *Aussie Invader 5R* team can be found on his website (aussieinvader.com). To my mind, the most remarkable thing about Rosco's machine is that it has been home-grown – built on a "shoe-string budget" in a garage at his home in WA.

To get the project to its current stage, Rosco has recruited an impressive number of generous sponsors, including some of Australia's leading manufacturing companies, scientists and engineers, who have generously afforded him large chunks of their time, expertise and material assistance along the way.

Two generous organisations have helped to bring *Aussie Invader 5R* to Avalon. The first is the AMDA Foundation, the not-for-profit organisation that brings us Australia's International Airshow biennially and which generously invited and assisted Rosco to exhibit.

The second benefactor is Heather Jones, the CEO of Pilbara Heavy Haulage Girls Group (PHHGG), who is probably better known in the East for her work in promoting truck driving safety. Heather and her PHHGG team offered to transport the 16m long Aussie Invader 5R to Avalon and back to WA, a trip that requires two semi-trailers for the 8,000km journey together with forklifts, side-lifter trailers, tilt-tray trucks, and some serious driving hours, not to mention a huge fuel bill.

Without the invitation and assistance from AMDA, and the even more generous transport support provided by PHHGG, Airshow visitors would not be able to marvel at the engineering wonder that is *Aussie Invader 5R*.

For readers who will visit the International Airshow at Avalon this year, I thoroughly recommend you call in to see Rosco and have a chat with this remarkable bloke who will be happy to sign a copy of his captivating book which describes his amazing journey.

Neil Smith, Managing Director, Wings

ABOVE Rosco in his garage at home with *Aussie Invader 5R*.

EDITED BY Bob Treloar

WA POLICE AIRCRAFT UPGRADE

WESTERN AUSTRALIA POLICE will upgrade its air wing aircraft with the lease of a Pilatus PC-24 twin jet, and upgrade its PC-12 aircraft, spending $8 million over the next four years. The twin-engine PC-24, expected to arrive by mid-2026, will halve the travel time from Perth to towns such as Kununurra and will be able to land on unsealed outback airstrips. It can carry eight police officers and is reconfigurable to carry cargo including equipment, emergency supplies, and evidence.

The PC-24 is currently used for aeromedical operations with NSW Ambulance.

Source: Australian Aviation

A Pilatus PC-24 business jet on a remote airstrip.
Photo: Pilatus.

STRIX takes to the air for the first time.
Photo: BAE Systems.

AUSTRALIAN VTOL MAIDEN FLIGHT

BAE Systems announced that STRIX, a new type of vertical take-off and landing (VTOL) aircraft, made a successful first flight in late October, paving the way for production. STRIX is being developed via a partnership between BAE Systems Australia and Australian aeronautical technology company Innovaero.

The VTOL sits at an upward-slanted angle when at rest, but rises to a vertical position when powered up before performing a vertical take-off and transitioning into horizontal forward flight. It lands vertically.

While the production version of STRIX will have a hybrid fuel/electric power system and carry a 160kg payload for up to 800km, the full-scale prototype that flew in October was electrically powered to fast-track flight testing and reduce program risk. Major flight test objectives were achieved, including safe and autonomous control of the all-new VTOL aircraft configuration.

BOEING LOSSES

BOEING REPORTED NET losses of nearly US$8 billion (A$8bn) in the first nine months of 2024. In the third quarter alone, the company reported a net loss of US$6.2 billion (A$10bn), one of its worst quarters ever.

A two-month work stoppage of commercial aircraft production at Seattle assembly plants, which ended in November, delayed delivery of new aircraft to several international airlines and is reported to have cost Boeing almost US$10 billion (A$16bn). Boeing launched a share sale in November to raise more than US$20 billion (A$32bn).

Source: Daily Data

REX LIFELINE

THE AUSTRALIAN GOVERNMENT is acquiring $50 million of debt from Rex Airlines to prevent its collapse and maintain aviation services for regional and remote communities. That builds on a previous commitment to provide a commercial loan of up to $80 million to maintain the airline's regional routes during an extended voluntary administration process.

Rex entered voluntary administration last July, cut hundreds of jobs and closed the subsidiary that had operated Boeing 737 flights between Australia's major cities since 2021.

WORLD'S LARGEST DIGITAL ATLAS

AUSTRALIAN DRONE TECHNOLOGY pioneer Aerologix has partnered with Soar, a digital mapping company, to create what is believed will be the world's most extensive library of high-quality drone imagery and maps.

The collaboration merges Aerologix's network of over 36,000 professional drone pilots with Soar's ambitious mission to build the first complete digital atlas of world maps and images. Users will be able to access a unified platform that combines drone imagery, satellite data and maps in one searchable location.

The Soar platform, featuring nearly 700,000 maps, is a free, open-access resource that invites contributions from anyone with mapping data and will be accessed by a range of contributors and consumers.

The company is one of a few drone companies onboarded into the Civil Aviation Safety Authority (CASA) digital sky platform, enabling Aerologix iOS and android apps to ingest CASA weather updates, location-based information and aeronautical charts.

FIREFIGHTING **CHINOOK UPGRADE**

THE NSW RURAL FIRE SERVICE (RFS) has upgraded its Chinook helicopter with the installation of an 11,000-litre internal tank. The tank replaces a temporary 10,000-litre underslung bucket that made it too dangerous to be used at night or over densely populated areas. The internal tank will enable the helicopter to fill more quickly, deploy more effectively and conduct night operations when fire intensity is typically lower.

Added to the RFS aerial fleet last year, the Chinook is Australia's largest firefighting helicopter. It operates from RAAF Base Richmond, NSW and can be deployed to Dubbo, Coffs Harbour and Cooma.

Clean lines of the Shark 600 in flight.

LONG-RANGE PRECISION

RETIRED RAAF TEST PILOT **RON HAACK** PRESENTS HIS FIRST IMPRESSIONS OF THE SHARK 600 SPORTS AIRCRAFT.

SHARK.AERO, a Czech-Slovak aerospace company based in Slovakia, has developed the Shark 600, a sports category aircraft that boasts a range of appealing attributes. In 2022, 19-year-old Zara Rutherford piloted #080 aircraft to global acclaim, completing a solo flight around the world and securing a Guinness World Record. Recently, the Costa Rican distributor of Shark flew a new aircraft from the factory in Slovakia to Central America, clocking up 7,961NM (14,743km) in 57 hours, at an average speed of 142 knots. Both achievements demonstrate that the Shark has the legs to fly further and somewhat faster (162kts) than many other aircraft in its class.

Ex-RAAF Qualified Flying Instructor Andrew Mills now runs Shark Aero Australia and has kicked off the Shark's Australian debut with a national demo tour that will culminate in an appearance at the Australian International Airshow at Avalon in late March. The aim of the tour is to offer pilots a chance to experience the Shark's features, performance and utility firsthand.

THE AIRCRAFT

Shark 600 is a two-place, low-wing sports category aircraft with retractable tricycle landing gear, designed in compliance with European UL and US Light Sport Airplane standards. The demonstrator aircraft that Shark Aero Australia has shipped to Australia for the tour is powered by a single 100HP Rotax 912ULS engine driving a variable-pitch propeller, but other powerplant configurations will be available later in 2025.

The composite monocoque fuselage incorporates an integral fin and is constructed as one piece with integral interior frames, armrests and floors. The cockpit shell creates an ergonomic cabin structure for two crew members sitting in tandem inside a Kevlar-carbon-aramid cage.

The forward fuselage provides a firewall with four engine mounting stations, a Ballistic Recovery System installation and nose landing gear mounting points. Further aft, the fuselage incorporates main landing gear and cockpit mounting points, attachments for the horizontal stabiliser, rudder mounts and a bottom fin.

The Shark 600 has a composite wing with trapezoidal root, and elliptically shaped tips optimised for fast, efficient cruise speeds. The wing is structured around a carbon main spar and an auxiliary spar carrying aileron hinges and a single-slotted flap extending over 60 percent of the trailing edge span.

A one-piece cockpit canopy consists of a carbon fibre frame with a Plexiglas windscreen. The canopy is supported by a gas strut and hinged on the starboard side. The canopy is locked from inside by a single point system, accessible to both pilots.

The elevator and ailerons are manipulated by side-stick controls on the right console at each pilot station. An electrically powered trim motor drives a trim tab fitted to the left section of the elevator. Ailerons are fitted with servo-tabs to reduce roll control forces at higher speeds and the circuit incorporates a spring centring mechanism in place of a trimming system.

The rudder is manipulated by floor-mounted pedals that also provide for independent hydraulic brakes and nose wheel steering.

Extension and retraction of the tricycle landing gear is electrically powered, with emergency gear lowering handles provided as a backup. The nose wheel retracts aft into a well (behind the firewall), while the

main landing gear retracts into the centre-wing section.

An EFIS/EMS with integrated flight data, engine parameters and navigation facilities is a standard fit for the front seat pilot. Controls for landing gear, flap, radio transceiver, movable ballast, optional equipment and backup flight instruments are incorporated in an ergonomic arrangement on the forward instrument panel. The aft seat instrument panel is integral to the canopy frame and can be configured optionally with an EFIS/EMS display and controls for radio transceiver, flaps and landing gear operation.

FLYING QUALITIES

Apart from its sleek, attractive appearance, the Shark 600 is a delight to fly. The side stick controls fit comfortably in the hand and facilitate precise pitch and roll commands throughout the flight envelope. Ergonomic implementation of pitch trim control and the radio transmit switch on each stick supports instinctive operation of both functions.

Pitch and roll control forces are light but positive, nicely harmonised and together with the power plant characteristics give a satisfying impression of a solid platform that is both stable and responsive. There is a slight breakout force (initial resistance to movement) in the roll control circuit that may affect close coupled tasks, such as close formation flying. Shark Aero is aware of the issue and may engineer the source of the effect out. Until then, as with most such characteristics, pilots learn, with experience, to compensate for the effect.

After flying the aircraft across the country, Leanne Mills, co-director and co-pilot on the demo tour, noted that she was more comfortable in the back of this tandem aircraft than in a side-by-side configuration, especially in the intense Australian summer heat. "There's more room in the back so I don't get sweaty being squished in beside Andrew for hours at a time, and it's easy to fly from the back seat as there's a full Dynon display in the back," she says.

The aircraft is not currently certified for aerobatics which is a shame as the view from the cockpit is expansive and unencumbered, so gentle aerobatics would add another enjoyable dimension to the Shark 600 experience and appeal.

ABOVE The cockpit instruments and controls.

Whether it's the thrill of precision handling or the convenience of long-range capability, the Shark 600 is poised to make waves in the Australian aviation market. Shark Aero Australia invites pilots to see, touch and fly their impressive machine. Visit the Shark display at Avalon or visit sharkaero.com.au to request a demo flight. You will enjoy it!.

TRACKING GPS DETERRENTS

NEW PASSIVE RADAR TECHNOLOGY CAN QUICKLY DETECT AND GEO-LOCATE GPS JAMMING AND SPOOFING SOURCES WITHIN THE GLOBAL NAVIGATION SATELLITE SYSTEM FREQUENCY BANDS.

IN JUNE 2024, GPSat Systems' GRIFFIN project team commissioned the first commercial sensor station/node (SN) at Keilor Park in Melbourne's International Airport business precinct.

The Melbourne company has developed its GRIFFIN (GNSS Rf InterFerence FINder) passive radar technology to deliver both real-time GPS radio frequencies (RF) spectrum situation awareness and precision geolocation of RF interference sources. The project was sponsored by ADF innovation programs during it's early R&D phases, culminating in a successful central Australia trial in mid 2023.

Since the Keilor Park sensor commissioning, it's highly directional 3D phased L1/L2 array beam forming antennas have been tracking and recording a steady stream of daily moving global navigation system and global navigation satellite system (GNS/GNSS) signal jamming sources in both L1 and L2 frequency bands. The low-to-horizon L1 signals clearly emanate from local freeway vehicle personnel privacy devices. Mostly, those RFI levels are relatively minor, short duration, and wouldn't cause much disruption beyond 100m.

However, on several occasions, powerful L1 wideband jammers have been observed and tracked for many minutes. The company says these are major future concerns for Melbourne airport's ground-based augmentation system (GBAS) approach and automatic dependent surveillance-broadcast (ADS-B) safety operations. Any aircraft on GBAS vertical guidance finals to Melbourne airport, approaching runways 34 or 60 during those interference events would have been adversely affected.

At higher elevations, L2 signals are originating from fast-moving Earth-observation (radar) and communications low-Earth-orbit (LEO) space vehicles that quickly arc across the sky. GPSat Systems managing director Graeme Hooper says the signals provide "wonderful targets of opportunity" for the team to collect data and refine its space vehicle orbit determination algorithms for future contributions to space domain awareness (SDA) and unified data libraries.

"GRIFFIN's ability to uniquely track and identify malicious LEO satellites transmitting GPS deterrent signals, while hiding among a larger populations of visible benign communication spacecraft, is expected to make a significant contribution to our future regional GPS SDA capabilities."

Keilor Park is the first of several future SN sites planned around Melbourne airport to form a single metropolitan-wide area passive GPS/GNSS surveillance network. The network is expected to deliver a very capable real-time GPS jamming and spoofing geolocation and spectrum situational awareness system. Depending on the network's sensor measurement of geometric dilution of precision (GDOP), the GRIFFIN central aggregated processor is expected to terrestrially trace multiple GPS RF interference sources to specific roadway locations. In addition, other regional Australia and New Zealand city SNs are expected to be networked to deliver separate SDA functionality for our space force.

"With this first site now live online, the next phase transitions to training the Department of Transport and other federal agency staff in the ongoing daily technology operations and management," says Hooper.

Source: GPSat Systems

BELOW GPSat Systems managing director Graeme Hooper with the Keilor Park GRIFFIN.

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IT'S A CAR, IT'S

A LONG-TIME SCIENCE FICTION FAVOURITE, IS THE FLYING CAR FINALLY SET TO BECOME A COMMERCIAL REALITY?

FUTUROLOGISTS HAVE long been predicting the appearance of flying cars, or roadable aircraft, which function as both aircraft and road vehicle. Concept designs have been prototyped over the decades, and yet none have become a practical reality.

In 1901, German-American immigrant Gustave Whitehead designed a less-than-successful aircraft described by *The Washington Post* as "a combination of an automobile and a flying machine", due to the inventor's claim that he had driven it several miles along the road prior to an unsuccessful test flight.

More serious flying car prototypes followed, using a variety of flight technologies, most designed to take off and land on a runway like conventional aircraft. The most successful example is the 1949 Taylor Aerocar. Designed and built by engineer and pilot Moulton Taylor, the Aerocar's wings can be folded back along the sides of its detachable fuselage and towed behind the small car. Several versions underwent road and flying tests and, in December 1956, the US Civil Aeronautics Administration (now the Federal Aviation Agency) certified the Aerocar. However, despite wide publicity and even an improved Aerocar III produced in 1968, Taylor couldn't get his flying car into mass production. In total, just six Aerocars were built.

NEARING LIFT OFF?

Despite many critics saying flying vehicles remain an experimental curiosity, the needle is starting to move towards mass production with companies and investors pouring millions of dollars into research and development.

Winner of an Australian Good Design Award in 2024, the Pegasus, created by Australian-based Pegasus International, is marketed as "the world's first truly drivable VOTL flying car that fits in your garage; no runaway required". Inspired by the mythical winged horse, the one- or two-seater Pegasus transitions from car to aircraft at the press of a button, ready for vertical takeoff and landing (VTOL).

A PLANE...

The CASA airworthy registered hybrid combines electric and petrol power, looks like a small helicopter, and integrates modern rotorcraft and automotive technology. It fits in a standard car park and can fly for three hours. While pre-orders are being invited, the Pegasus is not yet in commercial production.

Also taking inspiration from the mythical Pegasus, AeroMobil is a high-end supercar developed in Europe to be used both on the roads and in the sky. According to the company's website, the latest version is in an advanced stage of live test flights that began in September 2020. Registrations of interest are being taken.

KleinVision in Slovakia developed a prototype AirCar, which "drives like a sports car". Powered by a BMW engine and normal fuel, it takes just over two minutes to transform from car to aircraft. The technology has been sold to China and Hebei Jianxin Flying Car Technology Company now has the exclusive rights to manufacture the AirCar.

Another Chinese player, Xpenf Aeroht unveiled its modular flying car, the "Land Aircraft Carrier" at the China Airshow last November, where the crowd was treated to the vehicle's first public flight. The design features a compact eVTOL that folds away in the trunk of an electric minivan. The company reports its flying car manufacturing base is under construction, scheduled for completion later this year. With a planned annual capacity of 10,000 units, the factory will focus on producing the air module for the Land Aircraft Carrier, with deliveries expected to begin in 2026.

On 15 April 2021, the world's first consumer flying car showroom opened in Los Altos, California, launching pre-sales of the ASKA A5, a drivable VTOL with folding wings. The four-seater A5 is being billed as "the world's first electric-hybrid flying car with VTOL and short takeoff and landing capabilities". It is undergoing unmanned flight testing and has completed more than 800km of road testing.

However, despite the increasing hype, there are still no certified flying cars in commercial production.

LEFT Taylor Aerocar in flight, 2019.

RIGHT Taylor Aerocar on the road.

THE OBSTACLES

There is a lot to consider when it comes to designing and operating these dual-purpose vehicles. A flying car must be capable of safe and reliable operation both on public roads and in the air. Current types require manual control by driver and pilot, meaning the operator requires both a driver's and pilot's license. For mass adoption, vehicles would ideally be able to fly without a fully qualified pilot at the controls. They would also need to be environmentally friendly and affordable to buy and run. The use of electric power addresses concerns around environmental sustainability and energy efficiency, however, bringing costs down remains a challenge.

As with any vehicle, safety is crucial and any flying car must be certified by the relevant authorities as both a road vehicle and an aircraft. They also have rigorous maintenance requirements, which can be expensive. Regulatory bodies such as the International Flying Car Association and the European Flying Car Association have been developed to help monitor and regulate flying vehicles for widespread adoption,

ABOVE The ASKA A5 electric-hybrid flying car on the road.

ABOVE The Pegasus VOTL flying car transitions from car to aircraft at the press of a button.

ABOVE The AeroMobil AM 4.0.

LEFT The prototype Aircar in flight.

BELOW The Aircar on the road.

BOTTOM Xpeng Aeroht's Land Aircraft Carrier at China Airshow during its first public flight.

and regional regulatory bodies are also being developed.

The flying car also has unique power demands. An aero engine must deliver higher power than its typical road equivalent. However, on the road, the vehicle must not be overpowered. Power must also be diverted between the airborne and road drive mechanisms. Some designs therefore have multiple engines, with the road engine being supplemented, or even replaced by, additional flight engines. Jet engines are currently not an option due to the ground hazard posed by the hot, high-velocity exhaust stream.

Lift in flight is provided by a fixed wing, spinning rotor or direct powered lift. The earliest approach, as adopted by the Taylor Aerocar, was to attach removable flying surfaces and propellers to a road vehicle. The problem with that design, however, is that on the road, the removable parts need to be towed or left behind. VTOL is viable as it avoids the need for a runway and increases operational flexibility.

While there are still many hurdles to overcome, there's no doubt flying vehicles offer a multitude of opportunities. They could reduce travel by allowing direct line of flight at potentially higher speed, reduce road wear and tear, and ease the ever-growing traffic congestion (although increasing air traffic may present its own challenges).

Flying cars have been envisioned since the early days of motoring and aviation and today the words spoken by Henry Ford in 1940 are sounding increasingly prophetic: "Mark my word: a combination airplane and motorcar is coming. You may smile, but it will come."

Sandra Di Francesco

Panasonic CONNECT

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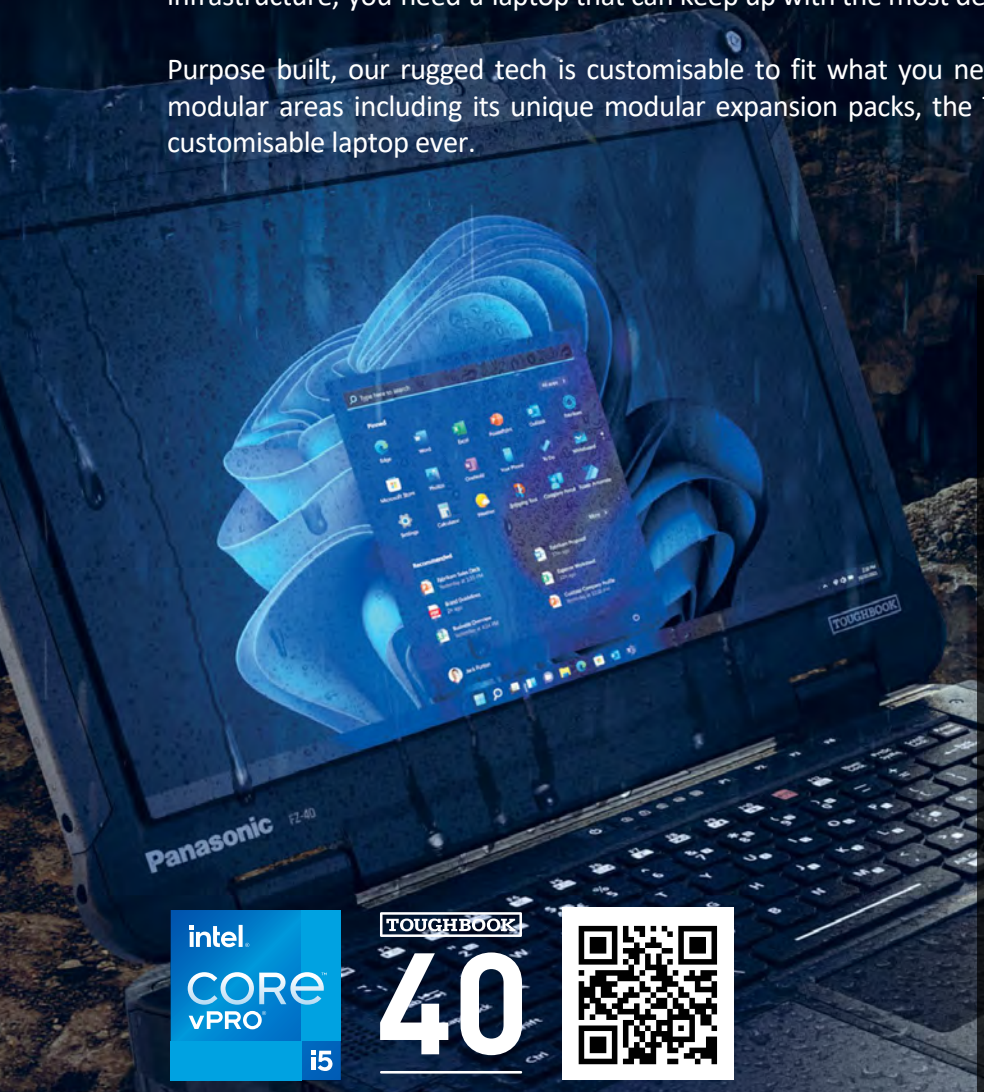

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MANAGING AIR TRAFFIC FROM SPACE

HOW AUSTRALIAN SATELLITES ARE TRANSFORMING AVIATION ON EARTH.

AUSTRALIA'S VAST LANDMASS presents unparalleled challenges for aviation. With remote interiors, sprawling mining regions and some of the most isolated air routes in the world, traditional ground-based air traffic management (ATM) infrastructure struggles to provide consistent coverage. Yet, with advancements in satellite technology, a solution is on the horizon.

Skykraft, a Canberra-based space company established in 2017, is in the process of building a large constellation of satellites in low-earth orbit to provide global ATM services from space.

Originally a concept within UNSW Canberra's Space Research Centre, Skykraft has evolved into a leading player in satellite-enabled ATM. It aims to compliment ground-based radar and VHF communications with its global satellite network by 2026 and has already made multiple successful launches from SpaceX stations in Florida, USA.

Australia has one of the largest flight information regions (FIR) in the world, covering 11 percent of global airspace, from the Antarctic to the northern Pacific. Airservices Australia manages the extensive area from two main centres, Brisbane and Melbourne. While effective, the current ground-based infrastructure has limitations. These are particularly evident in remote and economically critical areas such as the iron-rich Pilbara region in WA. Numerous flights transport workers and equipment to the mining hub, but ground-based communication and navigation infrastructure coverage is incomplete, especially at lower altitudes, increasing risks and inefficiencies for airlines and operators.

Using a constellation of satellites, unaffected by terrain or distance, Skykraft aims to provide seamless coverage down

to ground level across even the most remote areas, ensuring safer and more reliable communication and navigation for aircraft. With satellite-enabled coverage, pilots flying to and from regions or over long stretches of the Pacific Ocean can maintain consistent communication with air traffic controllers. The technology also reduces the need for costly construction of

LEFT Skykraft's satellites orbiting above Australia. Illustration: Tony Bela.

BELOW LEFT Skykraft's first 300kg satellite stack launched by SpaceX.

BELOW Skykraft spacecraft undergoing vibration testing.

ground infrastructure in remote locations.

Since mid-2024, Skykraft has made significant progress and its next batch of five spacecraft is scheduled for launch in May. The spacecraft were subjected to rigorous vibration testing in December 2024, ensuring their resilience during the intense conditions of a SpaceX launch. The company has also developed an end-to-end test system on the ground which simulates the operational environment, enabling comprehensive testing before the satellites are launched, and providing the ability to rapidly validate updates to the system and software.

The satellites incorporate components fabricated in Albury-Wodonga, NSW/Vic, by family-run businesses, highlighting the role of regional industries in the production of cutting-edge aerospace technology.

Satellite technology is also helping make aviation more sustainable. Satellite-based ATM can enhance route optimisation, enable direct flight paths and minimise delays caused by communication gaps or navigation inefficiencies, thus reducing fuel consumption and emissions, as well as cutting costs.

Skykraft's work is part of a broader effort to modernise aviation infrastructure worldwide. It is collaborating with international partners through initiatives such as the ISI Grant – an Australia-India partnership to support the joint growth of space projects – to advance global standards for position navigation and timing systems.

The space industry is a challenging arena, but it offers unparalleled growth opportunities. With fewer competitors than other tech sectors, there is room for innovation and advancement.

Skykraft's satellite technology promises to reshape aviation in Australia and beyond. The integration of satellite-based systems with traditional ground-based ATM infrastructure can provide unparalleled coverage and reliability.

As the aviation industry navigates the complexities of increasing demand for air travel, solutions such as satellite-based ATM systems offer a great path forward.

Q+

LOCKHEED MARTIN AUSTRALIA NEW ZEALAND **CHIEF EXECUTIVE WARREN 'MACCA' McDONALD** JOINED THE RAAF AGED 15 YEARS AND RETIRED AS AN AIR MARSHAL IN JANUARY 2021. HE SPOKE WITH WINGS ABOUT HIS CAREER AND LOCKHEED MARTIN'S ROLE WITH DEFENCE.

LOVE OF THE MISSION

How did your passion for aviation begin and what led you to join the Air Force?

My first flight was when I was about 12 years old. A retired World War II RAAF pilot named Archie Smith took me up in a little Cessna, near Oxley in NSW. It was an unforgettable experience – equal parts terrifying and exhilarating – but that flight sparked something in me.

At that age, I didn't have a clear plan for turning that spark into a career, but I was keen to get out of school. At 15, I joined the RAAF as a motor mechanic.

I was posted to Malaysia in the mid-1980s, and seeing more of the aviation world pushed me to take the next step and become a pilot. For me, it wasn't just about the flying, it was about the responsibility and the mission. There's a saying that there are two types of pilots: those who love flying and those who love the mission. I've always been the latter – working as a team to complete something that really mattered.

What range of aircraft did you fly during your career and which ones gave you the most satisfaction, or presented you with the most challenges?

I flew a narrow range of aircraft over my career, starting out on training aircraft, such as the CT4-A and then the Macchi MB-326H. I then commenced my service in the P-3 Orion. I also spent three years in Canada flying the Canadian P3 variant, the CP-140 Aurora.

After my time in the CT4, flying the Macchi was a completely different experience. It was sleek, fast and

beautifully responsive – a joy to fly. But the one that had the biggest impact on me was the P-3. I spent over 5,000 hours in that aircraft, and it was as challenging as it was rewarding.

Hands-on flying over the ocean at night at 300 feet and in pitch blackness required absolute trust in your crew and the technology. The P-3 was great and highly intuitive – it would generally let you know if you were about to make a mistake, either through the way it handled or a quick word from the flight engineer who was conveniently located in the cockpit.

Lockheed Martin (LM) supports a wide range of capabilities across Defence and the Air Force, including the fifth-generation F-35 Lightning II or Joint Strike Fighter (JSF). How does LM work collaboratively with the wide range of companies and countries involved in support of the JSF?

Lockheed Martin Australia New Zealand supports a wide range of capabilities and solutions, including the: F-35A Lightning II; C-130J Super Hercules; Aegis; MH-60R Seahawk; UH-60 Black Hawk; AIR6500 Joint Air Battle Management System; Guided Weapons and Explosive Ordnance Enterprise; M-142 HIMARS; AIR5428 Pilot Training System; and SouthPAN, an augmented satellite-based positioning and navigation solution for Australia, New Zealand, and its maritime region.

Delivering and sustaining these advanced all-domain capabilities is pivotal in addressing our complex security challenges and strategic defence priorities – and it is always done in collaboration with partners.

LM works closely with our Australian F-35 industry partners to develop their capabilities and capacity and continue to build the organic supply chain in-country. More than 75 Australian companies have shared in over $4.8 billion in contracts to support the production, sustainment, and follow-on development of the F-35.

How does LM ensure on-time delivery of complex Defence projects given the collaboration required with the companies and countries involved in the support of a wide range of capabilities?

LM has been a strategic industry partner of choice to the Australian and New Zealand Defence Forces for over 80 years, earning a strong reputation delivering and sustaining advanced defence technologies covering multiple programs.

LM's robust systems play a critical role; however, it is the strength of our people and local partnerships that underpin the effective delivery of complex defence projects.

As a prime, how does LM collaborate with local industries to strengthen sovereign capabilities?

Strengthening sovereign capabilities is vital, which is why we invest in local partnerships with industry. LM Australia is constantly scouring Australia's industry base for suppliers to join our programs. Through our Global Supply Chain program, we have awarded approximately $62 million in contracts to Australian companies since 2012.

We are also committed to increasing the capabilities of our Australian industry partners. Our Mentor Protégé Program aims to accelerate the development of core SME capabilities and open the door to potential export opportunities.

What is LM doing to support the ADF long-term, to maintain operational readiness and sustainment for its platforms?

LM is committed to bolstering the ADF's long-term operational readiness by delivering and sustaining world-best capabilities and through workforce development. Our sustainment enterprise works with Australian industry partners to maximise the operational readiness of key ADF platforms including the F-35A Joint Strike Fighter, and Black Hawk and Seahawk helicopters.

To support the sustainment of ADF platforms in the long-term, LM Australia is committed to creating opportunities for high-skilled and entry level roles with early career pathways and we invest in partnerships with universities, TAFEs, and STEM education initiatives to grow the workforce.

What significance does LM place on advanced technology in the Defence environment today and into the future?

Emerging threats require fully integrated, interoperable and future-ready solutions. Solutions that can rapidly evolve as threats become more capable. LM prioritises the development of these solutions in collaboration with Australia's researchers. With sites in Melbourne, Adelaide, Canberra and Brisbane, Advanced Systems and Technologies (AST) remains the first and most advanced multi-disciplinary LM research centre outside of the US.

AST executes programs with Australia's innovators in priority areas including counter-hypersonics, hypersonics, machine reasoning, and command, control, communications, computing, intelligence, surveillance and reconnaissance (C4ISR). AST's mission is to identify and mature key technologies to be transition ready to address Australia's most pressing national security needs.

What is the impact of the National Defence Strategy, Defence Strategic Review and Integrated Investment Program on LM's responsibilities and approach to supporting Defence requirements?

Those frameworks shape Defence priorities and procurement policies including bringing forward delivery of the key capabilities Australia would require at speed if a conflict arose.

LM Australia remains committed to facilitating genuine partnerships between the government and industry to grow sovereign capabilities and accelerate Defence acquisitions in support of Australia's national security interests.

Late last year, the RAAF's PC-21 trainer aircraft fleet surpassed 100,000 flight hours for the Pilot Training System (PTS), a fantastic achievement. How does the PTS prepare the ADF's trainee aviators for the increasingly complex missions they will fly in the future?

The collective talent and resolve of Defence's Air Academy, CASG and the Team 21 industry partners – LM Australia, Pilatus and Jet Aviation – have steadily matured the PTS to the point where it is now achieving record outcomes beyond those envisaged when the program commenced.

Trainee pilots come into the system with no previous experience. What follows is an incremental approach starting with classroom work, through to progress through training devices of increasing complexity up to a PC-21 simulator and finally to the aircraft itself.

The PTS gives ADF pilots the foundational skills required to progress onto advanced military aircraft such as fighter aircraft, surveillance aircraft and transport aircraft.

The C-130 Hercules has been the backbone of the RAAF's air mobility capability for over 65 years. What are some of the advanced features and capabilities of the RAAF's incoming new fleet of 20 C-130J Super Hercules?

We are proud of the RAAF's C-130 operations, which support Australia and partner nations in delivering the most capable, proven and versatile tactical airlift fleet capabilities. As we salute more than six decades of Hercules service, we are honoured to partner with the RAAF in many more decades of Hercules operations with Australia's new and expanding C-130J Super Hercules fleet.

We are working closely with the Australian Department of Defence and the RAAF on the configuration of these aircraft to meet their future mission priorities.

What kinds of next-generation capabilities will the AIR6500 Phase 1 Joint Air Battle Management System provide to the ADF, and to what extent will home-grown Australian technologies play a role?

Together with Defence, we are harnessing the ingenuity found in Australian industry to build a transformational capability that will establish the ADF as one of the most highly advanced in the world.

The AIR6500 project will deliver improved network architecture, next-generation deployable air-battle management systems and initial integration with priority platforms.

Approximately 60 percent of the work share is allocated to industry. We are working with Boeing Defence Australia, Raytheon Australia, Leidos, CEA, Silentium, C4i, Shoal and Consunet to build the ADF's Joint Air Battle Management System.

The strategic partnership has generated more than 270 new jobs across Adelaide, Melbourne, Williamtown and Canberra and

a further 300 in-direct jobs will be created in Australia's air and missile defence supply chain.

It has been suggested that Australia may become a hub to provide support for F-35 aircraft in the Asia region. Are you able to comment?

Australia's geographical location, industrial base and skilled workforce make it ideally positioned to become a Defence aircraft Maintenance, Repair and Overhaul (MRO) hub for the region, including for the F-35 Joint Strike Fighter.

LM is establishing a local network of MRO vendors to deliver sustainment services for F-35 aircraft operating in, or deployed to, the Indo-Pacific Region. This includes facilitating the pathways for sustainment partner BAE Systems Australia to lead airframe maintenance and Rosebank Engineering to deliver a wheels and brakes repair capability.

In addition to the local MRO vendor network, since 2018 several hundred dedicated LM Australia roles have been created for F-35 sustainment, with staff based at RAAF Bases Williamtown and Tindal – our largest F-35 sustainment footprint outside the US.

How do you keep your passion for aviation alive today?

I am incredibly fortunate to have had a career in aviation that took me around the world and gave me the opportunity to serve. My passion now is inspiring the next generation of pilots and maintainers. I enjoy encouraging students to consider aviation as a career. There's nothing more rewarding than seeing young people start to imagine what's possible for their own futures.

RIGHT On 24 November 2020, Air Marshal Warren McDonald AO, CSC handed over command of Joint Capabilities Group at a parade at Russell Offices, Canberra. Photo: Kym Smith/Defence.

FLIGHT-TEST INSIGHT

NON-INTRUSIVE FLIGHT TEST INSTRUMENTATION OFFERS A FLEXIBLE AND COST-EFFECTIVE SOLUTION FOR AIRCRAFT FLIGHT TRIALS.

NON-INTRUSIVE FLIGHT TEST instrumentation technologies are revolutionising aircraft testing by offering more flexible and rapid solutions that eliminate the need for extensive modifications to airframes and aircraft systems.

Non-intrusive technologies, namely wireless sensor systems, provide a significant advantage by allowing for quick and easy installation and removal. In recent times, fewer aircraft fleets are being purchased with dedicated flight-test aircraft. Non-intrusive systems that can be easily fitted and are fully removable are therefore critical to enabling test data to be captured from in-service aircraft.

The value of a wireless and adhesively mounted flight-test instrumentation system has long been recognised, but technical challenges in making the system operationally effective in the challenging environment found on the exterior of an aircraft at speed and altitude impeded their adoption.

Working in collaboration with Defence Innovations, Defence Science and Technology Group and the Air Warfare Centre, Melbourne-based engineering, technology and training company MEMKO has overcome the challenges with its Non-Intrusive Flight Test Instrumentation (NIFTI). NIFTI is a small, aircraft-independent, wireless sensing system that collects data using sensor nodes adhesively mounted to an aircraft's interior or exterior structure, offering a flexible and cost-effective solution for flight testing.

Key challenges addressed during NIFTI development included battery performance at low temperatures, managing thermal performance, memory capacity, enabling reliable wireless communications, and packaging components in a small form factor suitable for external mounting in the airflow outside an aircraft.

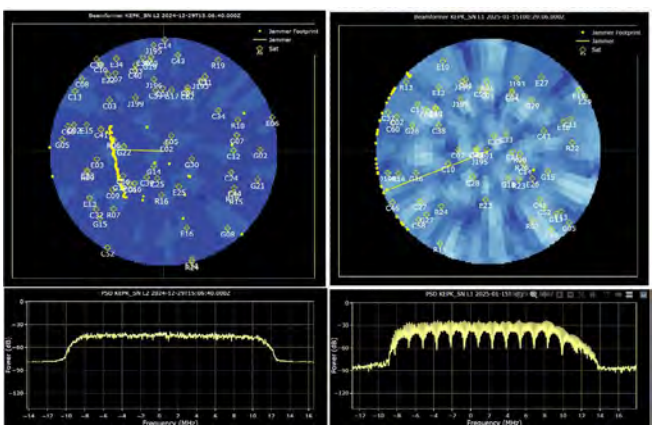
Despite the challenges, MEMKO saw the value that a wireless, adhesively mounted flight test instrumentation system could offer, says managing director Miro Miletic. "NIFTI does not require wiring to be installed, does not require holes to be drilled in aircraft structure and does not require interfaces with aircraft systems," he says. "As a result, NIFTI significantly reduces the engineering and certification effort needed to approve the installation of test equipment, the time needed to install test equipment and the time and effort needed to return an aircraft to its original condition following a test; making flight trials faster, more cost effective and more flexible."

As the systems continue to evolve, MEMKO anticipates the integration of artificial intelligence, enabling real-time data analysis during flight testing. Additionally, advances in miniaturisation and wireless communication could result in even smaller and more efficient sensor nodes, seamlessly integrated into the aircraft's structure, providing continuous monitoring without the need for manual installation and removal.

Beverly Witherby, marketing manager, MEMKO

ABOVE Full NIFTI sensor node mounted on an aircraft.

RIGHT Polar and spectral plots of different jamming signals.



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PROUDLY AUSTRALIAN

AUSTRALIA'S LARGEST PRIVATELY-OWNED DEFENCE COMPANY MARKS 25 YEARS.

NOVA SYSTEMS WAS born in the cockpit of a plane mid-flight, when RAAF veteran and test pilot Jim Whalley handed a business plan (developed during his MBA) to flight test engineer Pete Nikoloff.

Operating originally as Nova Aerospace, the company began in a small office in Edinburgh, South Australia, focused on providing independent test and evaluation (T&E) and flight test services to the RAAF. However, the founders had a bigger vision, to build a world-class engineering services and technology solutions organisation.

Now marking 25-years, the company has grown to be Australia's largest privately owned defence company and a leader in capability assurance and systems integration. It employs more than 1,600 people globally, with offices located across Australia, New Zealand, UK, Europe and Asia, and a supply chain of more than 700 sub-contractors.

It has clients across Defence, as well as emergency services, space, mining, utilities and commercial aerospace, focusing on T&E evaluation, certification and systems assurance. The company provides training to upskill the future Defence workforce, as well as incorporating advanced digital engineering methods into practice.

Beyond that, Nova's scope has expanded to include advisory and professional services, advanced training, systems integration, software and digital solutions, and aircraft modifications.

RIGHT Test and evaluation specialists testing a UAS.

BELOW Electromagnetic warfare specialists.

BELOW RIGHT Early Nova: Jill Noble, Jim and Pete.

CEO Dean Rosenfield, who joined the company in early 2024, says the company's vision is to make the world safe and secure.

"We deploy and integrate complex systems and software applications relied upon to save lives and protect communities," he says. "We're proudly, unapologetically Australian. And that's not just a fact – it's our competitive advantage.

"Our global reach means we are early adopters of advanced technologies and have a passion for leveraging enabling technologies such as artificial intelligence and digital engineering to tackle future challenges."

In Australia, Nova Systems has played a role in significant Defence programs for more than two decades, through professional services and partnerships, including RAAF's E-7A Wedgetail Airborne Early Warning & Control aircraft acquisition, AP-3C Orion aircraft upgrades and the acquisition of the MQ-4C Triton UAS.

Source: Nova Systems

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FAR LEFT ADF Full Mission Simulator.

LEFT CAE VISTA instructor.

BELOW LEFT CAE Hawk 127 simulator.

TRAINING SOLUTIONS

AS BATTLESPACES BECOME INCREASINGLY COMPLEX, MORE ADVANCED TRAINING IS BEING 'FLOWN' IN SIMULATORS.

TRAINING PERSONNEL DEPLOYED in distributed operations and uncrewed missions is becoming just as crucial as training the pilots of crewed aircraft, according to CAE Australia. And with an increasing number of new, crewed military aircraft having only single-seat variants, the importance of high-fidelity simulation as part of the training regime is paramount, says Matthew Sibree, the company's managing director Indo-Pacific.

Across 30 years supporting the ADF, CAE has seen an increase in the number of synthetic training devices used for both basic and conversion training, Sibree says, and is also seeing an increasing number of more advanced training events being 'flown' in simulators rather than live aircraft.

"The battlespace is becoming so complex that the only means to train utilising the full capabilities of the weapon systems is to conduct training within a secure synthetic environment," he says.

Reducing risk and the cost of training is also an important goal. "Digitally immersive technologies offer the ability to reduce training time, resources and cost, all while delivering better, safer outcomes for the student and organisation."

For uncrewed aerial systems (UAS), as well as live crewed platforms, CAE conducts a training needs analysis leading, ideally, to an integrated training solution. Whether a UAS pilot does no flying training or is a re-purposed fighter pilot, the company aims to combine its suite of cutting-edge products and systems, including its UAS Mission Trainer, to develop confidence, proficiency and trust. Crewed or uncrewed, the ability to simulate a complex, joint environment and command and control system is vitally important, says Sibree. It takes a system of systems approach based on accurate modelling of real-world platforms and communications links.

"This approach allows pilots and operators to interact with networks of simulated systems and AI-driven adversaries in a controlled environment, providing critical training and operational insights for modern forces."

CAE Australia, a regional business of CAE Defense & Security, specialises in Defence training, and mission and operations support solutions. While the company is best-known for manufacturing products such as Level D full-motion flight simulators for a range of ADF rotary and fixed-wing platforms, only 30 percent of its revenue now comes from hardware. The rest comes from what Sibree calls 'services', based largely on integrating training systems and delivering instructional, engineering and maintenance expertise.

Artificial intelligence (AI) and machine learning (ML) now enable training programs to adapt to the individual needs and learning pace of each student, ensuring they receive the most relevant courseware and personalised guidance. "AI and ML will push the boundaries of what is possible in simulation-based training, with tools that allow instructors to monitor trends, provide feedback, and adjust training material when conducting individual, team, or distributed training," he explains.

As the RAAF considers its sixth-generation needs, CAE remains "laser focused", says Sibree, on ensuring its training solutions evolve with the needs of the ADF and multi-domain operations across the region. "Whether it be innovating current training systems to provide the ability to surge and scale or implementing science-based approaches, our goal is to ensure that all personnel can operate proficiently in complex environments, which takes a lot of training to achieve."

Gregor Ferguson

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Contact Details:
For further information on engagement with the Centre please contact:
A/Professor Andrey Molotnikov (andrey.molotnikov@rmit.edu.au)
or
Professor Milan Brandt (milan.brandt@rmit.edu.au)

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A PEOPLE-CENTRIC CAREER

LEADING AIRCRAFTWOMEN CASEY-LEE REBELLATO IS COMMITTED TO SHAPING AND MONITORING AIR FORCE'S MOST VALUABLE ASSET, ITS PEOPLE.

GROWING UP ON A CATTLE FARM close to RAAF Base Williamtown, a career in the ADF was always close to home. The idea of a career that was people-centric aligned with my values, so joining was a really exciting time for me.

I originally enlisted as part of the Gap Year program as a human resources advisor (also known as a personnel capability specialist). I loved that I was able to test the waters before diving straight in. I fell in love with the organisation as well as the people, opportunities and rewarding experiences.

That led me to step into a leadership-based role where I can pursue continuous growth as a human resources manager (also known as a personnel capability officer). In 2024, I undertook training at Officer Training School where I gained the skills to be an inspiring and effective leader.

My proudest moment was being able to play a part in the Afghanistan repatriation flight returning to Australia. Being able to assist Afghan evacuees as a Middle Eastern woman in the ADF was extremely rewarding and allowed me to exert compassion in an unknown environment.

Months later, I was selected to be painted as part of an ADF mural (pictured right) in Nambour which was an honour.

Being a human resources manager allows me to shape and mentor our most valuable asset, our people. I look forward to working in the recruitment and retention area to assist others in finding the same value in the organisation that I did.

The ADF has developed a sense of self I didn't know existed. It has strengthened my ethics, values and resilience in more ways than I knew was possible. I've come to know myself as a stronger, more resilient woman. Being able to be who I truly am and serve my country simultaneously is something I do not believe I could find in any other organisation.

The ADF has also assisted me in gaining a master's degree in business administration which has shaped how I manage organisational needs and respond appropriately.

The camaraderie and mateship among my peers is second to none. The life experiences it has provided me, I would never have been able to obtain elsewhere. I love serving and protecting the nation that has protected me, and feeling supported by my Air Force family in every step I take. It's a special feeling. In every deployment, exercise and everyday work environment, being a team player is an integral part of mission success.

To learn more about a career in the ADF, go to adfcareers.gov.au

ABOVE Personnel Capability Specialist Leading Aircraftwomen Casey-Lee Rebellato of No 2 Operational Conversion Unit, RAAF Base Williamtown. Photo: CPL Melina Young.

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CHANGING **ALTITUDES**

AFTER SUCCESSFULLY STRUGGLING FOR EQUALITY, WOMEN NOW COMPRISE A QUARTER OF THE AIR FORCE.

RIGHT
RAAF pilot Flight Lieutenant Hayley Moulds behind a KC-30A Multi-Role Tanker Transport at an airbase in the Middle East. Photo: POIS Yuri Ramsey.

RIGHT AVM Julie Hammer AM CSC

FAR RIGHT
WAAAF and WRAAF recruiting posters.

PEACE AND SECURITY APPLY EQUALLY TO MEN AND WOMEN THE WORLD OVER, and it is inescapable that military organisations work better, more efficiently, and are more capable if they use all the talent on offer in 100 percent of the world's population. Women now participate in all roles in the RAAF in the defence of Australia. But that was not always the case.

Before World War II, military service for women was restricted to the nursing profession. War-related roles for women during WWI were only available in the Australian Army Nursing Service. More than 2,000 Australian women served overseas in military clinics and hospitals near battlefields and on ships and trains in Europe and in support of operations at Gallipoli. Those who remained at home were limited to domestic tasks and creating care packages: knitting and baking goods, packaged up with words of support from home.

The years between the wars sowed the seeds of social change. Women were staying longer in education and finding work to supplement the family income.

Modelled on Princess Mary's Royal Air Force Nursing Service in the UK, the RAAF Nursing Service (RAAFNS) was established in July 1940 with 36 nursing sisters. Between 1940 and 1955, more than 600 women joined the RAAFNS, serving overseas during WWII, the Korean War and the Malayan Emergency, where they lived and worked in the same conditions as the men. The RAAFNS continued to provide valued service until 1977, when it was formally absorbed into the RAAF.

Within the first year of the declaration of WWII, there was insufficient manpower for the RAAF to sustain its rapid expansion. Within months, the concept of an auxiliary force was developed and in December 1940, the establishment of the Women's Auxiliary Australian Air Force (WAAAF) was approved by the War Cabinet and by the Advisory War Council in January 1941. Recruitment began the following March.

More than 600 women joined the RAAFNS, and thousands joined the WAAAF. While employment opportunities were initially limited, WAAF servicewomen ultimately worked in 77 percent of the available RAAF roles. By the end of the war, more than 27,000 women were making significant contributions to Air Force capability and the war effort. However, women's contributions were considered a temporary necessity and within two years of the war concluding, the auxiliary arm of the service was disbanded.

The outbreak of the Korean War and the continuing need to provide support for the Malayan Emergency (1948-1960) caused a dramatic drain on the Permanent Air Force and resulted in the establishment of the Women's RAAF (WRAAF) in July 1950.

The initial period of service was two years and more than 2,000 women applied to join. The period of service was increased to six-years in 1959 and provided the opportunity for women to serve in more than 21 areas. However, rates of pay for women were pegged at two thirds the salary of their male counterparts and they were required to leave if pregnant. The appointment of Her Majesty Queen Elizabeth, the Queen Mother, as Air Chief Commandant of the WRAAF in 1957 provided deserved recognition to the force while the provision of well-designed and tailored uniforms provided a touch of elegance.

Again, war provided challenges for the Air Force. With Australia's commitment to the Vietnam War, the RAAFNS was tasked with the provision of medical support for wounded Australian service personnel

evacuated from Vietnam via No 4 Hospital at RAAF Butterworth. During that time, 106 RAAFNS nursing officers were deployed to Butterworth to cope with the demand to care for the wounded.

Throughout the 1950s and 1960s, the move towards social equality across Australia provided significant benefits for serving women. From 1965, female officers were offered permanent commissions and from 1969 servicewomen could marry and remain in the service. Along with the RAAFNS, WRAAF members shared the opportunity to serve overseas. They received equal pay with their male counterparts in 1972, but it wasn't until 1978 that officers and non-commissioned officers received remunerative equality with their male counterparts.

The 1980s saw a dramatic shift for employment opportunities for women. At the start of the decade women represented seven percent of the work force. By the end of the decade that had increased to 14 percent. The first female pilot graduates entered the workforce in 1988. By then, 87 percent of Air Force roles were available to women, although it wasn't until 1992 that combat roles were available to women.

Despite a reduction in the size of the Air Force in the 1990s, it participated in an increasing number of peacekeeping, humanitarian aid and disaster-relief operations around the globe. Against this backdrop there was an increasing equality for RAAF servicewomen. Air Commodore Julie Hammer AM CSC became the Air Force's first female one-star officer, and subsequently the first Air Force female two-star officer. Flight Lieutenant Johanne Mein became the first female pilot in the Roulettes aerobatic team.

Today all roles in the Air Force are open to women, at equal pay with men.

From humble beginnings, with limited opportunities, servicewomen have successfully struggled for equality. They have made their mark in the RAAF with professionalism, dedication and sacrifice and now comprise a quarter of the Air Force.

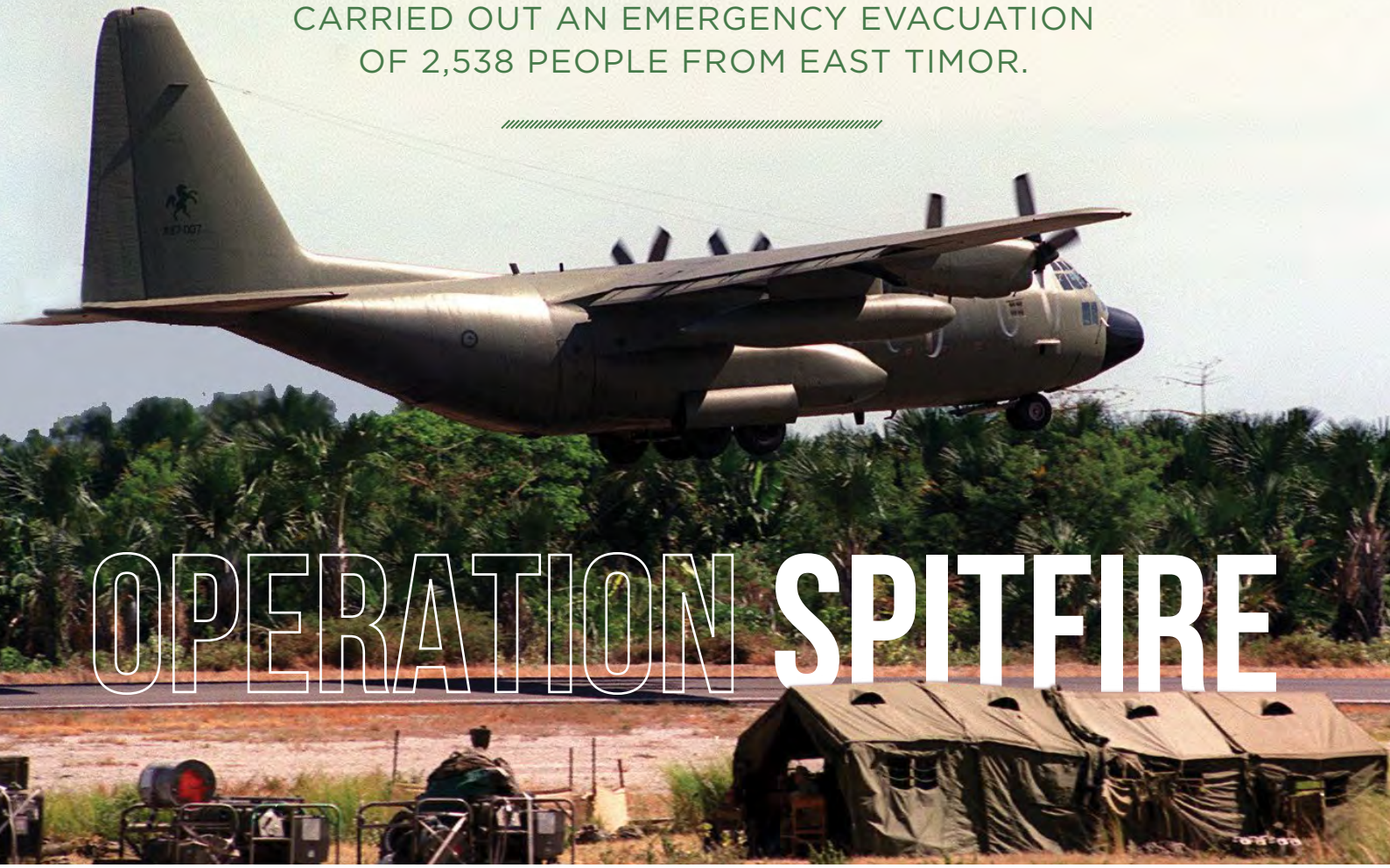
Edited extracts from Changing Altitudes (Big Sky Publishing, RRP $19.99).

Changing Altitudes: Stories of Australian Air Force Women has been produced by Air Force's History and Heritage Branch with contributors who have served in the Air Force. It provides an excellent overview of the emerging role women played in the development of the RAAF against a backdrop of contemporary Australian events and social climes.

It is enriched with the personal stories of women who served from the 1940s to present day, capturing the essence of societal attitudes prevailing in each decade, and presenting a wonderful variety of personal stories of the women who helped to shape our history. They are honest, warm and express the spirit of personal endeavour to serve in the Air Force while facing social limitations.

Bob Treloar

IN SEPTEMBER 1999, THE RAAF AND RNZAF CARRIED OUT AN EMERGENCY EVACUATION OF 2,538 PEOPLE FROM EAST TIMOR.



OPERATION SPITFIRE

ON 14 SEPTEMBER 1999 FLYING OFFICER BRETT 'ARCHIE' ALDERTON, No 36 Squadron RAAF, piloted what was far from a routine C-130 flight. As chaos reigned and a city burned around him, his cargo was a sea of exhausted and confused humanity – 186 passengers, including 175 desperate civilians – evacuated from Dili to Darwin as part of Operation Spitfire.

A colony of Portugal since the 1500s, East Timor was invaded by neighbouring Indonesia in 1975, beginning a 24-year-long brutal occupation in which an estimated 100,000 people died. The East Timorese never stopped fighting, and in 1999 their long struggle for resistance came to a head when Indonesian President B.J. Habibie announced that East Timor's fate would be put to its people. In a 'popular consultation' (the Indonesians would not accept the use of the word referendum), the East Timorese would be asked if they accepted or rejected increased autonomy as a province of Indonesia. To vote for 'autonomy' was to accept continued Indonesian rule; to reject 'autonomy' was in effect to vote for independence.

The announcement of the vote set off months of violence and intimidation directed against the East Timorese by pro-autonomy militias. At first, the attacks largely targeted key independence figures and their families, a deliberate plan to influence the outcome of the vote. However, when 78 percent of East Timor's 450,000 registered voters voted against 'autonomy' on 30 August 1999, the outcome was clear. The people wanted independence. The announcement of the ballot results on 4 September heralded a new phase of violence. For weeks, pro-autonomy militias attacked civilians, burned East Timor's villages and towns, looted, raped and forcibly removed people to neighbouring provinces. The Indonesian authorities in East Timor did little to stop or even stem the violence. Numerous studies, including the recent *Official History of Australian Peacekeeping Operations in East Timor* by Professor Craig Stockings, have made clear the complicity and tacit approval of various levels of the Indonesian military. In less than a month, some 70 percent of East Timor's buildings were burned to the ground, unknown numbers were killed, and hundreds of thousands displaced.

EMERGENCY EVACUATIONS

The RAAF played a vital role throughout Australia's many years of operations in East Timor (from 2002 known as Timor-Leste); but none, perhaps, was more critical than the emergency evacuations they carried out between 6 and 14 September 1999 – Operation Spitfire.

ABOVE LEFT A RAAF C-130 Hercules takes off from Komoro Airfield during INTERFET, September 1999, not long after its participation in Operation Spitfire. Photo: Sergeant W. Guthrie/ Department of Defence.

TOP RIGHT East Timorese civilians take shelter in the UN compound in Dili during the worst of the anti-independence violence, 1 September 1999. Photo: David Dare Parker/AWM.

ABOVE RIGHT East Timorese civilians view the remains of Yeronimo Yoaquim Galucho (42 years old), and Malicoli (65 years old), allegedly killed by members of an anti-independence militia. Photo: David Dare Parker/AWM.

The United Nations Mission in East Timor (UNAMET), the multinational mission that had been in East Timor since June to register voters, assist with the election, investigate crimes and, where possible, protect civilians exercising their right to vote, became a target for militia in the post-election violence. Particular savagery was directed at the East Timorese civilians who had worked for the UN mission. On 5 September, Ian Martin, the British head of UNAMET, made a formal request for Australia to evacuate his non-essential staff. Martin's request led to the execution order for Joint Task Force (JTF) 504 – Operation Spitfire – one of several contingencies in place for Australia to react to the situation unfolding so close to Darwin. From 6 September, RAAF – and one Royal New Zealand Air Force (RNZAF) – C-130 aircraft conducted ferry runs between Darwin and Dili and Baucau to evacuate Australian (and approved other) nationals and non-essential, non-East Timorese UNAMET staff. Aboard each C-130 was a small security detail from JTF504's Special Forces component, drawn from 3 Squadron, Special Air Service Regiment.

The first Australian C-130 arrived at Komoro Airfield, Dili on the morning of 6 September. Its crew later recalled looking out of their aircraft to see a city in flames as long convoys of Indonesian troops left the city, carrying looted building materials, household furniture and East Timorese locals with them. The airfield itself was under the protection of an Indonesian Special Forces unit and an infantry battalion, who pointedly had their weapons aimed inwards, towards the airstrip, not out towards the supposedly uncontrollable militia violence. Tensions rose when the SASR security detachment emerged from the aircraft in an understandably aggressive posture, complete with their backpacks containing poorly concealed weapons. The situation only eased after Colonel Ken Brownrigg, the Australian Army Attaché in Indonesia, insisted the Australians ease their posture, and strategically place linguists throughout their number to chat and share cigarettes with their Indonesian counterparts. The first day of Operation Spitfire saw five C-130 fights into Komoro, with a total of 300 evacuees.

HOSTILE STANDOFF

A serious incident occurred on 7 September at Baucau, 120km east of Dili, where local Indonesian forces had threatened to withdraw their protection for UNAMET unless they declared their locally employed staff as internally displaced persons, and thus hand the vulnerable locals over to Indonesian control. When the UN staff refused to do so, violence escalated, culminating in the UNAMET staff withdrawing to the local UN compound and a nearby UN Civilian police residence. The compound and residence were surrounded by militias and sprayed with gunfire, prompting the local Indonesian military commander to declare martial law and order UNAMET to leave.

A tense standoff ensued at the Baucau airfield. The local TNI commander placed trucks on the airstrip to prevent the C-130s from taking off unless the locally engaged East Timorese staff were left behind. To do that would have left them to a terrible fate because the airfield was

RIGHT An East Timorese boy in the refugee camp at Marrara, near Darwin, 29 September 1999 – one of the many civilians evacuated by C-130 as part of Operation Spitfire. Photo: Ray McJannett/AWM.

BELOW Extensive damage to Dili as seen from the air, November 1999. Photo: Brian Manns/AWM.

BOTTOM Marshalling a C-130E Hercules of No 37 Squadron, RAAF at Dili airfield during INTERFET, 1999. Photo: Corporal Darren Hilder/ Department of Defence.

surrounded by Indonesian troops and hostile militia. International UNAMET staff formed a protective cordon around the local staff to protect them, and tensions rose further when it became apparent that Bishop Carlos Belo, a prominent independence figure, was among the crowd waiting for evacuation. After some time, the hostile forces relented and allowed the C-130s to take off with international staff and Bishop Belo aboard. The local UN staff were allowed to leave, but only by UN Puma helicopter. The two Pumas present were certified to carry 17 passengers; they each flew the 120km to Dili with 35 aboard, their rotors under visible strain.

Baucau was the most serious incident for Operation Spitfire, but the evacuations continued for days in a tense security environment and at a high tempo. When the UN announced on 8 September that it would completely withdraw from East Timor because of the deteriorating situation, the international staff once again refused to be evacuated unless their locally engaged staff were evacuated to Darwin with them.

The Australian Government eventually announced it would allow the locals and their families to come to Australia on temporary safe haven visas, and after reluctant agreement from the Indonesians, the final phase of Operation Spitfire began.

On 14 September, Indonesian troops secured and lined the road running from the besieged UN compound in Dili to Komoro airfield, and in the pre-dawn darkness a convoy of trucks, each with a UN and Indonesian military representative aboard, made their way to the waiting C-130s. On that day alone, 1,500 refugees and others were flown from Dili.

Despite being conducted at short notice and under extreme circumstances, Operation Spitfire was a success. Between 6 and 14 September 1999, the RAAF and RNZAF C-130s flew 37 sorties evacuating 2,538 people from East Timor: 555 UNAMET personnel; four attaché staff; 343 locally engaged UNAMET staff; 1,456 refugees; and 180 others (journalists and approved foreign nationals). As Flying Officer Alderton reflected on his record: "It felt good to be able to help them".

Dr David Sutton, Senior Historian, Australian War Memorial

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ABOVE
Tactical Operations Center, Nha Trang, July 1968.

IN 1964, THE RAAF deployed new Caribou tactical transport aircraft operated by the RAAF Transport Flight Vietnam (RTFV) to the developing war in Vietnam. Based at Vung Tau in the south of the country, RTFV later became No 35 Squadron RAAF. The Caribou operated there for eight years, with personnel serving an operational tour of 12 months.

Caribou aircraft provided support to the Australian Task Force every day by providing resupply flights that carried personnel, rations, mail, ammunition and assorted freight. However, the bulk of 35 Squadron's efforts were actually in support of American forces throughout South Vietnam as part of the US 7th Air Force, 834th Air Division. The flights covered the expansive Mekong Delta region in the south known as IV Corps, the area around Saigon known as III Corps and the rugged Central Highlands (II Corps) further north.

In Asia, the lunar new year is the most important annual celebration by far. The Vietnamese lunar new year is called Tet, or more correctly, *Têt Nguyên Đán* which translates loosely as feast of the first morning of the first day, and normally occurs in January or February. In 1968, Tet was to be celebrated from Tuesday, 30 January, a day after my 21st birthday.

On 27 January, I had been rostered for a week-long detachment to Nha Trang with Stewart McAlister. Although a Flying Officer, Stew was in his late twenties and was one of the mature old hands of the squadron. He was only weeks from finishing his 12-month tour in South Vietnam. Most importantly to me, he was approved as a right-hand seat check captain, which meant he could be the aircraft captain, permitting a junior aircraft captain, like me, to fly from the left seat as he confirmed my ability to do the job and become familiarised with operations in South Vietnam.

Stew tasked me to fly the first half of the 005 Mission from Vung Tau to Saigon, then northward along the coast landing at the relatively minor towns of Phan Thiet and Song Mao before visiting the major USAF base at Phan Rang. To track our movements, we reported by high frequency radio to the USAF 834th Air Division Airlift Command Centre, callsign *Hilda* on each sector.

Our first task for the afternoon was

an easy one to Qui Nhon, about 100 nautical miles up the coast, from there we were tasked to fly to Pleiku, about 75 miles due west from Qui Nhon into the Central Highlands. Pleiku was about 2,500 feet above sea level so we flew west from the coast initially at about 3,000 feet above mean sea level. We gradually climbed to maintain our minimum 3,500 feet clearance from the ground in case of random small arms fire.

Once at Pleiku, we were quickly loaded with pallets of supplies that invariably included ammunition and headed north over the mountainous terrain to the Special Forces (SF) camp at Mang Buk. Many of the SF camps near the border were located in or near river valleys which provided an easier route for troop movement, rather than negotiating the multitude of mountain ranges in the Central Highlands.

The next day, 28 January, Stew again tasked me to fly in the morning, and we were off to Pleiku with supplies from the coast, and from there into the SF camps, including Dak Pek, which was about 70nm to the north of Pleiku and only about 8nm from the Laotian border. For the rest of the day we continued to supply SF camps out of Ban Me Thuot East.

I woke on the morning of 29 January in Nha Trang as a 21-year-old. It didn't feel any different, and we headed out for a very busy day at the office. Although there was no formal advice about likely increased enemy activity, CIA intelligence reports released to the public many years later indicated that the Americans were expecting action from the communists in our area of operations.

For the rest of the day, we continued to supply SF camps and after our last flight we either decided by ourselves, or were tasked by Hilda, to overnight at Pleiku, rather than our normal overnight base of Nha Trang.

Arriving at Pleiku just before dark, Stew noted there were no other transport aircraft on the ground. Normally, there would be a number of C-130 and C-123 transport aircraft parked overnight. We queried the tower on the lack of aircraft, but they seemed none the wiser – or at least they weren't telling us. We found out later that

all other airlift aircraft had been evacuated to coastal airfields late in the afternoon.

On shutting down our engines and securing the aircraft in a very exposed part of the empty tarmac, the Pleiku based SF personnel arranged transport for our four-man crew to the SF HQ of Detachment C2 at Camp Holloway, about 3km from the main Pleiku strip. After a couple of beers and something to eat, I was asleep in a standard Army camp bed.

And then the fireworks started.

Like most interruptions to a deep sleep, noise initially forms part of a dream. I can't for the life of me remember the context of my dream that rationalised incoming mortar rounds, but I was quickly back in the land of the living when I realised the noise was a combination of very close explosions and continuous automatic gunfire.

At 0100 hours on 30 January, the enemy had broken the agreed ceasefire and launched the Tet Offensive attack on various parts of the Pleiku military complex, airfield and small city about 3km due west of Camp Holloway.

Outside the protection of the sandbagged barracks, the noise increased as I followed others to a bunker to be briefed. There seemed to be a constant sound of automatic gunfire from all directions. Some of it was the relatively soft but rapid clatter of numerous M60 7.62mm calibre machine guns, and another was the heavier and less rapid sound of the 50-calibre heavy machine gun.

One of our hosts explained that there were three perimeters made of obstacles and razor wire. Each perimeter was separated by about 50m of relatively open ground that would give the defending machine guns easy view of attacking troops – in daylight anyway. Graceful streams of red tracer bullets filled the dark sky. Incoming tracer seemed to be arcing up in the distance before falling randomly into the Camp Holloway compound. Outgoing tracer was much lower as though the defending guns were aiming directly at ground targets not far away. The problem of not being able to see the invading forces was solved by regular launching of M127A1 White Star parachute flares shot up by flare pistol or hand-held grenade launcher. The flares floated gently down, illuminating ground between the defensive perimeters.

Following our briefing in the command bunker, we returned to our accommodation which was effectively a protected bunker. All we could do was talk to the few SF officers who, like us, were told to keep their heads down and presumably, their powder dry. At first, sleeping wasn't really an option, the rate of incoming mortar rounds seemed to be less frequent, but the automatic gunfire was incessant. With memories of my prisoner of war training course not two months old, I contemplated a scenario of North Vietnamese (NVA) or Viet Cong bursting in through the door brandishing AK47 automatic rifles, while I stood there with my 9mm pistol. It didn't bear thinking about, but I did anyway.

Stew asked if we could be transported out to the main airstrip to see if our aircraft had survived. Our SF hosts were quite firm, we were to stay put until they assessed if it was safe. We didn't argue. With the benefit of hindsight, our SF hosts were wise to assess that there was still a threat of attack. As they escorted us to the main airfield, there must have been at least 400 enemy combatants in the area.

Amazingly, RAAF Caribou A4-210 was sitting alone and intact on the open parking area. Apart from pure luck in not being hit by the rocket barrage aimed at the airstrip, she must have presented an easy target for NVA or Viet Cong troops attacking the airfield. Suspecting our aircraft may be booby trapped with explosives of some sort, all four of us carefully checked every hole, panel and possible locations in the undercarriage bays where a grenade may be hidden.

After a further two days of resupplying SF camps, we completed our eventful 005 Mission detachment with flights to scheduled airfields in the Central Highlands, Tan San Nhut and Saigon, and returned to Vung Tau.

CIA REPORT

The action began early on 30 January when 500 to 700 Communists followed up heavy rocket barrages against Pleiku Airfield and a nearby Montagnard training centre with an assault which penetrated the capital city itself. Battle results to date include 103 Communists killed compared with allied losses of seven killed and 22 wounded.

LEFT
Camp Holloway, 1965-66.

BELOW LEFT
Camp Halloway after the attack.

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SCAN ME

THE SIDE HUSTLE

WHEN DOES A HOBBY BECOME A BUSINESS?

THE 'SIDE HUSTLE' has become a common feature of Australian households. It seems the opportunities and possibilities are only limited by your imagination. A quick online search of the term side hustle reveals hundreds of interesting ideas that could be adapted and monetised by anyone willing to put in the time, energy and (sometimes) money to develop them. They can include activities such as dog walking, fitness classes, gardening services, car washing and even developing a clothing line.

It's not uncommon for a side hustle to start out as a hobby which develops into something more. As a result, the time will come when a hobbyist should think about whether a hobby has changed from being a part time private interest into a business.

If it has become a business, all sorts of regulatory consequences may follow, such as formal record keeping and tax returns. That's not necessarily a bad thing. After all, a hobby that's transformed into a serious business can often turn your former private side hustle into a profitable venture that improves your and your family's financial independence and may even build a long-term asset that can be sold on to investors in years to come.

Unfortunately, working out whether or not your hobby has become a business is not a clear-cut process. A good starting point in making that assessment is to consider what a business is and what it isn't.

WHAT IS A BUSINESS?

As a general rule, a business involves a set of continuous and repeated activities you do for the purpose of making a profit, usually paid in money, but also being paid in goods and services (e.g. by barter deals). You can run one business or multiple businesses at the same time.

However, not everything you do to make money is necessarily a business. According to the Australian Taxation Office, your activities are not a business when they are:

- A one-off transaction (unless it's the first step in carrying on a business or intended to be repeated)
- Done as an employee
- A hobby or recreation from which you don't seek profit
- A simple investment, such as passively holding shares from which you receive dividends or a rental property you let through an agent.

Even if you're not in business, you may still need to declare certain payments you receive, such as rent, dividends and capital gains from one-off transactions such as the sale of an investment property.

Here are some steps to help determine whether you are in business.

STEP 1: IDENTIFY ALL RELEVANT, RELATED ACTIVITIES.

These include: keeping records; obtaining licenses and permits; if you rent out premises or goods, everything you do to

rent out those premises or goods; if your activity is providing goods or services, everything you do in providing them.

STEP 2: ARE YOUR ACTIVITIES A BUSINESS?

The more of the following questions to which you answer yes, the more likely it is that your activities will be a business.

- Do you intend to be in business?
- Do you intend to and have a prospect of making a profit from your activities?
- Is the size and scale of your activities enough to make a profit?
- Are the activities repeated and continuous?

In addition, are your activities planned, organised and carried out in a business-like manner? For example, do you:

- Keep business records and have a separate business bank account?
- Advertise and sell your services to the public, rather than just to family and friends?
- Operate from business premises?
- Maintain required licences, permits and qualifications?
- Have a formal business plan or budget?
- Have a business name and/or an Australian Business Number (ABN)?

STEP 3: WHEN DOES YOUR BUSINESS START?

It's important to know when your business starts. This will impact the registrations you need, the record keeping and compliance you require, how tax laws apply to your activity and the tax concessions or deductions that are available to you.

Put simply, your business starts when you have more than an intention to be in business and have made the decision to start it, acquired the minimum level of assets to start running the business and have actually started your business activities.

PROFESSIONAL ADVICE

Unfortunately, as you will have concluded from the analysis above, making a decision about whether or not your activity is a business is not necessarily straightforward. It comes down to carefully balancing and judging the significance of various criteria that together can lead you to a conclusion.

Therefore, if you're in any doubt about your circumstances, you may be wise to seek the advice of a qualified accountant (for example, a CPA or a chartered accountant) who has experience in advising small business owners like you. If you do decide to consult a qualified accountant (some aren't qualified), be aware that professional fees may apply, sometimes in the order of hundreds of dollars per hour. You may find an accountant who will offer you an introductory meeting (say 15-30 minutes) free of charge, but if you decide to seek more detailed advice, it's important to understand (in writing) the scope and likely cost of the advice before proceeding.

Other options include attending introductory small business courses offered by various not-for-profit organisations and governments.

Air Commodore Robert M C Brown AM FCA (Ret'd)
ADF Financial Services Consumer Centre

2025 FLYING CAMPS

WORDS by Brian Grinter AAL

Cadets and instructors at the Air League's summer flying camp.

IN JANUARY, the NSW Group of the Australian Air League (AAL) held its annual summer flying camp at its Air Activities Centre at Camden Airport, southwest of Sydney. The camp was held over nine days with 22 students from nine squadrons.

Cadets who attend camps have a wide range of flying experience, but for many this year, it was their first flight training experience. Starting with the instructors' briefings, they began flying with lessons on the effects of controls, climbing and descending, turning and then on to other manoeuvres. They also learnt about airfield operations, including how to perform pre-flight inspections and refuel the aircraft.

For the remaining cadets, the camp was an opportunity to build on their training and renew friendships made in previous years. They undertook more advanced training, including circuits, stalling and practice forced landings for their Recreational Pilot Licence. Two cadets completed their first solo flight in PA-28 VH-LRA under the supervision of instructor Charles Droudis.

ABOVE Cadets had the opportunity to meet Officers of the NSW Police Force Air Command when PolAir 4 visited Camden.

Congratulations to L/Cdt Jensen Reynolds of Manly Sqn and L/Cdt Griffin Coombes of Marrickville Sqn.

Several rainy and overcast days prevented the cadets from completing as many flights as they had hoped, but they made the most of the opportunity and completed nearly 90 flights with a total of 91 flight hours.

The cadets also had the opportunity to learn more about aviation with a visit to the control tower to meet the Airservices Australia controllers responsible for safe operations at Camden Airport and to GB Aviation, where they learnt about aircraft maintenance and saw a Pitts Model 12 in the workshop with a massive nine-cylinder radial engine putting out over 400hp.

Other highlights included a visit to the airport by the NSW Police with their Bell 429 helicopter PolAir 4 and learning about NSW Police Force Aviation Command, and also the NSW Rural Fire Service who were operating a Bell 412SP helicopter from Canada, which had been deployed to fight

ABOVE Cessna 152 VH-SOX and some of the cadets who started learning to flying in it.

ABOVE Grade 3 instructor Errol Townsend completed 100 hours of volunteer instruction at the flying camp.

fires during the Australian summer. Cadets also visited the hangars of Air Combat Australia, which offers jet-fighter experience flights, to inspect the company's Czech-made Aero L-39 Albatros.

There were also movie nights, games of football and visits to the local swimming centre and bowling alley in the evenings.

On the last night, a formal Dining-In Night was attended by Neil Alexander, Head of Operations for the Scouts NSW Air Activities Centre and Jonathan Lam, Head of Operations for Phoenix Aero Club. During the dinner, the cadets received awards for their accomplishments, and volunteer instructors received the League's gold pilot brevets in recognition of their service.

The Air League's Air Activities Centre at Camden is owned and operated by the NSW Group of the Australian Air League, with a fleet of training aircraft, including a Piper PA-28 Warrior, Cessna 172, and Cessna 152. The centre provides cadets with the opportunity to undertake air experience flights and flying training, as well as participate in annual flying camps during school holidays. It is staffed exclusively by volunteers, and for nearly 40 years, has provided thousands of air experience flights and training hours to members of the League.

ABOVE L/Cdt Griffin Coombes completed his first solo flight with instructor Charles Droudis.

TOP Neil Alexander from the Scouts Air Activities Centre with Rimon Jawar.

ABOVE Jensen Reynolds completed his first solo flight with his instructor Charles Droudis.

ABOUT THE AUSTRALIAN AIR LEAGUE

The Australian Air League is a youth group for boys and girls aged eight years and older who are interested in aviation as a career or a hobby.

In the Air League, they learn about aviation in all its forms through classes in the theory of flight, navigation, aircraft engines and a variety of subjects. The Air League also aims to enable them to achieve their full potential and become better citizens who can effectively serve the community.

With squadrons in most states, the AAL has been serving the community in Australia since 1934. It is entirely self-funding and is staffed by volunteers.

airleague.com.au; phone 1800 502 175

NEW SQUADRONS

FOLLOWING A SUCCESSFUL INFORMATION session at the end of 2024, the Victoria Group is commencing operations of a new squadron meeting at the Goulburn Valley Aero Club, Shepparton Airport this year. The Air League operated in the Shepparton area during the 1940s and 1950s and is pleased to be able to re-open a squadron.

Meanwhile, the Queensland Group is seeking interest to open a new squadron in Caloundra on the Sunshine Coast, starting mid 2025 and was planning to hold an information session in February.

To learn more about the new squadrons, visit airleague.com.au or call 1800 502 175.

WORDS Flight Lieutenant (AAFC) Paul A Rosenzweig OAM

Staff and cadets with a DG1000S glider at Balaklava Airfield.

THE THRILL OF A WINCH LAUNCH

LAST YEAR WAS a busy one for Aviation Operations Wing, which provides gliding training through three flights of the Gliding Training School.

Toward the end of 2024, Balaklava Glider Training Flight introduced 20 Cadets from 6 Wing to "the wonders of soaring in a glider and the thrill of a winch launch" with Pilot Experience (PEX) flights in DG1000S gliders from Balaklava Airfield, SA.

In NSW, Bathurst Glider Training Flight ran glider flying courses for 3 Wing Cadets, culminating with a record 25 Cadets flying their first solo in the DG1000S Glider.

Cadet Sergeant Alex Van Neijenhoff (320 Squadron) flew his first solo flight in April 2024, inspired by the uniformed service of multiple family members. His great-great-grandfather served in the First and Second Australian Imperial Force during both World Wars, a grandfather served in the Dutch military forces, and his uncle is a current Flight Sergeant in the RAAF.

CSGT Van Neijenhoff said flying solo gave him a sense of success. "As I climbed out of my glider I had a big grin on my face," he said. "Flying is a way to feel free, to be in the air in your own aircraft. It will truly shock you how big the world really is and how you have only just started on a journey to explore the world in a new view."

Warwick Glider Training Flight, Qld ran glider training courses in the school holidays for 2 Wing Cadets. Cadet Under Officer Hamish Young (203 Squadron) achieved the award of Air Experience Instructor, qualifying him to instruct on subsequent flying training activities.

Gliding Training Camp 3/24, conducted in September, saw 298 sorties flown (a total of 174 hours) and 12 ab-initio Cadets commenced flying training. In addition, three senior trainees achieved their first solo flights. Congratulations to Cadet Warrant Officers Lara Kilbourne (208 Squadron) and Max Carnitz (207 Squadron) and Cadet Sergeant Tristan Emms (210 Squadron), who flew their first solo flights in September.

ABOVE CUO Tristan Free conducting a solo sortie during a flying training course conducted by GTS Warwick Flight. Photo: FLTLT (AAFC) Stuart Addinell.

NO 1 WING 75TH ANNIVERSARY

NO 1 WING AAFC (previously North Queensland Squadron Air Training Corps) will celebrate its Diamond Jubilee on 3 March 2025.

The Air Training Corps (ATC) was formed in 1941 with six wings, one in each state, including No 3 Wing in Queensland. Its role was to provide pre-entry training for young men enlisting in the RAAF as aircrew and was part of the Empire Flying Training Scheme. When the ATC was restructured in 1946, the Queensland wing became 3 Squadron. By 3 March 1950, there were 10 flights in the Queensland squadron and it was decided to establish another squadron to serve the northern part of the state.

The first parade for No 1 Flight was held in Townsville on 4 May 1950, and a second flight was established at the Townsville Technical College with its first flight commander being appointed in May that year. In the years following, flights were formed at Cairns, Mackay, Ingham, Innisfail, Mareeba, Charters Towers, Bowen and Mt Isa. The Townsville flights were integrated into one unit due to staffing and accommodation issues.

A number of name changes occurred over the years. With the introduction of information technology and computers, squadrons were changed to wings and the former flights became squadrons with the prefix number of their respective wings, the flight numbers remaining unchanged. In 2001, ATC was changed to Australian Air Force Cadets.

To mark 75 years, 1 Wing will host a gathering of current and former staff members in Townsville on 17 May. Any former staff wishing to attend are encouraged to contact 1 Wing. A wing parade for all current cadets and staff is planned for the September school holidays.

SQNLDR (AAFC) Geoff Strange, 1 Wing

SOLO SUCCESS

IN THE SCHOOL HOLIDAYS last year, 12 candidates from No 2 Wing attended a flying training camp final stage conducted by Elementary Flying Training School (EFTS) Amberley Flight, Qld, with a view to flying solo in the DA-40NG Diamond. That followed an earlier week-long course to complete the initial courses required by the training system.

All trainees successfully completed their solo flights and received their First Solo badges from the Commanding Officer of EFTS, Squadron Leader (AAFC) Mark Dorward and their instructors.

Cadet Warrant Officer Caitlin Tiatto (230 Squadron) reflected: "On the day I went solo, everyone was so contagiously supportive, excited and happy. The feeling of taxiing back in with the entire team of cadets and staff waving and waiting for me is something I will never forget."

Cadet Sergeant Austin Mildner (233 Squadron) said: "EFTS will always be my favourite memory of cadets and the friends that I made from the course".

Cadet Under Officer Samantha Grant (230 Squadron) observed: "Flying the Diamond was easier and harder than I thought; there was a lot to focus on, but everything made sense".

EFTS Amberley Flight also offered Cadet Aviation Experience Pilot Experience (PEX) flights to some 60 2 Wing cadets based in Rockhampton and Yeppoon, operating out of Rockhampton Airport. A PEX flight is an instructional flight under the supervision of a qualified flying instructor, at no cost to the Cadet, where Cadets can experience the joy of controlling an aircraft in flight.

Flight Lieutenant (AAFC) Robert Neilson, the Wing Aviation Liaison Officer for 2 Wing, said the weekend was a great success.

"EFTS Amberley are grateful to the staff of those squadrons for their support and hospitality," he said. "The dedicated EFTS-AMB team flew the aircraft up from RAAF Base Amberley, spending the entire weekend giving these aspiring aviators a taste of flight before heading back on Sunday afternoon. What an inspiring weekend for our future pilots."

Aviation Operations Wing provides powered flying training through the three hubs of the EFTS, located at Amberley, Qld, Richmond, NSW and Point Cook, Vic. The school primarily delivers flying pathways to Cadets from No 2, 3 and 4 Wings through the AAFC's Powered Aircraft Capability using leased Diamond DA40-NG Star aircraft.

For Cadets who do not have access to the established EFTS flights, powered flying opportunities are provided by a RAAF-approved service provider. Throughout 2024, Cadets from 6 Wing, SA had the opportunity to undertake PEX flights through this program, offered by Adelaide Biplanes at Aldinga Airfield.

ABOVE CWOFF Caitlin Tiatto with WGCDR(AUX) Mark Broadbridge after her first solo flight.

TOP CUO Samantha Grant receives her First Solo badge from SQNLDR(AAFC) Mark Dorward.

ABOVE CSGT Ro Van Den Berg during his PEX flights with Adelaide Biplanes at Aldinga Airfield.

AVIATION EVENTS 2025

MARCH

25-30

Avalon 2025 Australian International Airshow, Avalon Airport, Vic
A world-class industry exposition and thrilling airshow displays showcase new technologies that help shape the future of Australian aviation.
airshow.com.au

31

Air Force's 104th birthday, national
RAAF birthday will be marked with local base commemorations and official events in Canberra.

APRIL

06

Barossa Air Show, Rowland Flat, SA
Bringing together a unique and eclectic group of aircraft and pilots from around Australia.
barossaairshow.com.au

10-13

Antique Aeroplane Association of Australia National Fly-in, Cowra, NSW
Antique, classic and contemporary aeroplanes, both civil and military from the 1920s to 1960s.
antique-aeroplane.com.au/events

18-20

Omaka Classic Fighters Airshow, Omaka Aerodrome, Blenheim, NZ
Aircraft from the 1920s and 1930s will fill the Marlborough skies, including aerobatics by iconic WWII warbirds. A weekend of fantastic flying, classic cars, fireworks, food and entertainment
classicfighters.co.nz

25

Anzac Day, national
anzacportal.dva.gov.au/commemoration/days

MAY

08

Victory in Europe (VE) Day
anzacportal.dva.gov.au/commemoration/days

20-24

Langkawi International Maritime & Aerospace Exhibition, Malaysia
A biennial exhibition for the defence, commercial and industrial maritime and aerospace sectors of the Asia Pacific region.
lima2025.com

JUNE

01
Bomber Command Commemorative Day
bccdf.org.au

06
Anniversary of D-Day
bccdf.org.au

07
Reserve Forces Day

16-22
Paris Air Show, Le Bourget, France
siae.fr/en

21-22
Dayton Air Show, Ohio, USA
daytonairshow.com

23
International Women in Engineering Day

JULY

14-27
Exercise Talisman Sabre
defence.gov.au/defence-activities

21-27
AirVenture 2025, Oshkosh, Wisconsin, USA
eaa.org/airventure

27
Korean Veterans' Day
anzacportal.dva.gov.au/commemoration/days

AUGUST

15
Victory in the Pacific Day

18
Vietnam Veteran's Day

31
Malaya and Borneo Veteran's Day

SEPTEMBER

03
Battle for Australia Day

15
Battle of Britain Anniversary, Hobart
raafatas.org.au/battle-of-britain

NOVEMBER

04-6
Indo Pacific International Maritime Exposition
indopacificexpo.com.au

11
Remembrance Day

18-20
MilCIS Expo & Conference, Canberra
milcis.com.au

FLIGHT OFFICER MARGARET J SUTHERLAND (NEE CURGENVEN)

1 January 1940 - 20 December 2024

MARGARET JOINED THE RAAF Nursing Service on 17 May 1965 and discharged from the Air Force on 17 May 1968. She was posted to No 4 RAAF Hospital at a time when Australian servicemen, wounded in South Vietnam, were transported to Butterworth before evacuation to Australian hospitals.

She was assigned to the United States Air Force 902nd Aeromedical Evacuation Squadron, Headquarters Clark Air Base, from 18 January to 6 March 1967. During that time, she flew on 40 combat missions in 47 days in South Vietnam, evacuating 2,500 casualties.

Fifty-five years later, on 25 March 2020, Margaret was awarded the US Air Medal for her service in South Vietnam. She was the first Australian woman to be awarded the medal. In part, the citation for her award reads: *During this period, outstanding airmanship and courage were exhibited in the successful accomplishment of important missions under extremely hazardous conditions. The highly professional efforts of Section Officer Curgenven contributed materially to the mission of the United States Air Force and reflect great credit upon herself and the Royal Australian Air Force.*

The Air Medal is awarded for meritorious achievement in aerial flight, and since World War II has been awarded to members of allied foreign forces on limited occasions.

Along with her late husband, Squadron Leader Bob Sutherland, Margaret was instrumental in the establishment of the Albury Wodonga Branch of the RAAF Association in 1989.

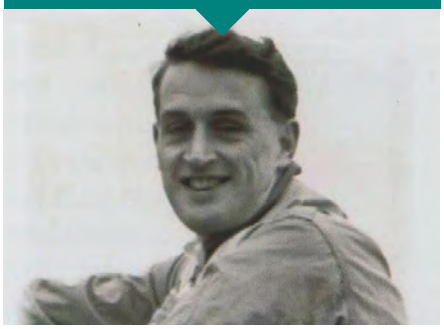
In the same period, they coordinated community support and advocacy for the formation of No 412 Squadron, Australian Air Force Cadets in Albury-Wodonga.

Margaret served, with distinction, on active service in Malaysia and Vietnam, and with commitment in her community, in support of the RAAF and with service to her country.

Bob Treloar

AIR COMMODORE GEOFFREY WILLIAM TALBOT

5 July 1931 - 15 January 2025



GEOFF TALBOT was born and educated in Young, NSW. On 2 February 1948, aged 16, he joined the Air Force as an engineering apprentice, signing on for 15 years.

He completed three years at RAAF Base Wagga, and his final apprenticeship year at RAAF Base Richmond. While at Wagga, Geoff applied for pilot training, but was refused as he was locked in to five years' apprenticeship trade training. Instead, he joined the Wagga Aero Club and attained his civilian pilot's licence.

In 1953, he was accepted for pilot training and was posted to No 1 Elementary Flying Training School at Archerfield and Uranquinty, flying Tiger Moths and Wirraways. He was awarded his pilots wings at Point Cook, graduating as a sergeant, in April 1954.

Geoff was posted successively to four different fighter squadrons flying Mustangs, Meteors, Vampires and Sabres, and then as an instructor at Point Cook and East Sale. While at East Sale, he became an acceptance pilot for Vampire Mk 35s from de Havilland at Bankstown.

In 1958, Geoff was posted to the Empire Test Pilot's School, RAF Farnborough, UK. In 1959, he was tasked to evaluate the European contenders for replacement of the Sabre. While evaluating the Mirage, he became the first Australian to fly at twice the speed of sound.

In 1960, he was posted to the UK Aircraft and Armament Experimental Establishment at Boscombe Down, a military aircraft testing site, and joined the fighter test squadron.

Geoff served at HQSC Melbourne in 1962-63 and was posted to the Aircraft Research and Development Unit (ARDU) at Laverton in 1964 for test pilot duties. He became Chief Test Pilot at Government Aircraft Factory. On leaving in 1968, he had flown all but the last six of the 116 Mirages produced by GAF.

Geoff was awarded the Air Force Cross for his test flight activities and as Officer Commanding Test Flight at ARDU.

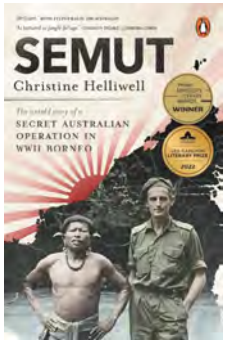
Promoted to Wing Commander and posted as Commanding Officer No 1 Squadron in January 1973, he spent a year in the United States, accepting new aircraft from General Dynamics. He led the second ferry flight to RAAF Amberley. His last flight in an F-111 was at Amberley in 1976.

He served in various executive positions at Defence Headquarters, Canberra; Assistant Commandant at RAAF Staff College Fairbairn; the Joint Intelligence Organisation; and Director of Operational Requirements. He held the position of Australian Aide-de-Camp to Queen Elizabeth for five years.

Promoted to Air Commodore in January 1983, he was Exercise Director for Exercise Kangaroo 83, and then Director of Service Intelligence, and Deputy Director (Military) in Joint Intelligence.

Air Commodore Geoffrey William Talbot AFC retired from the RAAF on 3 July 1986. In 38 years of service, he accumulated more than 6,500 flying hours in 75 different aircraft types.

Bob Treloar



REVIEW BY Bob Treloar

SEMUT

By **CHRISTINE HELLIWELL**
Penguin Books; RRP $24.99

IN 1944, THE WAR in the South West Pacific was nearing its culmination. The invasion of Borneo by Australian forces under Operation Oboe was imminent.

Operation Semut was planned by the Australian Army's Services Reconnaissance Department and conducted by Z Special Unit during World War II to assist the invading forces as part of the Australian Borneo Campaign.

The objective of the operation was to enlist the support of the local inhabitants to wage a guerrilla war against the Japanese forces in their local regions. *Semut* recounts the challenges and hardships endured in the Borneo jungle and of the willingness of the Dayaks and other groups to engage in jungle warfare.

The Australian 9th Division secured north Borneo, but was restricted to coastal areas. When the retreating Japanese forces moved inland, the Semut forces harassed them, calling in airstrikes and attacking isolated groups of enemy soldiers and eventually working to restore civil administration.

Banned from head hunting by the British administration before the war, under Semut the tribes were encouraged to return to the practice, provided only Japanese heads were taken. This served to terrify Japanese soldiers. The loyalty, bushcraft and fighting ability of the Dayaks and others ensured the success of Operation Semut.

Author Professor Christine Helliwell has spent considerable time in Borneo researching the Dayak culture and has successfully highlighted the personalities and the roles these people played in the operation.

Semut is well written and provides a fascinating insight to a little-known operation by a group of people in a generally overlooked part of WWII.

REVIEW BY Bob Treloar

THE KOREAN KID

By **ROCHELLE NICHOLLS**
Big Sky Publishing; RRP $29.99

THE KOREAN KID is the biography of Jim Kichenside, a boy who grew up in Marrickville, New South Wales, in the 1930s and 40s. He joined the RAAF to escape his humble surrounds and went on to fly Meteor fighter aircraft in the Korean War; Dakota and Beaver aircraft with the RAAF Flight in Antarctica; Sabre aircraft in Malaysia and Thailand during Confrontation with Indonesia; and finally, Caribou aircraft at RAAF Base Richmond, preparing young pilots for the Vietnam War.

He was posted to Iwakuni, Japan in 1952 where he was trained on Meteors. Having flown only eight hours on the aircraft he was posted to Korea, and within an hour of reporting to his commanding officer, was airborne flying on operations. At just 21 years of age, he was the youngest pilot flying in No 77 Squadron, and after proving himself on operations, was dubbed the Korean Kid.

Returning from Korea, he continued to serve in the Air Force, briefly commanding a fighter squadron and then the RAAF 1960 Antarctic Flight. Posted to Williamtown, Jim converted to Sabre aircraft and was deployed to Butterworth, Malaysia during Konfrontasi, while there he deployed to Ubon, Thailand twice as Detachment Commander.

Jim returned to Australia and commanded a Caribou transport squadron. He ferried the last Caribou purchased by Australia from Canada to Richmond. He returned to civilian life in 1975.

Jim's story reflects Australian and world events through the 1950s, 60s and 70s and is recorded with attention to detail, warmth, compassion and understanding. The author provides a detailed historical backdrop to ensure Jim's experiences are seen in the context of world events while providing a human, first-hand account.

REVIEW BY Bob Treloar

THE MATILDA MISSION

By **BRIAN EDWARDS**
Rocket Frog Books; RRP $15

MAYDAY, MAYDAY - *Hotel Papa Hotel, I am 2,000 feet over Smarden, tracking 173 degrees – engine failure – will be carrying out a forced landing.* Thus, opens the account of a middle-aged adventurer intent on flying a Tiger Moth from England to Australia.

The drive for Brian Edwards to fly this mission in 1990 was to raise funds for Legacy and honour his father's memory. His father, a pilot in No 460 Squadron RAAF, flying Lancasters, was lost on operations in 1943 and Brian and his mother were subsequently supported by Legacy when he was growing up.

Brian purchased a Tiger Moth, which coincidentally was built in 1943 and which he painted bright yellow and dubbed it *Matilda*. The tensions, doubts and tribulations encountered when preparing for the trip are offset with a group of supporters and family providing encouragement. From Binbrook, England across southern Europe, the Middle East, India and South East Asia, Brian describes encounters with the many people who helped him out. His description of the scenery he witnessed, including the green fields of France, the jewels of the Greek Isles, Pyramids at Luxor, Saudi Deserts, the vast Indian plains, and the jungles of Thailand and Malaysia easily carry the reader along the way.

Fatigue, adverse weather, errors and self-doubt are recounted openly and humbly and reveal a person who was stretched to his limits, but who wouldn't give in.

At 100 pages it is an easy, and delightful, read. It contains a handy map to keep the reader oriented and there are many lovely photographs, which unfortunately, are black and white. It would have been good to see the resplendent yellow Tiger Moth in colour.

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