# WINGS

SPRING 2020
VOLUME 72 NO.3


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ON THE COVER
Boeing E-7A Wedgetail Airborne Early Warning and Control aircraft at RAAF Base Williamtown.


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AIR FORCE ASSOCIATION

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## WINGS SPRING VOLUME 72 / NO.3



## MESSAGE FROM
# COMMANDER SRG

**JOINING A DISTINGUISHED** line of Royal Australian Air Force Groups and Units, elements of Surveillance and Response Group (SRG) capabilities feature as part of a wider surveillance theme in this edition of *Wings* – and as Commander SRG I am delighted to contribute to the introduction.

SRG has a long and proud service history and is one of the largest and most diverse Force Element Groups in the Air Force. I am incredibly proud to be part of that history; to carry on that legacy while forging a new path. It is a path that is both challenging and evolutionary as SRG capitalises on high technology systems in support of achieving air superiority as part of a fifth-generation fighting force.

Under the motto 'Foremost Sentinel', SRG is the organisation that provides the 'Know, Understand and Respond' line of effort, delivering situational awareness to commanders wherever the battle may be. SRG's increasing focus and support to cyber and space capabilities ensures Air Force and the ADF is suitably equipped and mission ready across multiple domains.

I continue to be inspired by the incredible talent and resilience of our people – to see opportunities for continuous improvement and to identify new ways of achieving operational effectiveness in response to the changing environment.

To that end, SRG's success, achievements and attainment of critical milestones in 2020 have been as broad as they are complex.

From coordination of major construction projects for our new systems, providing disaster relief, both from our aircraft and on the ground, playing a role in the COVID response, search and rescue, exercises and operations at home and abroad – as well as support to an international space mission – our activities are certainly diverse. I firmly believe it is the sum of individual efforts that makes SRG so effective and our personnel should take pride in the critical role they play in that success.

I could not be more proud to be Commander SRG during this exciting time of unprecedented change and consider it the greatest privilege of my career to be given the opportunity to lead such a capable and effective team.

Best wishes and please enjoy this edition of *Wings*.

*Air Commodore Barbara Courtney AM*
*Commander Surveillance and Response Group*

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# PRESIDENT'S CORNER

*Carl Schiller OAM, CSM, National President Air Force Association*

**AT THE TIME OF WRITING,** COVID-19 is undergoing a second wave of infections in Victoria with New South Wales coming dangerously close to another significant outbreak. Closure of state borders and police checkpoints to contain people who reside in high-infection areas are creating anxiety in the wider community.

The use of ADF personnel to assist in safeguarding the community is reassuring. I have received numerous comments commending our Service men and women for their efforts. These are unsettling times which is why we need to support our friends and their families, and reassure them Australians are resilient and will get through this epidemic.

Ex-Service Organisations (ESO), like the Air Force Association (AFA), have an important role to play in troubling times. These organisations provide support to the veteran community, including current and former ADF members. Advocacy for those seeking support and services from Defence or DVA, welfare and wellbeing support, and employment and vocational advice are now likely to be in demand. There are many ESOs in the country. Although they differ in the services they provide, support to veterans and their families is a common theme. Go to dva.gov.au/civilian-life/find-ex-service-organisation to view a list of ESOs and their contact details.

Air Force is planning its 100th Anniversary Celebration to be held on 31 March 2021. It has sought the Association's assistance to arrange the attendance of retired Air Force veterans and their partners at the commemoration in Canberra. Air Force, like the general community, is hoping the current COVID-19 crisis will be over by the end of 2020 to enable the inclusion of a veteran attendance component in the celebration. AFA will advertise the event and will be seeking expressions of interest from those wishing to attend. Watch for the flyer.

In the meantime, be mindful of your health and follow government guidelines to avoid contracting COVID-19.

## AIR FORCE ASSOCIATION

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Membership is open to serving and former members of the Australian Defence Force and Allied Armed Forces, their family members, current and former Air Force Cadets, Air League Cadets and members of the public who have an interest in aviation and who support the mission and objectives of the Air Force Association.

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EDITED BY Bob Treloar


# E-7A WEDGETAIL TURNS 10

**IN MAY, RAAF'S** airborne early warning and control capability, the E-7A Wedgetail, celebrated 10 years of service.

Air Force operates six E-7A Wedgetail aircraft from RAAF Base Williamtown, NSW. A Boeing 737-700 variant, the E-7A Wedgetail combines long-range surveillance radar, secondary radar, passive detection and surveillance receivers and tactical/strategic voice and data communications systems.

One of the most advanced airborne battlespace management platforms in the world, Wedgetail provides the Australian Defence Force with the ability to survey, command, control and coordinate joint air, sea and land force operations in real time.

Over the past 10 years, No.2 Squadron's E-7A aircraft have been regularly employed throughout the world supporting concurrent exercises and operations, often with all six aircraft deployed simultaneously. Wedgetails have actively participated in Operations Spate, Atlas and APEC Assist, while providing concurrent support for Operation Okra.

During Operation Okra, the E-7A Wedgetail had responsibility for command and control of all coalition aircraft operating in a designated battle management area. Data provided by the Wedgetail ensured the joint force had high integrity situational awareness across all domains, air, land and sea delivering a force multiplier effect, not only for RAAF but for all participating nations. Crews regularly managed more than 80 combat aircraft during a single mission.

*Source: Defence Connect*

**ABOVE** A30-003 at lift-off from RAAF Base Williamtown.

## First Squadron of F-35S ON TARGET

**LOCKHEED MARTIN HAS** now delivered more than 500 fifth-generation F-35 Lightning II fighter aircraft to US and international customers, and a further 220 aircraft are on the assembly line in Fort Worth, Texas. The manufacturer said as the increase in production continued, the price of new aircraft had fallen to its lowest in the program's history and the operating costs of those already delivered to customers continued to fall.

The purchase cost of the conventional take-off and landing F-35A version in the current production batch is now below the promised $A122 million price tag for the first time, and Australia's next batch of aircraft will be even less. On the sustainment side, the operating cost is slightly under $US35,000 per flight hour with a target of $25,000, which will put the F-35 in the ballpark of today's fourth-generation fighters.

That is good news for the RAAF, which has received 25 F-35As out of a total of 72 aircraft on order. By January next year the first of its three fighter squadrons will be declared operational.

At the end of this year, the second operational fighter Squadron (77 Squadron) will cease flying the F/A-18 "Classic" Hornet and begin the year-long transition to the F-35A. In turn, the last remaining Hornet Squadron (75 Squadron), based at Tindal in the Northern Territory, will begin F-35A conversion in January 2022. Following a year of consolidation, the Joint Strike Fighter capability is set to achieve final operational capability by the end of 2023.

*Source: The Australian*

**ABOVE** F-35 demonstration at the 2018 Avalon air show. Photo: Nigel Pittaway.

# Australia buys more TRITON UAVS

**AUSTRALIA HAS ORDERED** another two Triton unmanned aerial vehicles (UAVs) to add to the one already under contract. The RAAF plans to field a total of six such UAVs. The first MQ-4C is expected to enter service in mid-2023, with all six scheduled to be fully operational by late 2025. They will be based at RAAF Base Edinburgh, South Australia. The total value of the program is expected to be about $5 billion.

The Triton builds on elements of the Global Hawk unmanned aerial system, with structural reinforcements to the airframe and wing. De-icing and lightning protection systems have been incorporated and enable the Triton to penetrate cloud in the icing layers and gain a closer view of surface targets.

Supporting missions for up to 24 hours, the Triton is equipped with a sensor suite that provides a 360-degree view of its surroundings for over 2,000 nautical miles. The MQ-4C's primary long-range maritime search sensor is a belly-mounted X-band AN/ZPY-3 Multi-Function Active Sensor electronically scanned array radar, which enables the UAV to cover more than 2.7 million square miles in a single sortie. Other equipment includes an electro-optical and infrared sensor turret and an electronics support measures suite.

The Triton will be flown by qualified Air Force pilots from a ground station, supported by a co-pilot and will supplement the Boeing P-8A Poseidon multi-mission maritime patrol aircraft. Information gathered by the Triton will be analysed and communicated to Command and Control centres by crews drawn from all functional elements of the ADF.

*Source: NavyRecognition.com*

**ABOVE** RAAF Northrop Grumman MQ-4C Triton HALE UAV. Photo: RAAF.

# Air-to-air refuelling FOR NEXT-GEN FIGHTER

**THE RAAF HAS** demonstrated the capability of its KC-30 tanker to successfully support the F-35 Joint Strike Fighter.

The KC-30A MRTT is fitted with two forms of air-to-air refuelling capabilities: an advanced refuelling boom system mounted on the tail of the aircraft and a pair of all-electric refuelling pods on outboard stations under each wing. System operation is controlled by an air refuelling operator in the cockpit able to monitor refuelling progress on 2D and 3D screens.

The KC-30A MRTT can remain 1,800km from its home base for up to four hours with 50 tonnes of offload fuel available. In its transport role, the KC-30A can carry 270 passengers and it has under-floor cargo compartments that can accommodate 34,000kg of military and civilian cargo pallets and containers.

While the KC-30A's interior is almost exactly like a normal airliner, the rest of the aircraft has been modified to perform the air-to-air refuelling function. The KC-30A's boom can offload fuel at a rate of 4,500 litres a minute and its hose-and-drogues systems can each deliver fuel at 1,600 litres a minute.

*Source: Defence Connect*

**BELOW** A US F-35 Lightning II in formation with a RAAF KC-30 MRTT.

# RAAF Air traffic support during BUSHFIRE CRISIS


Transportable air operations tower.

**WITH THE CONTINUING** threat of Covid-19 and the pandemic consuming the world, it is easy to forget that only nine months ago Australia was battling out of control fires along the length of the east coast.

A glimpse back into that fiery battle highlights the support and commitment provided by the often overlooked and often taken for granted RAAF air traffic controllers.

No.44 Wing deployed a transportable air-operations tower to Bairnsdale Airport in early January at short notice after the Australian Defence Force was called to support Victorian State Emergency Services to fight bushfires and provide community aid.

Significant fluctuations in weather had an adverse effect on flying conditions and the volume of fire-fighting air traffic made the Transportable Air Operations Tower a critical component for the continued emergency efforts in Gippsland.

The service that Flight Lieutenant Young and his colleagues provided at Bairnsdale Airport delivered a much safer and efficient flying environment for pilots operating in the area and allowed for sustained flying operations during challenging traffic and visibility conditions.

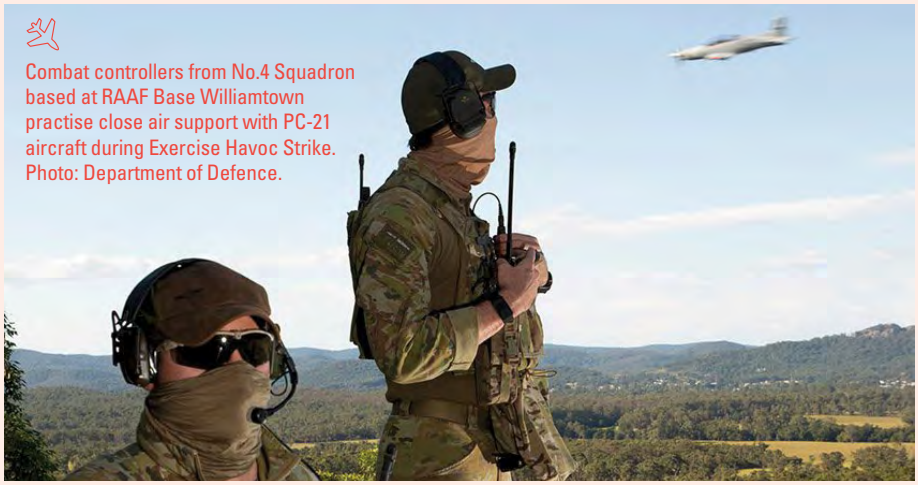
FLTLT Young acknowledged the effort of his crew and said: "It's a great feeling to come and actually do what we train for. The day-to-day air traffic services is our job but the reason why we wear the uniform is to get out here and help when Defence is called upon."

# COMBAT CONTROLLERS PUT THROUGH THEIR PACES

**COMBAT CONTROLLERS FROM** the RAAF's No.4 Squadron completed a successful four weeks of Close Air Support exercises around RAAF Base Williamtown, NSW, during Exercise Havoc Strike.

No.4 Squadron Combat Control Team is tasked to be the first on the ground to assess viability for the safe arrival of aircraft and personnel. It comprises combat controllers who have specialist skills in reconnaissance, assault zone control and clearance of an airfield. They provide a range of capabilities including declaration that a landing zone is safe for aircraft movements, meteorology observation and air strike direction.

Exercise Havoc Strike allowed No.4 Squadron to simulate scenarios and problem sets that required the combat controllers to integrate, synchronise and control multi-domain assets and effects to concurrently manage and safely de-conflict airspace for multiple fixed and rotary wing assets, generate an effect on the signals spectrum to disrupt a target and coordinate intelligence promulgation. They were also required to conduct surveillance and reconnaissance of the forward operating zone and direct precision strike of hostile forces in close proximity to friendly forces.


Combat controllers from No.4 Squadron based at RAAF Base Williamtown practise close air support with PC-21 aircraft during Exercise Havoc Strike. Photo: Department of Defence.

The exercise provided the first opportunity to work with the 4SQN PC-21 aircraft which were introduced to the Squadron in late January 2020.

*Source: Defence Connect*

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# Exmouth space facility TAKES FIRST PICTURES

**THE FIRST PICTURES** from the joint Australia-United States space facility at Exmouth on WA's Coral Coast follows its reassembly in a purpose-built facility, complete with a 270-tonne rotating dome.

Through a partnership between the RAAF and the US Space Force, the telescope developed in the US for scientific research has been relocated to Exmouth. The world-leading, 360-degree telescope will enable Defence to better track and identify objects and threats in space including space debris, as well as predict and avoid potential collisions.

Alliance with the US is at the core of Australia's security and defence planning, and provides Australia access to advanced technology and information. In an increasingly complex security environment, closer Australian-US defence cooperation will strengthen our respective capability advantages. The Exmouth facility is an important part of the global Space Surveillance Network, which provides space domain awareness to both Australia and the US.

The Space Surveillance Telescope will now undergo a period of extensive qualification tests and is expected to be operational in 2022.

*Source: Australian Defence Magazine*

**BELOW** RAAF Base Tindal.

# US weapons store FOR RAAF BASE TINDAL

**THE UNITED STATES** is paying to store its military weapons on Australian soil at RAAF Base Tindal in the Northern Territory. Weapons storage areas and a new jet "fuel farm" have been planned for more than a decade as part of joint training programs between the US and Australia.

The US Naval Facilities Command Pacific announced a $15.01 million contract to construct two earth-covered magazines and a production area that will include a munitions assembly conveyor shelter to support US and Australian military joint training activities. It is expected to be completed by 2022.

Tindal's runway is being extended to support KC-30A Multi Role Tanker Transport and larger US B-52 Stratofortress bombers.

The project supports plans outlined by the bilateral United States/Australia Force Posture Agreement and enables Bilateral Enhanced Air Cooperation missions. The Force Posture is a post ANZUS military treaty signed between the US and Australia in 2014. It will mean Australia is better able to respond, with other partners in the Asia Pacific, to any regional contingency, including humanitarian assistance and dealing with natural disasters.

*Source: Katherine Times*

# Second CubeSat LAUNCHED

Rocket Lab's electron rocket on the launch pad at Māhia Peninsula, New Zealand.

**THE RAAF,** in collaboration with University of New South Wales (UNSW) Canberra, has successfully launched the second of four CubeSats to be flown in a program designed to test radio communications technologies to help shape future space capabilities in Australia. It follows the launch of the M1 Pathfinder in late 2018.

The launch took place on Rocket Lab's 12th mission from New Zealand's Māhia Peninsula, on 13 June 2020. Successful communication with the satellite was established via UNSW Canberra Space's satellite ground station hosted by Cingulan Space, near Yass in NSW.

The M2 Pathfinder, developed by UNSW Canberra, in partnership with the RAAF, is a significant step in developing Australia's defence space systems. Small satellites such as M2 Pathfinder, also known as CubeSats, are about the size of a loaf of bread and allow high-tech capabilities to be tested at a lower cost than larger satellites.

The program allows small satellites to be used to evaluate technologies to be deployed on more complex space systems, such as communication or Earth observation satellites. They have enabled UNSW Canberra to develop several space courses and programs to benefit Defence capabilities in space.

*Source: Defence Connect*

WORDS Flight Lieutenant Bel Scott

# Bomber Command COMMEMORATION


Kevin Dennis CMG.

**IN A SMALL CEREMONY** held at the Air Force Memorial in Adelaide on 30 May, RAAF Edinburgh and the RAAF Association (South Australia) partnered to honour those who served in Bomber Command during World War II.

At the Torrens Parade Ground, Senior Air Force Representative – South Australia and Air Warfare Centre Commander AIRCDRE Brendan Rogers and RAAFA (South Australia) President Robert Black AM joined Commanding Officer 462SQN WGCDR David Clyde, other ADF representatives, SA Governor Hieu Van Le, SA Premier Steven Marshall and a representative of the Opposition to lay wreaths in commemoration of those who served.

GPCAPT (Retd) Robert Black noted how wonderful it was to have RAAF Edinburgh and RAAF Association come together for such important ceremonies, stressing how it served as a means of passing on the legacy to today's serving veterans.

GPCAPT Greg Weller, Director Community Engagement, said the commemoration has become one of the key ceremonies for which RAAF Edinburgh partners with the RAAF Association every year.

WGCDR Clyde said the ceremony is even more important for RAAF Edinburgh, recognising that No.462 Squadron, a distinguished RAAF Bomber Command Unit, was now a reformed RAAF Squadron.

"462SQN was part of the No.100 Group of Bomber Command that was responsible for countermeasures and jamming enemy radars," WGCDR Clyde said.

The Squadron's Halifax aircraft were modified with electronic jamming equipment to interfere with German night-fighter and ground-based radars and communications.

"Today the 462SQN patch with the three vertical yellow stripes that were emblazoned on the Halifax tail and Z5 on its body to make it easily identifiable within the RAF that the aircraft was utilised by 462SQN is a continual reminder of the Squadron's historical links and significant operational achievements," Squadron Warrant Officer 462SQN Darren Rhodes said.

Eight RAAF squadrons and about 10,000 Australian airmen served with Bomber Command in Australian and composite squadrons in RAAF or RAF uniforms. Of those 10,000, just over one-third paid the ultimate sacrifice. Today, the RAAF, once again, operates 460 and 462 Squadrons within the Air Warfare Centre — both originally distinguished Australian units within Bomber Command.

Bomber Command Halifax.

## HONOURING OUR FALLEN

The annual Bomber Command Commemorative Ceremony unites current and ex-serving Air Force members, the wider veterans community and key representatives from across the Adelaide community to honour those who served in the largest and longest bombing campaign of World War II.

The annual service not only commemorates the South Australians who served in Bomber Command, but also honours the small number of Bomber Command veterans, such as Kevin Dennis CGM, who are part of the veteran's community today.

Warrant Officer Dennis was a bank clerk in Adelaide when he enlisted in the RAAF and trained as a wireless operator, serving in 462 Squadron.

During a raid to Frankfurt on 13 March 1945, his aircraft was hit by heavy flak while leaving the target. The flight engineer was killed and the plane sustained heavy damage. WO Dennis was seriously wounded – one foot was almost completely severed and his other leg shattered. Although bleeding profusely, he refused to leave his post and continued to send and receive messages until the aircraft's forced landing in France.

During his long hospital convalescence in England, a Conspicuous Gallantry Medal (CMG) arrived in the mail from the King.

The citation read in part, 'for courage of the highest order when he must have been experiencing extreme agony'.

WOFF Dennis is one of only 10 Australians awarded the CMG for actions during WWII, of which six were awarded to members of Bomber Command.

SQNLDR David Leicester DFC and Bar, OAM, also a member of RAAFA (SA), served with distinction in Bomber Command, completing two operational tours while serving with the RAF's No.640 Squadron, No.158 Squadron and No.35 Squadron. He survived 68 missions on Halifax and Lancaster aircraft including 37 with Pathfinder Squadrons. Through the period, he rose from Sergeant to Squadron Leader and is believed to have been the youngest Squadron Leader and Flight Commander in Bomber Command at one stage.

Unfortunately, due to COVID-19 restrictions, the Bomber Command veterans could not be part of this year's service.

SQNLDR David Leicester.

# LIFE MEMBERSHIP

**AT NSW DIVISION ANNUAL GENERAL MEETING,** conducted by video link on 4 May, State President Ron Glew announced the award of Air Force Association Life Membership to Geoff Peterkin OAM. The certificate and life-member badge had been presented to Geoff by Fighter Squadrons Branch president Mike Lavercombe at an informal afternoon tea the day before.

Geoff, who has been a member of the Fighter Squadrons Branch since 2004 and Honorary Secretary for most of that period, received the award for his diligent and enthusiastic contribution in the development of IT systems to enable information dissemination and membership management within NSW Division and particularly the Fighter Squadrons Branch. Additionally, as honorary secretary, Geoff has played a key role in bringing members of several disparate fighter squadron associations into the Fighter Squadrons Branch.

The award took Geoff by complete surprise and he was humbled to think that such an honour should be given to him for doing something he finds so enjoyable.

Congratulations Geoff on the well-deserved award.

**ABOVE** New life member Geoff 'Terkin' Peterkin with FSB President Mike Lavercombe (right) and VP Dave Leach.

# Supporting firefighters

**THE AIR FORCE ASSOCIATION** continues to support the former ADF Firefighters who have fought for a decade for recognition of their exposure to poisonous waste materials used in Air Force fire training up until 2001 when safe practices were introduced. Presumptive legislation to help firefighters claim for health support and compensation exists in most states, the ACT and NT. There is also a presumptive clause within the *Safety, Rehabilitation and Compensation (Defence-related Claims) Act 1988* for Defence firefighters. However, former firefighters from an earlier era have been prevented from accessing the 'beneficial' provisions of that Act due to a unique set of transitional arrangements. Moreover, they cannot claim under the *Military Rehabilitation and Compensation Act 2004* or the *Veterans' Entitlements Act 1986*. Effectively, they have little cover for their Service-related injuries.

The Association has had several meetings with senior DVA staff on the matter and has recently brought the matter to the attention of the Minister of Veterans' Affairs. The Association argues there is national and international recognition of the hazardous nature of firefighting. Civilian firefighters' work-related cancerous conditions are covered under the various state/territory legislations, so it seems reasonable Defence firefighters, from any era, should also be covered by legislation. There is irrefutable evidence of the contaminated waste materials used in earlier Air Force fire training. These former serving members are proud of their service and appreciate there was no intention or negligence in what has occurred. They are simply seeking adequate health support and, if applicable, compensation. The Association has presented to DVA several suggested options for a resolution and has strongly indicated it will remain resolute in its assistance to these former servicemen. The Association remains optimistic for an acceptable outcome.

EDITED BY John Kindler


# GAINING A REAL-TIME VIEW

## of airspace over future battlefields

**AIRSPACE ABOVE** future battlefields is expected to be increasingly congested with large numbers of unmanned aerial systems, manned aircraft, munitions and missiles filling the sky. New technologies are required to effectively integrate effects from all domains to de-conflict friendly forces and rapidly counter an enemy's actions on the battlefield.

The US Defence Advanced Research Projects Agency (DARPA) announced it is conducting an Air Space Total Awareness for Rapid Tactical Execution (ASTARTE) program in partnership with the US Army and US Air Force.

ASTARTE aims to provide a real-time, common operational picture of the dynamic airspace in the most complex and challenging adversary anti-access/ area denial, or A2/AD, environments.

**LEFT** Advanced low-cost sensors, AI algorithms. and virtual technology to enable common operational picture as part of ASTARTE. Photo: DARPA.

It is designed to provide a precise picture of the airspace to allow for long-range fire missions as well as manned and unmanned aircraft operations simultaneously and more safely in the same airspace. ASTARTE is focused on three technical areas:

- Development of algorithms to predict airspace conflicts, propose de-confliction solutions with associated risk analysis, and direct sensors in the ASTARTE network to maintain the necessary airspace picture at a given moment in time
- Develop or leverage existing low-cost sensors to detect and track, in real-time, manned and unmanned aircraft, airborne weapons, and other potential flight safety hazards, such as unmanned balloons, in an A2/AD setting
- Development of a virtual laboratory to model, simulate and virtually experiment using a combination of current C2 systems and ASTARTE technology.

# RAF swarming drones exceed expectations

**ROYAL AIR FORCE** projects to develop swarming drones are "exceeding expectations", according to correspondence from the UK's Minister of State for Defence, Baroness Goldie. The minister said Project Mosquito had entered Phase 2 and Many Drones Make Light Work had undertaken successful trials in March.

"Following the successful first trials, 216 Squadron was reformed at RAF Waddington on 1 April 2020. They will take on the operating role for the RAF's fleet of network-enabled drones."

Swarming drones are designed to support manned fighters such as the Eurofighter Typhoon or F-35, confusing air defences and allowing fighters to penetrate adversaries' air space.

# USAF next-generation FIGHTER PROGRAM

**WITH THE GROWING** success of Russian and Chinese fifth-generation fighter aircraft like the Su-57, J-20 and JF-31, the United States has kicked off a suite of development programs to replace the ageing F-15 Eagle and fifth-generation F-22 Raptor air frames beginning in the 2030s.

While the US has plans to maintain fifth-generation combat aircraft like the F-22 and the F-35 and recently announced the acquisition of an advanced F-15X variant, the rapid evolution of potential adversaries' fifth-generation air combat capabilities has forced a major step-change in the way the US responds.

The US Air Force (USAF) has identified that the future system will have to counter adversaries equipped with next-generation advanced electronic attack, sophisticated integrated air defence systems, passive detection, integrated self-protection, directed energy weapons and cyber-attack capabilities.

Shifting from the concepts established in the USAF's Air Superiority 2030 plan, it is proposed that a future fighter program would rapidly prototype technologies with a focus on maturing them for inclusion in an advanced aircraft to be fielded in the early 2030s.

Achieving that would require a focus on three key areas: agile software development – a process by which programmers quickly develop, test and implement code, soliciting feedback from users throughout the process; open systems architecture – enabling a great degree of plug-and-play functionality; and finally, digital engineering – including 3D modelling across the entire program to support lower costs, manufacturing and sustainment programs.

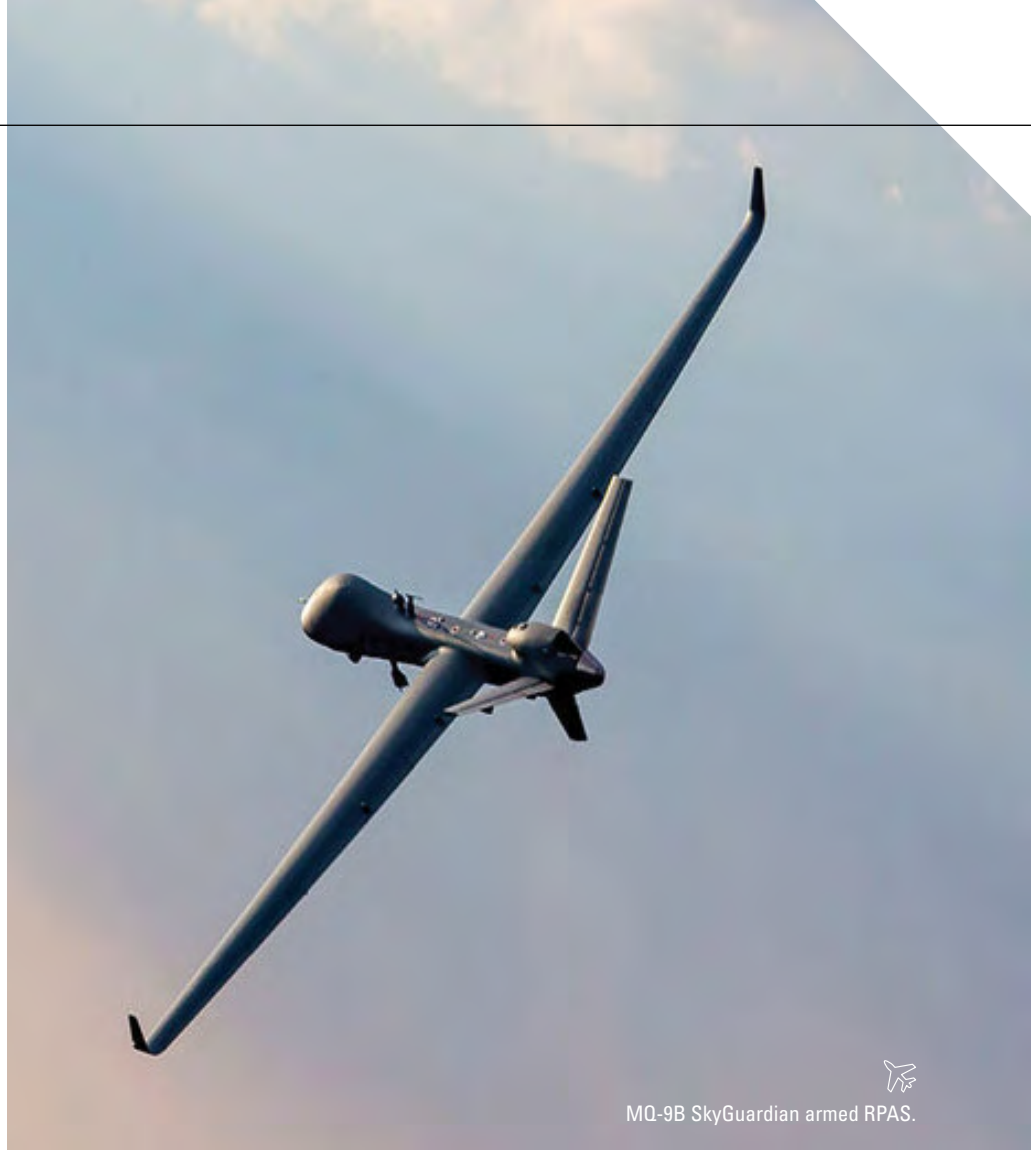
Artist concept of a next-generation fighter.

# DEVELOPING THERMAL SOLUTIONS

**GA-ASI HAS PARTNERED** with Australia-based Conflux Technology for the development of a heat exchanger for the GA-ASI's line of remotely piloted aircraft systems (RPAS).

Conflux Technology, which specialises in thermal and fluid engineering, is providing design expertise in the optimisation of additive manufacturing heat exchangers. GA-ASI CEO Linden Blue said: "GA-ASI and Conflux are developing novel and state-of-the-art thermal solutions for application to our existing and next-generation RPAS. This will allow enhanced endurance and lower manufacturing cost, as well as more flexibility in our product design and integration."

Under Project Air 7003, GA-ASI's MQ-9B SkyGuardian variant was selected by the Australian Government to provide the Armed RPAS for the Australian Defence Force.



MQ-9B SkyGuardian armed RPAS.

# AUSSIE SME WINS GLOBAL F-35 SUPPLY CONTRACT

**CHEMRING AUSTRALIA,** based at Lara near Geelong, Victoria secured a $US107.5 million ($AU150.9 million) contract for the production and delivery of countermeasure flares for Australian, United States and international F-35 operators.

Chemring Australia is a leading manufacturer and supplier of air-launched countermeasures against sophisticated electronic systems.

Defence Minister Linda Reynolds welcomed the contract announcement, saying: "This is a strong endorsement of our domestic manufacturing capability, and the policies we've put in place to bolster our sovereign defence capability."

Since 2011, Chemring Group and Defence have worked closely with the US Navy's Naval Air System team to qualify Chemring Australia as the second source supplier of the MJU-68 countermeasure, and MJU-61 training flares.

To date, more than 50 Australian companies have shared in almost $1.7 billion in production contracts as part of the global F-35 Program, employing more than 2,400 Australians.

**ABOVE** Defence Minister Linda Reynolds with WGCDR Jason Clare CO No.3 Squadron.

# BOEING DELIVERS

## first unmanned Loyal Wingman aircraft


**BOEING DEFENCE AUSTRALIA** partnering with the RAAF and Australian defence industry celebrated the roll-out of the first Boeing Airpower Teaming System unmanned aircraft in May, the first military aircraft to be fully designed and built in Australia in 50 years. The aircraft is Boeing's largest investment in an unmanned aircraft outside the US.

The Loyal Wingman, at 11.5m and with a range of 3,200km, applies artificial intelligence to fly independently, or in support of manned aircraft, while maintaining safe separation. The drones will be able to engage in electronic warfare as well as intelligence, reconnaissance and surveillance missions and swap quickly between those roles, according to Boeing.

Head of Air Force Capability Air Vice-Marshal Catherine Roberts said: "I applaud the efforts of Boeing working collaboratively with a breadth of Australian defence industry from prime partners like BAE Systems Australia, through to SMEs like RUAG Australia and Ferra Manufacturing, to deliver the concept demonstrator illustrating the capability of Australian industry."

The aircraft was engineered using a digital twin to model its structures, systems, capabilities and full life cycle requirements; manufactured with Boeing's largest-ever resin-infused single composite piece; and assembled using proven advanced manufacturing processes.

The Loyal Wingman prototype now moves into a ground test phase, followed by taxi and first flight in late 2020.

**ABOVE** The first unmanned Loyal Wingman aircraft was presented to the RAAF by Boeing Australia in May. Photo: Boeing.

# DSTG partners with GILMOUR SPACE TECHNOLOGIES


Gilmore Space Technologies One Vision Rocket

**DEFENCE SCIENCE AND** Technology Group has signed a strategic agreement with Gold Coast company Gilmour Space Technologies to research propulsion, materials and avionics and other defence-related technologies to develop a three-stage hybrid rocket to launch small payloads and satellites.

Minister for Defence, Linda Reynolds said the collaboration demonstrates the government's commitment to supporting the Australian defence industry. "Technology advances have allowed rocket systems and launch service providers to offer access to space at a greatly reduced cost and infrastructure footprint," she said.

Minister for Defence Industry Melissa Price added that it will open opportunities for Australian companies to offer space capabilities to the ADF and commercial customers. "Recent advancements in the capabilities of micro and nano-satellites, small satellite constellations and additive manufacturing present a unique opportunity for Defence and Australian industry," she said.

# RUAG's next-gen technology

**RUAG AUSTRALIA HAS** announced the acquisition of next-generation technology to convert its machine shop into a state-of-the-art, interconnected, data-driven environment to support the development of customer supply chain processes, including those for Joint Strike Fighter F-35 hydraulic components.

Industry 4.0 brings with it the next-level advancement of interconnectivity between devices, equipment, tools, visualisation systems, and their human users within the manufacturing system. The move to full interconnectivity at RUAG's Hydraulic Centre of Excellence, housed at its Bayswater facility, generates significantly improved efficiencies as it creates a new human-to-machine interface.

The company combines engineering expertise with landing gear hydraulic actuator manufacture, maintenance, repair and overhaul, and metal treatment and finishing in its role as a DASR Part 145, DASR Part 21J, EASA Part 145, CASA Part 145, NADCAP, and AS9100D approved organisation.

# Key munitions MANUFACTURING

**THE GOVERNMENT HAS** announced a $1.1 billion agreement with Thales Australia for the continued management and operation of Australia's munition factories in Benalla (Victoria) and Mulwala (NSW).

The agreement provides surety of supply of key munitions and components for the ADF. The new contract will also support key federal government initiatives including export opportunities as part of the Defence Sovereign Industry Capability Priorities.

**ABOVE** Georgie Uebergang and Shae Skelton conducting a final inspection of 50cal Ball linked ammunition.

# Icon SI wins $10m contract

**AUSTRALIAN COMPANY ICON SI** has been awarded a $US10.07 million ($AU13.8m) construction contract as part of the US Force Posture Initiatives (USFPI). The US Naval Facilities Command Pacific contract will see Icon SI construct an earth-covered magazine facility at RAAF Base Tindal.

USFPIs are an extension of Australia's existing Defence alliance with the US. The objectives of the initiatives are to improve interoperability between Australian and US armed forces, provide opportunities to engage with partners in the Indo-Pacific, promote regional stability and better posture both nations to respond to contingencies such as humanitarian assistance and disaster relief operations. Infrastructure and facilities development under the USFPI will be concentrated between Robertson Barracks, RAAF Base Darwin and RAAF Base Tindal as well as training areas and ranges in the Northern Territory.

# Veteran employment award for AeroPM

**IN AN ONLINE** ceremony in May, AeroPM was named Outstanding Veterans' Employer of the Year and the Veteran's Employer of the Year, Medium-Sized business by Prime Minister Scott Morrison.

AeroPM was founded in 2014 by CEO Emily Frizell, who had served 16 years in the RAAF. In 2018, when AeroPM gained acceptance on the Defence Support Services Panel, she was joined by husband and general manager Adam Frizell, who had served 22 years in the RAAF. This year, AeroPM engaged its 50th employee and currently maintains a veteran employment rate of over 90%.

"We are proud that our people display the highest re-engagement rates within Defence Industry and that we are well known for our transparency and accountability. The award really did recognise that our point of difference is our people," Ms Frizell said.

# HIGH-ALTITUDE BALLOON TRIALS

**THE FIRST OF** a series of high-altitude balloon trials was successfully launched at West Wyalong, NSW, in early June.

The trials aim to demonstrate Australian designed and developed launch capabilities that can deliver and maintain sensor payloads to an altitude that significantly improves situational awareness over a wide area.

Possessing high altitude balloons as part of Australia's sovereign capability means advanced sensors can be deployed into the atmosphere quickly and cost-effectively, providing comprehensive battlespace awareness to our forces.

A 3D printed version of Jasper, an award-winning animated character developed by Air Force to encourage more children to pursue STEM careers, was filmed as she soared into the stratosphere on one of the balloons.

**ABOVE** Jasper enjoying the ride.

# LOFTY AMBITIONS

## NEWCASTLE AIRPORT AIMS TO NOT ONLY BECOME A GLOBAL GATEWAY INTO NORTHERN NSW, BUT TO DEVELOP A WORLD-LEADING DEFENCE AND AEROSPACE PRECINCT ON ITS DOORSTEP.


**APART FROM ITS TRADITIONAL** and long-standing role, Newcastle airport has more recently expanded its influence through the development of a world-class aerospace and defence technical park adjacent to both itself and RAAF Base Williamtown. The centrepiece of the airport's 76 hectares of expansion land is Astra Aerolab, which will see the creation of a working environment that will attract a globally significant workforce to the region. That ambition has been bolstered through NSW Government support and the announcement in May of a Special Activation Precinct at Williamtown.

CEO Dr Peter Cock is unapologetic about his organisation's grand plans.

"Some may see our aspirations for the airport and the region as lofty," he says. "On the contrary, we feel a truly international airport and world-class innovation is the very least our region deserves."

Established in 1947, Newcastle Airport started life as Williamtown Civilian Airport next door to RAAF Base Williamtown on land leased from the Department of Defence. Little more than a tin shed, the tiny airport was destined for great things. With the city of Newcastle just 30 minutes down the road and working in partnership with the RAAF, it has seen continued expansion.

RAAF Base Williamtown has become Australia's premier air combat base and the operational and sustainment hub for the tactical fighter and support fleets. In parallel, Newcastle airport has grown into an international airport and key regional asset.

In 2006, Jetstar chose Newcastle Airport as its base for A320 heavy maintenance, driving ongoing economic and employment outcomes for the region. In 2007, the airport welcomed

a milestone one million passengers through the terminal for the first time. The airport has continued to develop and in 2016, it extended its head lease for 60 years. In 2019, Newcastle Airport welcomed a record 1.284 million people through the terminal.

Newcastle, serviced by Jetstar, Virgin Australia, QantasLink, Regional Express and FlyPelican, offers daily direct flights to Brisbane, Melbourne, Gold Coast, Sydney, Canberra, Ballina and Dubbo

**ABOVE** Today's Newcastle Airport terminal.

**LEFT** The original terminal, the Tin Shed.

and onward to more than 57 direct worldwide destinations. The airport launched direct flights to Auckland, New Zealand in November 2018.

## CODE E RUNWAY

One of the key projects to increase the connectivity of the Hunter Region and Northern NSW to the rest of the world is to upgrade the runway shared with RAAF Williamtown to Code E status – widening from 45m to 60m.

The upgrade and terminal expansion will enable wide-bodied, long-haul aircraft to use the airfield. That will not only take locals to where they need to go, but also bring the rest of the world to the region.

Additionally, direct connection by air opens freight routes, allowing existing industries access to new markets and providing a catalyst for new industrial development in the region.

"This current constraint limits the potential of our region, reducing our connections to the world's fastest growing economies," says Dr Cock.

"Upgrading the airport to Code E status will connect the Hunter Region and Northern NSW to the rest of the world, reinvigorating the visitor economy and delivering jobs and growth. It will also ensure NSW has three international airports by the end of the decade, allowing us to take full advantage of the globalised economy when borders reopen."

Not surprisingly, there is enormous and enthusiastic local community demand from both leisure and business travellers for Newcastle Airport to expand passenger services to include direct international flights to a wide range of destinations.

The upgrade will build on budgeted defence maintenance work planned to start in mid-2021.

## ASTRA AEROLAB

As well as the critical runway upgrade, Newcastle Airport's other key focus is developing and expanding its Defence and Aerospace Precinct – Astra Aerolab. Co-located with RAAF Base Williamtown and the airport, Astra Aerolab is designed to enhance Australia's ability to deliver world-class sustainment and manufacturing capability to the Defence sector. The location offers unprecedented airside access to the growing RAAF combat fleet, including the F-35A Lightning Strike fighter, F/A-18 Hornets and the Boeing E-7A Wedgetail.

Astra Aerolab sits adjacent to key defence industry participants, including core defence contractors such as Boeing, BAE Systems and Lockheed Martin.

"Astra presents a revolutionary approach to workspaces in our own backyard. It heralds a new era for our region, as we grow our capability to welcome some of the world's most elite aerospace and defence industry organisations to be part of this globally significant development. We are seeing history in the making as Astra comes to life," says Dr Cock.

Astra has begun to take shape. The NSW Government contributed $11.8 million to the development under the Growing Local Economies program, established under the Restart NSW Fund. Construction of a new access road, clearing and site preparation began in May. By year's end, new roads, roundabouts and infrastructure will be in place, ready to welcome tenants to the world-class facility.

With continued support from government and the region, the airport team is determined to ensure that as Australia moves into recovery, Newcastle Airport continues to build on its two keystone projects to unlock economic potential, connect the region to the rest of the world and drive real change.

Newcastle Airport chair Kirby Clark sums up the team's ambitions: "In the past, Newcastle could be accused of being too meek in stating its case for public and private investment. For too long we have held our ambitions in check, satisfied with being a regional town with regional ambitions. Perhaps because we were used to being told that, as a second city, we had to wait our turn. Newcastle Airport is determined to work with regional leaders at all levels to change that thinking and drive the intergenerational change we need."


# MARITIME SURVEILLANCE

## BASED ON THE BOEING B737-800, THE P-8A POSEIDON IS A CRITICAL ELEMENT OF AUSTRALIA'S FUTURE MARITIME PATROL AND RESPONSE STRATEGY.

**PROJECT AIR 7000** was established to deliver a mixed fleet of piloted and remotely piloted aircraft to replace Australia's AP-3C Orion aircraft.

On 21 February 2014, the Australian Government approved the purchase of eight P-8A Poseidon aircraft. The acquisition of an additional four was approved in March 2016.

Operated by No.11 and No.292 Squadrons based at RAAF Base Edinburgh, the P-8A is a modern, highly reliable aircraft derived from the Boeing B737-800 airliner, modified to incorporate maritime surveillance and attack capabilities.

The P-8A together with the MQ-4C Triton Unmanned Aerial System are critical elements of Australia's future maritime patrol and response strategy.

Australia now has the full fleet of 12 Poseidon aircraft under the command of No.92 Wing and expects to declare Full Operational Capability by mid-2022.

The P-8A is a potent, highly versatile and reliable aircraft designed to conduct maritime surveillance and protection throughout Australia's maritime approaches and areas of interest. The aircraft is equipped with impressive technical attributes integrated to deliver flexibility, responsiveness and an attack capability in the prosecution of anti-submarine and anti-surface warfare, maritime surveillance and search-and-rescue primary roles.

Based on the proven commercial design of Boeing's 737-800 fuselage, the P-8A is built from the ground up as a military aircraft. It was substantially modified to include a weapons bay, under-wing and under-fuselage weapon hard points, as well as strengthening to enable sustained low-level operations and turn manoeuvres beyond the normal certified limit of commercial transports. The aircraft is also fitted with an air-to-air refuelling capability.

A crew of up to 10 operates the P-8A Poseidon, roles include:

- Pilot and Co-pilot – responsible for safe and effective operation of the aircraft in all phases of flight
- Tactical and Co-tactical Coordinator – responsible for effective employment of the aircraft sensors and weapons to complete the tactical mission
- Electronic Warfare Operator – responsible for operation of the aircraft's electronic sensors and analysis of electronic data derived from onboard and external sensors
- Acoustic Warfare Operator – responsible for the operation of acoustic sensors and analysis of target acoustic data to support the tactical mission.

The P-8A's advanced sensor fit includes maritime radar, electro-optics and an acoustic system that has the ability to effectively search large expanses of ocean. The potent combination of sensors and both sub-surface and surface weapons provides a joint maritime commander with a variety of response options. The range and flexibility of the weapon system was exemplified by a short-notice search-and-rescue mission conducted in the Southern Indian Ocean, close to the coast of Reunion Island, that successfully aided recovery of two stricken sailing vessels and their crews.

## OPERATIONAL HIGH POINTS

During Exercise RIMPAC, Hawaii in 2018, Poseidon effectively integrated with the joint force and demonstrated its preparedness by prosecuting anti-submarine warfare tactics against

regional country and allied assets. Of note, the Poseidon participated in live-fire exercises and successfully employed Mk-54 Torpedoes against a submerged target and an AGM-84 Harpoon against a retired United States Navy frigate.

The P-8A Poseidon conducts routine deployments in support of Operation ARGOS, the ADF contribution to enforce sanctions against North Korea in support of United Nations Security Resolution 2397. The mission involves surveillance patrols of regional waters to monitor and deter illegal ship-to-ship transfers.

In October 2019, 92 Wing deployed a Poseidon to the Middle East for the first time for Operation MANITOU. The capability played a key role in supporting freedom of navigation and the free flow of shipping in the region as an element of Australia's contribution to the International Maritime Security Construct.

In 2018, the P-8A Poseidon deployed to RMAF Butterworth in Malaysia in support of Operation GATEWAY; the ADFs longest enduring operation which contributes to the preservation of regional security and stability in Southeast Asia.

In short, the P-8A capabilities and flexibility provides Australia with a range of response options and deployment profiles.

The flexibility of the platform and its highly trained crews was further demonstrated during Operation Bushfire Assist. The Poseidon conducted surveillance support operations in the Victorian alpine region, regional New South Wales and Kangaroo Island in South Australia, occasionally operating for more than 10 hours in a single mission.

The P-8A Poseidon also participates in both local and international exercise activity where the ability to integrate with and support Australian and International Maritime Task Forces is crucial to the development of integrated Joint Force tactics and procedures.

## FUTURE STATE

In alignment with the Chief of Air Force's intent, SRG continues to make a significant contribution to air and space power as part of the Joint Force. As such SRG continues to embrace Air Force's transformative approach – into a fighting force that capitalises on the introduction of modern technology systems to support future maritime operations.

SRG has developed significantly and will continue to evolve; to best exploit the P-8As capabilities when operating in synergy with the MQ-4C Triton UAS, as part of an integrated Maritime Intelligence, Surveillance and Reconnaissance Family of Systems.

Together, the P-8A Poseidon and MQ-4C Triton platforms will provide Australia with one of the most advanced maritime patrol and surveillance capabilities in the world.

**ABOVE LEFT** RAAF Flight Lieutenant Ike Brady from No.11 Squadron carries out pre-flight checks on a P-8A during Operation Bushfire Assist. Photo: CPL Brenton Kwaterski ©DoD.

**OPPOSITE** RAAF P-8A Poseidon UNIPAC II drop training exercise over St Vincent Gulf, SA. Photo: CPL Brenton Kwaterski ©DoD.

## P-8A SPECIFICATIONS

**WINGSPAN: 37.64m**

**HEIGHT: 12.83m**

**LENGTH: 39.47m**

**PROPULSION: two CFM56-7B engines 27,300lbs thrust each**

**MAX SPEED: 907kph**

**RANGE: 1,200nm with 4hrs on station**

**CEILING: 41,000ft (12,496m)**

**MAXIMUM TAKE-OFF GROSS WEIGHT: 85,819kg**

**WEAPONS: with 11 weapon stations (five in the weapons bay, four under the wings and two under the fuselage), it can carry over 10,000kg of weapons. All hard points are fitted with digital weapon interfaces.**

**COMMUNICATIONS SUITE: over 10 separate radios and data links across the VHF, UHF, HF and SATCOM spectrums.**

RAAF Airmen Corporal Josh Golding and Leading Aircraftwoman Tiane Hoffmann in front of a P-8A Poseidon at Australia's main operating base in the Middle East region. Photo LSIS Craig Walton ©DoD.


# THE BIG PICTURE

DEFENCE'S EYE IN THE SKY, THE E-7A IS A COMPLETE BATTLE MANAGEMENT SYSTEM, CAPABLE OF COVERING AN AREA THE SIZE OF WESTERN AUSTRALIA IN A 10-HOUR MISSION.

**HERALDED AS ONE** of the most strategically important purchases ever made by the Australian Defence Force, the E-7A Wedgetail has the ability to survey, command, control and coordinate a joint air, sea and land battle as it is prosecuted.

At the core of its success is the E-7A's ability to gather information from a wide variety of sources, analyse it and then distribute it to all friendly air and surface assets. As such, the E-7A can control the tactical battle space; providing direction to fighter aircraft, surface combatants and land- and sea-based elements, as well as supporting aircraft such as tankers and intelligence platforms.

The E-7A Wedgetail platform is based on the Boeing Business Jet, a 737-700IGW airframe variant of the Boeing 737 Next Generation airliner. Implementation of Wedgetail mission systems is innovative, unconventional and unique with an antenna design built around an evolved variant of the Northrup Grumman Electronic Systems multirole electronically scanned array (MESA) radar, dubbed the "top hat".

The complex antenna arrangement has not been used in any other design and offers a much smaller, lighter and lower drag antenna array that allows for a smaller and cheaper narrow-body structure. The MESA radar and 10 state-of-the-art mission crew consoles provides a capability to track airborne and maritime targets simultaneously.

Capable of rapid and extended-range deployment with in-flight refuelling, the E-7A Wedgetail has proven highly reliable and effective on operations. An E-7A Wedgetail cruising at an altitude of 10,000m can maintain surveillance over a surface area of 400,000sq.km. Over a 10-hour mission, it can cover more than four million square kilometres, an area the size of Western Australia. As the ADF's 'eye in the sky'; the E-7A is a complete battle management system that allows the ADF to see the big picture as it happens.

## DESIGN & DEVELOPMENT

Australia recognised a need for an airborne early warning and control aircraft in the 1990s. In 1996, the government sought tenders for Project Wedgetail and in 2000 the contract was awarded to Boeing Integrated Defence Systems.

Under the $3.8 billion contract (in today's terms), Boeing and Northrop Grumman teamed with Boeing Australia and BAE Systems Australia. Boeing Australia provides training, maintenance and support for the aircraft while BAE provides electronic warfare self-protection, electronic support measures and ground support systems. The result is the delivery of an airborne early warning and control platform that is the envy of air forces worldwide.

The RAAF has six E-7A Wedgetail aircraft, operated by No.2 Squadron based at RAAF Base Williamtown, NSW, with additional deployment facilities at RAAF Base Tindal, NT. The RAAF E-7A platform achieved Initial Operating Capability in November 2012 and Full Operational Capability in 2015.

## OPERATIONAL HIGH POINTS

The E-7A Wedgetail has showcased its strength and agility during Operation OKRA several times since October 2014 as part of the Air Task Group. At OKRA,

Wedgetail crews have been responsible for command and control of all coalition aircraft in a 'battle management area' – a position of leadership and trust that is reflective of the strength and capability of the asset. Crews regularly managed more than 80 combat aircraft during a single mission and have conducted record-breaking endurance sorties for their aircraft type.

In an integrated force, the E-7A shares information with other deployed elements, allowing crews to monitor progress of the air and ground battle. For example, they have exploited the increased situational awareness to dynamically re-position refuelling aircraft as close as possible to Australia's Super Hornets and other coalition strike aircraft, reducing the refuelling time between tactical engagements.

A RAAF E-7A Wedgetail made history for the longest Australian command and control mission in a war zone during a recent combat mission in the Middle East Region (MER). At 17.3 hours, the mission entailed command and control of large numbers of coalition aircraft, and the crew completed two air-to-air refuels. Since then No.2 Squadron has completed 17 rotations of personnel into the MER and has a mission success rate above 94%.

The E-7A's participation in international exercise activity has maintained and strengthened Air Force's relationships with our coalitional partners and contributed to increased levels of interoperability.

During Exercise Cope North in 2020, No.2 Squadron personnel were exposed to a complex battlespace environment, providing them with familiarity in monitoring and controlling a range of different aircraft types and providing coalition partners a greater understanding of the Wedgetail's capability. Working in collaboration in the same air space with the US and Japanese partners provided important training outcomes, delivering a stronger and more effective coalition force for years to come.

Important Defence industry partnerships and a culture of excellence have also been key to the operational effectiveness of the E-7A Wedgetail, celebrating 10 years of RAAF service in 2020. It is also a significant year for No.2 Squadron association members, with some marking the 50th anniversary of their contribution to the Vietnam conflict. No.2 Squadron was awarded a Vietnamese Cross of Gallantry and a United States Air Force Outstanding Unit Commendation. It also received a US Presidential Unit Citation for service in World War II. The Squadron's efforts had been previously acknowledged with the 2018 Duke of Gloucester Cup award for outstanding achievement as "the RAAF's most proficient flying unit" supporting E-7A operations.

The important partnerships and successful collaboration with the Airborne Early Warning and Control System Program Office (Capability Acquisition and Sustainment Group) and Defence industry partners have contributed to the effectiveness and operational success of the platform.

The Wedgetail platform significantly multiplies the effectiveness of existing Navy, Army and Air Force, and will help Australia maintain a capability edge well into the future.

**OPPOSITE** An E-7A Wedgetail and F/A-18F Super Hornet fly aft of a KC-30A Multi Role Tanker Transport as part of Operation OKRA. Photo: CPL Brenton Kwaterski ©DoD.

**BELOW** A Royal Australian Air Force E-7A Wedgetail arrives at the Australian Defence Force's main operating base in the Middle East region. Photo: CPL Dan Pinhorn ©DoD.

## E-7A SPECIFICATIONS

**WINGSPAN:** 33.6m

**HEIGHT:** 12.6m

**LENGTH:** 34.3m

**PROPULSION:** two CFM56-7B engines 27,300lbs thrust each

**MAX SPEED:** 870kph

**CEILING:** 41,000ft (12,496m)

**MESA RADAR RANGE:** in excess of 400km

Electronic warfare self-protection measures that maximise the effectiveness of the E-7A comprise directed infra-red, chaff and flare counter-measures and communications systems including HF, VHF, UHF, Link-11, Link-16, UHF SATCOM integrated through a comprehensive Interphone Communications System.

# NOWHERE TO HIDE

## HYPERSPECTRAL SURVEILLANCE IS COMING, READY OR NOT.

**HYPERSPECTRAL IMAGING EXPLOITS** the unique spectral characteristics of targets to aid in detection and identification of materials. Defence Science and Technology (DST) Group defence scientist Tim Bubner says it is very hard to hide from spectral sensors which scan across multiple electro-optical frequency bands.

"While artificial camouflage does the job matching the surrounding environment in the visible spectrum, it actually can make you stand out in the other bands, if you can exploit them."

Bubner's team has been collaborating with a team from the US Naval Research Laboratories (NRL) for several years, honing skills in exploiting hyperspectral phenomenology and developing state of the art sensor technology and systems, for use in airborne surveillance.

"Hyperspectral sensing is unique," says Bubner. "Very seldom can you create camouflage that defeats all the wave bands that are accessible to us. In the past, hyperspectral sensors were predominantly used in the daytime, but a thermal hyperspectral sensor currently operating on DST's Defence Experimentation Airborne Platform (known as the DEAP aircraft) gives us a 24-hour capability."

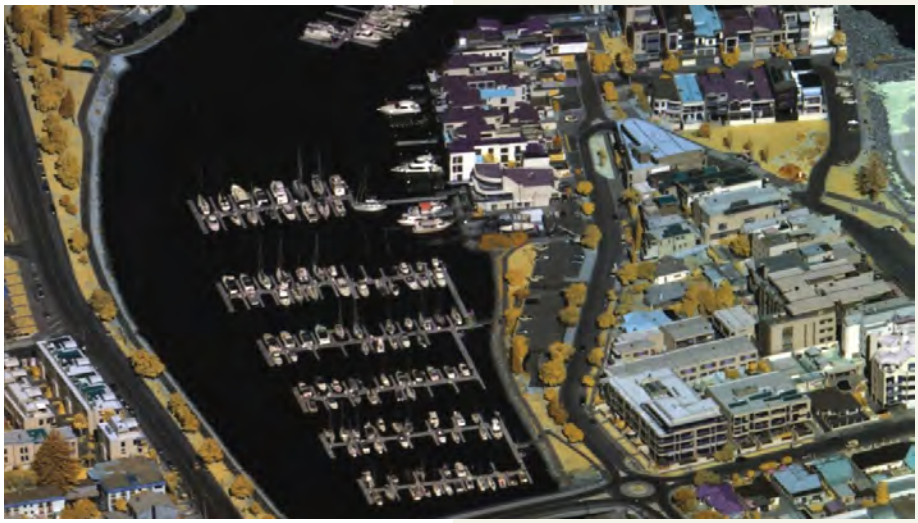
Another winning feature with this type of sensing is its passive nature, allowing users to scan the environment accurately and silently from safe standoff distances. The team's research has coupled fundamental signature measurements using both lab and field-based spectrometers, with high-performance hyperspectral sensors in airborne trials. Those trials have demonstrated proof of concept for data collection and showcased the evolution of exploitation tool development for near real-time automated target detection.

Jonathan Neumann, a NRL scientist integrated with the DST Group team, says the partnership has been valuable for his team. "There are limits to what we can accomplish back in the US, DST Group nicely complements what our research is aiming to achieve," he says.

The partnership has included experiments of direct relevance to Australian and US Defence problem spaces, including supporting the Australian AIR7000 and US PMA290 programs. "DST's DEAP aircraft, which has flight-certified pods custom-built for mounting sensors, was certainly a key enabler for the program. Recent flight trials, including experiments in tropical North Queensland, were exceptional. The DEAP aircraft carried dual reflective (daytime) and thermal hyperspectral payloads, enabling our respective teams to do everything necessary to support the trial objectives."

### EXCITING POSSIBILITIES

A key focus of research has been to demonstrate to Defence the unique capability that hyperspectral technology offers: the remote identification of materials by a passive collector. The experiments carried out by Bubner and colleagues, who are keen to see the uptake of the technology, have informed Defence of the wavebands, spectral resolution, pixel size and other parameters that should be considered



when defining future capability options.

Underlying it all is an understanding that hyperspectral sensing is an evolutionary and complementary enhancement over persistent or high-resolution motion imagery video snapshots.

DST Group defence scientist Gavin Fowler, Intelligence, Surveillance and Space Division explains that it's much more than just looking at a picture. "Hyperspectral sensing provides an understanding of the target materials' properties which is not available from other imagery. We're working with high-performance thermal and extremely long-range, short-wave IR hyperspectral systems for surveillance tasks including maritime surveillance, target detection in cluttered environments and stand-off gas plume detection from passive stand-off distances. If we can retrieve the spectral characteristics of the target, analysts get a much better understanding of what's happening on the ground.

"The other real strength of our system is that it allows for automated processing. You can have an onboard processor which can auto-detect, identify and geolocate. We've demonstrated automated stand-off detection of invisible gas plumes in near real-time and automated anomaly detection in the maritime environment.

"A main theme for us now is to promote how Defence can use hyperspectral sensing, by showing how we can insert these products into an enterprise level situation awareness capability – into the bigger picture. That's the next big challenge.

"No sensor will provide all the answers but we've reached a level of maturity with these that allows us to say, 'If you had these sensors you could work out if that was a life jacket anomaly at sea or camouflage net in natural hide, or that there is an invisible gas plume in this location'."

## EMBEDDED PARTNERS

For Bubner, having Neumann and his US colleagues embedded in the team at Edinburgh has been crucial. "They haven't just come across for program meetings, we've been doing real ridgy-didge work, side by side. The trust and friendship that builds up is critical to collaborative success. It's been a classic partnership, allowing DST to build an indigenous capability that our partners can engage with.

"Because it's been an integrated team, we've all been learning from each other. Everyone's got such a variety of skills and experience – it's a real melting pot of technologists, sensor operators, engineers, image-exploitation experts and spectroscopy specialists. That variety of skills and expertise has allowed us to fulfil the outcomes we've been demonstrating."

It is the sort of collaboration DST Group will be promoting under the new Defence S&T strategy "More, Together".

While it's the technical challenges and the opportunity to work with state-of-the-art sensors and technology that gets Bubner out of bed and into the DST labs, Fowler gets great joy from bringing it all together into an integrated system and then "getting out there" to demonstrate it in a variety of scenarios in some challenging and unique locations. "You don't get that in a regular office job."

The US engagement for this research happened under the Coalition Warfare Program, while the DST team was funded under various Defence programs.

**TOP** DEAP Aircraft.

**ABOVE** DEAP sensors.

**LEFT** 3-band false colour SWIR hyperspectral image.

# EARLY EARTH OBSERVATIONS FROM SPACE

LAUNCHED IN 1978, SEASAT COLLECTED MORE INFORMATION ABOUT OCEAN PHYSICS IN 105 DAYS THAN HAD BEEN COLLECTED IN THE PREVIOUS 100 YEARS.

**THE SEASAT MISSION** pioneered satellite oceanography and proved the viability of imaging radar for studying our planet. The mission was designed to demonstrate the feasibility of global satellite monitoring of oceanographic phenomena and help determine the requirements for an operational ocean remote sensing satellite system.

In 1969, a group of engineers and scientists from many institutions came together at a conference in Williamstown, Massachusetts, USA, to study how satellites could be used to improve our knowledge of the oceans. In the 1970s, NASA's Jet Propulsion Laboratory (JPL) engineers and scientists realised the sensors they were developing for interplanetary missions could be turned on Earth to better understand our planet. NASA began planning for the SeaSat mission three years later, as the first multi-sensor spacecraft dedicated to observing Earth's ocean. A broad user group, numerous NASA centres (JPL built the experimental satellite called SeaSat) and industry partners worked together, culminating in a launch in June 1978.

Many of SeaSat's technologies became legendary, as their useful datasets became invaluable in our understanding of Earth system science. Many later remote sensing missions benefited from SeaSat's legacy including imaging radars flown on NASA's Space Shuttle, altimeters on Earth-orbiting satellites such as TOPEX/Poseidon, and scatterometers (microwave radar sensors used to measure the reflection or scattering effect produced while scanning the surface of Earth) on ADEOS I, QuikSCAT and Jason-1.

## UNIQUE DATA

SeaSat, the first satellite dedicated to establishing the utility of microwave sensors for the remote sensing of Earth's oceans, collected a unique set of synoptic data on ocean winds, waves, temperature and topography. After the equivalent of 100 work years of intensive analysis of a relatively small subset of that data, a multidisciplinary team of scientists, engineers and analysts has concluded that the majority of goals for measuring geophysical parameters were met. Consequently, the overall project objective: to demonstrate the concept of a global, nearly all-weather, microwave ocean surveillance capability, had been accomplished.

Data was transmitted from the satellite in three separate streams: 25kbps real-time stream containing instrument data from ALT (radar altimeter), SASS (SeaSat – a satellite scatterometer), SMMR (scanning multichannel microwave radiometer) and VIRR (visible infrared radiometer) and all engineering subsystem data, an 800kbps playback stream of recorded real-time data, and a 20MHz analog SAR (synthetic-aperture radar) instrument data stream.

SeaSat was not equipped with an onboard recorder, so three US and two international ground stations downlinked data from the satellite in real time: Fairbanks, Alaska; Goldstone, California; Merritt Island, Florida; Shoe Cove, Newfoundland; and Oakhanger, United Kingdom.

SAR data from SeaSat was acquired digitally and most of it was optically processed into survey data products, available on 70mm film. The SeaSat 100km swath data was processed into four 25km wide products at JPL. A small percentage of the data was digitally processed. Those products contain the complete 100km wide swath of data.

After acquisition, the data was originally archived on 39-track raw data tapes. To ensure data preservation, those tapes were duplicated in 1988 and again in 1999. During the second transcription, the raw telemetry data was transferred onto 29 more modern SONY SD1-1300L 19mm tapes.

## TRUE PIONEER

SeaSat collected more information about ocean physics in its brief life than had been collected in the previous 100 years of shipboard research. The spacecraft established satellite oceanography and proved the viability of several radar sensors, including imaging radar, for studying our planet. The SeaSat mission spawned many subsequent Earth remote-sensing satellites that track changes in Earth's ocean, land and ice, including many currently in orbit or in development. The advances gained through SeaSat have been applied to

**LEFT** Artist's concept of Jason and TOPEX/ Poseidon working in tandem.

missions studying other planets as well.

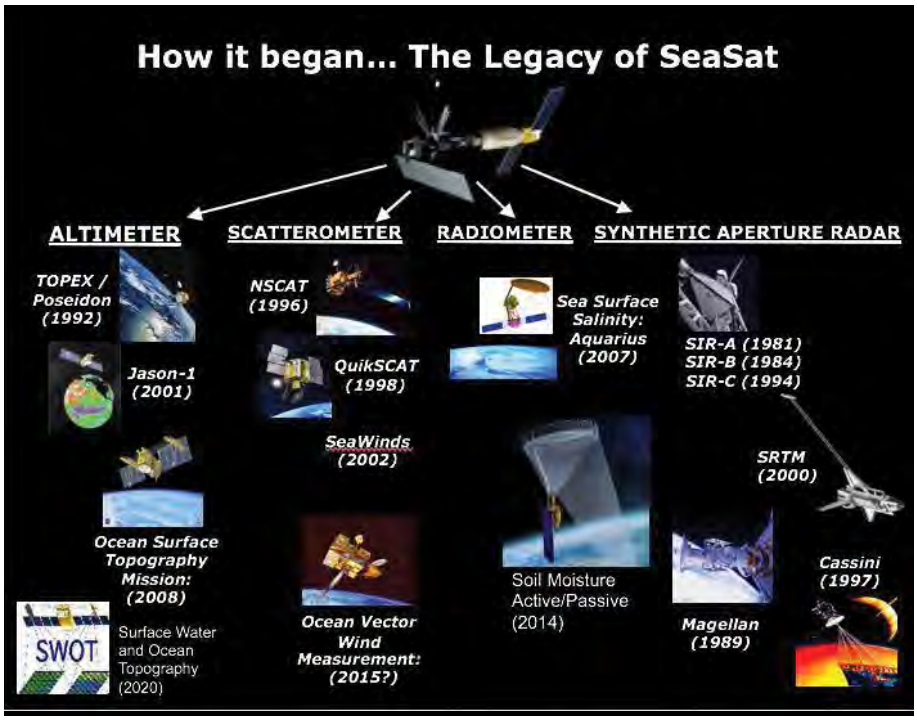
Stan Wilson, post-SeaSat NASA program manager, says the mission demonstrated the potential value of ocean microwave observations. "As a result, at least 50 satellites have been launched by more than a dozen space agencies to carry microwave instruments to observe the ocean," he says. "In addition, we have two continuing records of critical climate change in the ocean that are impacting society today: diminishing ice cover in the Arctic and rising global sea level. What greater legacy could a mission have?"

Bill Townsend, SeaSat radar altimeter experiment manager, says SeaSat flew long enough to fully demonstrate its groundbreaking remote sensing technologies. "Its early death permitted the limited available resources to be marshaled toward processing and analysing its approximately 100-day data set," he says. "This led to other systems, both nationally and internationally, that continued SeaSat's legacy, enabling SeaSat technologies to be used to better understand climate change."

With further processing from the Alaska SAR Facility, scientists will be able to travel back in time to research the ocean, sea ice, volcanoes, forests, land cover, glaciers and more. Previously, only about 20% of SeaSat SAR data had been digitally processed.

## SEASAT SPACECRAFT

SeaSat was the first Earth-orbiting satellite designed for remote sensing of the Earth's oceans. It had a mass of 2,300k and carried the first spaceborne synthetic-aperture radar (SAR). Specific objectives were to collect data on sea-surface winds, sea-surface temperatures, wave heights, internal waves, atmospheric water, sea ice features and ocean topography. SeaSat was managed by NASA's Jet Propulsion Laboratory and was launched on 27 June 1978 into a nearly circular 800km orbit with an inclination of 108°. SeaSat operated until 10 October 1978, when a massive short circuit in the Agena-D bus electrical system ended the mission.



"The short 100-day SeaSat mission provided a moment of epiphany to remind people that the vast ocean is best accessed from space," says Lee-Lueng Fu, JPL senior research scientist and project scientist for the NASA/French Space Agency Jason-1 satellite and NASA's planned Surface Water and Ocean Topography mission.

The scatterometer instrument provided the first real-time global map of the speed and direction of ocean winds that drive waves and currents and are the major link between the ocean and atmosphere. Other missions, such as JPL's NASA Scatterometer, Quikscat spacecraft, SeaWinds instrument on Japan's Midori 2 spacecraft and the OSCAT instrument on India's Oceansat-2, also used the technology first tested on SeaSat. Data from those instruments helps to forecast hurricanes, tropical storms and El Nino events.

Precise measurements of sea surface height used to study climate phenomena such as El Nino and La Nina have been made since SeaSat using advanced ocean altimeters on the NASA/European Topex/Poseidon and Jason missions. Jason-3, the latest Jason mission, launched in 2015, continued the 20-plus-year climate data record. Weather and climate models, ship routing, marine mammal studies, fisheries management and offshore operations have all been improved using satellite altimetry.

SeaSat demonstrated the benefit of using radiometer measurements of water vapor to correct altimeter measurements of sea surface height by simultaneously flying a radiometer with a radar altimeter. The accuracy of altimeter readings is affected by water vapor, which delays the time it takes for the altimeter's signals to make their round trip to the ocean surface and back.

## A RICH HERITAGE

All subsequent NASA/European satellite altimetry missions have used that technique. SeaSat's legacy continued in the radiometer, scatterometer and SAR for NASA's Soil Moisture Active Passive mission to measure global soil moisture, launched in 2014.

Sea ice, and its role in controlling Earth's climate, was also part of SeaSat's oceanographic mission. The SAR instrument provided the first high-resolution images of sea ice, measuring its movement, deformation and age. The SAR also monitored the global surface wave field and revealed many oceanic and atmospheric related phenomena, from current boundaries to eddies and internal waves. Currently, SAR and scatterometers are used to monitor Earth's ice from space.

"It's hard to imagine where we would be without the radiometer pioneered on SeaSat, but certainly much further behind in critical Earth observations than we are now," says Gary Lagerloef of Earth & Space Research, Seattle, principal investigator of NASA's Aquarius mission to map ocean surface salinity.

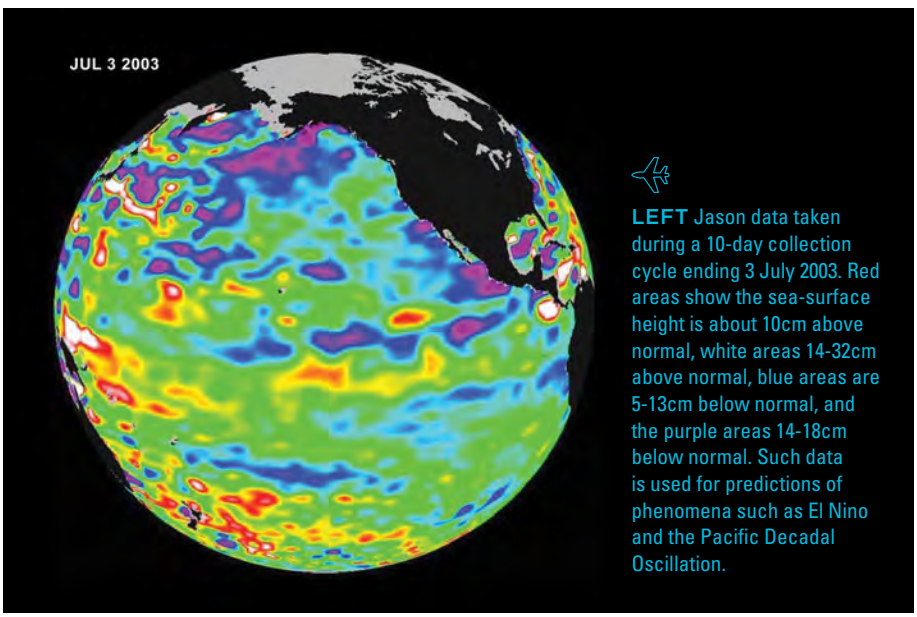
SeaSat's SAR also provided spectacular images of Earth's land surfaces and geology. Datasets from SeaSat were used to pioneer radar interferometry, which uses microwave energy pulses sent to the ground to detect land surface changes, such as those created by earthquakes, and measure land surface topography.

During the 1980s and 1990s, three JPL Shuttle Imaging Radar experiments flew on the Space Shuttle. JPL's Shuttle Radar Topography Mission used the technology to create the world's most detailed topographic measurements of more than 80% of Earth's land surface in 2000. Currently, JPL's Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) airborne imaging radar system for a wide variety of Earth studies is using the technology.

SeaSat's demonstration of spaceborne repeat-pass radar interferometry to measure minute Earth surface motions has led to a new field of space geodetic imaging, says Paul Rosen, JPL project scientist for a future NASA L-band SAR spacecraft currently under study, and it forms the basis for his mission.

"Together with international L-band SAR sensors we have the opportunity in the next five years to create a 40-year observation record of land-use change where overlapping observations exist," he says. "These time-lapse images of change will provide fascinating insights into urban growth, agricultural patterns and other signs of human-induced changes over decades and climate change in the polar regions."

JPL's Magellan mission, which mapped 99% of the previously hidden surface of Venus, and the Titan radar onboard the JPL-built and managed Cassini orbiter to Saturn both used SeaSat technology.

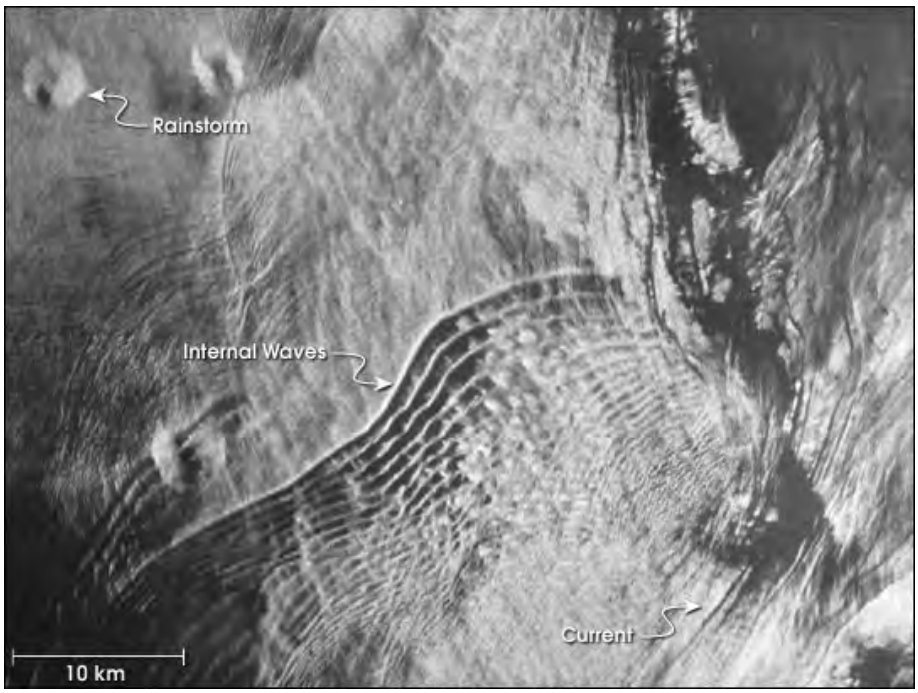



**LEFT** Jason data taken during a 10-day collection cycle ending 3 July 2003. Red areas show the sea-surface height is about 10cm above normal, white areas 14-32cm above normal, blue areas are 5-13cm below normal, and the purple areas 14-18cm below normal. Such data is used for predictions of phenomena such as El Nino and the Pacific Decadal Oscillation.

*Tom Nolan, retired earth scientist, NASA Jet Propulsion Laboratory*

*To learn more, go to jpl.nasa.gov/missions/seasat or go to https://nssdc.gsfc.nasa.gov/nmc/SpacecraftQuery and search 'SeaSat'.*

**BELOW** SeaSat image of oceanic phenomena in the Gulf of Mexico. Image: NASA.




## KEY INSTRUMENTS

SeaSat carried five major instruments designed to return the maximum information from ocean surfaces.

- Radar altimeter to measure spacecraft height above the ocean surface.
- Microwave scatterometer to measure wind speed and direction.
- Scanning multichannel microwave radiometer to measure sea surface temperature.
- Visible and infrared radiometer to identify cloud, land and water features.
- Synthetic aperture radar (SAR) L-band, HH polarization, fixed look angle to monitor the global surface wave field and polar sea ice. The SAR support structure was designed and manufactured by Northrop Grumman Astro Aerospace in Carpinteria, California. The structure deployed once on orbit.

# FIGHTING
## THE COLD WAR FROM 85,000 FEET

WORDS Bob Treloar, based on a presentation to the Flight Test Society of Australia by Russell Szczepanik, Blackbird Pilot

## ENTERING SERVICE IN 1964, THE SR-71 BLACKBIRD STILL HOLDS THE WORLD SPEED RECORD SET IN 1976.

**BUILT TO FIGHT** the Cold War, the SR-71 Blackbird was, and still is, the fastest aeroplane in the world, holding the world speed record it set in 1976. On operations, it outran every missile fired at it.

The SR-71 Blackbird was a two seat, twin-engined long-range supersonic aircraft built by the Lockheed Corporation. It could fly at speeds in excess of Mach 3.2 and at a height greater than 85,000 feet (26km). It was in service from 1964 to 1989, followed by a period of reactivation from 1995 to 1998. NASA flew the aircraft during the later years of reactivation for its research program and the Air Force conducted further reconnaissance missions. It was designed by the Lockheed Advanced Development Projects Division, otherwise known as the Lockheed Skunk Works, and developed under the highly classified OXCART reconnaissance program.

The onset of the Cold War brought down the Iron Curtain and the Western World knew little about Soviet military and civilian installations across the region. It was proposed that the United States commence reconnaissance flights over the Soviet Union using the U-2 Dragon Lady.

President Eisenhower, who was concerned those flights could precipitate a war, was informed that the U-2 flying at 70,000 feet could not be detected by Soviet radar. While that was apparently the case for American radar systems, it was not true for the Soviet systems. Thus, in 1958 U-2 reconnaissance flights over Russia commenced, defying destruction by the Soviet air defence systems, but not detection.

On 1 May 1960, a U-2 flown by Francis Gary Powers was shot down when hit by one of a salvo of three SA-2 Guideline surface-to-air missiles. Some 14 Guideline missiles had been fired at the aircraft during the mission. Unable to activate the aircraft's self-destruct system when thrown free of the aircraft during the explosion, the aircraft was captured virtually intact by the Soviet forces. The invulnerability of America's spy aircraft had been challenged and found wanting – a new generation of aircraft was required.

## DEVELOPMENT

The incident had immediate diplomatic repercussions and reinforced the need for a new type of reconnaissance aircraft that could fly faster and higher, safe from Soviet surface-to-air missile systems. The CIA wanted an aircraft that could fly above 90,000 feet or thereabouts, at high speed and as invisible to radar as was feasible.

In 1964, US President Lyndon Johnson announced that the Lockheed Advance Development Projects would build another strategic reconnaissance aircraft – one so fast that no other airplane could reach it.

The task of designing such an ambitious machine fell on Clarence "Kelly" Johnson, one of the world's greatest aircraft designers, and his secret division of engineers at the Skunk Works. "Everything had to be invented. Everything," recalled Johnson, who died in 1990, the same year the Blackbirds were first retired from service. During his career Kelly had been responsible for the development of the U-2 and contributed to the design of more than 25 other aircraft.

The predecessors of the SR-71 Blackbird were the A-12 and YF-12, designed to replace the U-2 conducting strategic reconnaissance missions over the USSR. Those aircraft were grouped within the OXCART program, funded by both the CIA and the Air Force.


In 1961, President Kennedy had upheld a decision made by President Eisenhower the year before that the US would not conduct any further reconnaissance flights over the Soviet Union. That decision, combined with improving Soviet air defence systems and rapidly developing satellite technology, changed the A-12 mission to the conduct of tactical reconnaissance around the globe. Consequently, the A-12's intended strategic employment never came to fruition.

Nevertheless, 13 A-12 Blackbird aircraft were built and they flew reconnaissance missions over Vietnam and North Korea before their retirement in 1968. The program's cancellation was announced on 28 December 1966, citing budget concerns and the forthcoming SR-71, a derivative of the A-12. The designation YF-71 was used to release information to the public as a cover story to conceal the existence of the SR-71.

The SR-71 was designed for flight at speeds over Mach 3 with a flight crew of two in tandem cockpits, whereas the A-12 carried only the pilot. In the SR-71, the pilot occupied the forward cockpit and the reconnaissance systems officer the rear cockpit. The reconnaissance systems officer operated the surveillance systems and electronic jamming equipment and directed navigation along the mission flight path. The SR-71 was designed to minimise its radar cross-section, an early attempt at stealth design. However, it could be detected by Soviet radar systems and the exhaust plume from the aircraft engines increased its susceptibility to radar detection. The aircraft were painted a dark blue, almost black, to increase the emission of internal heat and to reduce its visible profile against the night sky. The dark colour led to the aircraft's nickname "Blackbird".

Lockheed engineers faced unique challenges when designing and building the Blackbirds. Aerodynamic friction and continuous engine operation during high-speed flight subjected some parts of the airplane to temperatures as high as 560°C. Average surface temperatures ranged from 240°C to 330°C.

Such heat precluded the use of aluminium as a basic structural material and the Skunk Works team turned instead to titanium, stainless steel, and other advanced alloys, as well as to high-temperature plastics.

The result was a truly magnificent aircraft. It was 108 feet (33m) long, with a wingspan of 55 feet (17m). It had a maximum take-off weight of 170,000 pounds (77,000kg), maximum fuel load of 80,000 pounds (27,215kg) and was powered by two Pratt and Whitney J-58 engines, each producing 32,5000 pounds of thrust with continuous afterburner-ram jet operations above Mach 2.6.

## EARLY DEPLOYMENT

The first operational SR-71 aircraft arrived at Kadena Air Base, Okinawa, Japan on 8 March 1968 and flew its first operational mission over Vietnam on 21 March.

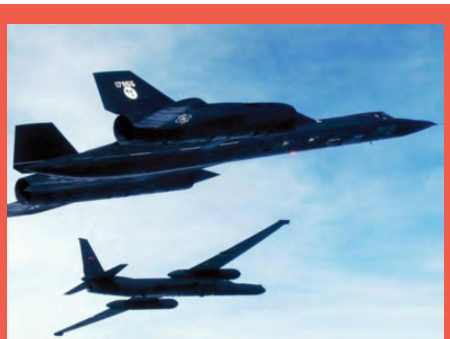
Thirty two SR-71 aircraft were built and 12 were destroyed in accidents, killing one flight-test reconnaissance and navigation systems specialist. None were lost to enemy action.

## MISSION PROFILE

The SR-71 was home based at Beale Air Force Base, California. Training missions were conducted mainly over the western USA and operational missions were conducted by Detachment 1 at Okinawa, Japan, or by Detachment 4 at Mildenhall, United Kingdom. Before operational missions were flown, crews underwent extensive training and rehearsals in the SR-71 flight simulator. In fact, one pilot, Colonel Richard Graham USAF (Ret'd), said that sitting in the aeroplane and being able to look outside seemed strange.

Missions flown from Okinawa generally focused on North Vietnam (in the early days); North Korea; Vladivostok and the Kamchatskly Peninsula, while from Mildenhall missions were flown over the Barents Sea; Baltic Sea; Middle East; and over Germany during the conduct of NATO exercises.

A routine mission profile flown by the SR-71 included a light-weight take off followed soon after with air-to-air refuelling from a KC-135 tanker to



### FASTER THAN A SPEEDING BULLET

A comparison between a speeding rifle bullet and the SR-71 is revealing.

RIFLE

Muzzle velocity: 3,000 feet per second (914.3m per second)

SR-71

Cruise velocity 3,100+ feet per second (944.8m per second)

56km (35 miles) every minute


give the aircraft a range of 2,500 miles (4,000km) before rendezvous with another KC-135 for further refuelling.

The initial phase of the sortie was normally conducted at subsonic speed before accelerating to supersonic flight approaching the area of interest. Acceleration to supersonic flight was commenced in a slight dive to minimise a high drag area around Mach 1 and then climbing at 450 knots EAS (equivalent air speed) to Mach 3 at around 70,000 feet. Supersonic flights generally lasted no more than 90 minutes before the pilot had to find a tanker.

Some missions lasted for 10 hours or more, which required five or more aerial refuellings. During those missions, tubed food was fed to the crew member through the helmet and water supplied through a tube. However, typical missions were closer to 2.5 to 4.5 hours and only required one or two refuels.

Of the 12 SR-71s that were lost, four were a consequence of tyre failure. Early on, aircraft launched with an 80,000 pounds full fuel load on board. That placed an excessive load on the tyres during the take-off roll, resulting in a failure upon landing. To overcome that issue and reduce aircraft losses, take-off fuel load was generally reduced to 40,000 pounds; a trade-off between reducing tyre damage on take-off and controllability of the aircraft at low speed immediately after take-off.

There was a misconception that the aircraft required immediate refuelling after take-off due to leaking fuel tanks. However, fuel leaks were measured in drips per minute, and were not significant when compared to the overall fuel capacity of the aircraft.

From a human perspective, SR-71 flights were always challenging. The aircraft was equipped with ejection seats for each crew member and the two crew members wore fire-resistant, full-pressure space suits. Once accepted into the SR-71 program, the pilot and reconnaissance systems officer were permanently crewed together and did not fly with other aircrew members. Effective crew coordination when flying at two miles every three seconds was considered imperative and crews trained together, flew together and virtually lived together.

At 80,000 feet the outside air pressure was less than ½ psi (sea level pressure is 14.7 psi) and while the cockpit could be pressurised to an altitude of either 10,000 or 26,000 feet, a cockpit depressurisation or an ejection would have been a serious affair without a space suit as human blood boils at the reduced atmospheric pressure at 60,000 feet. The cockpit temperature was maintained at 37°C, and the crew could adjust the internal temperatures of their pressure suits.

## INTELLIGENCE PRODUCT

The SR-71 carried a variety of sensors including a side-looking Advanced Synthetic Aperture Radar and a variety of "wet film" cameras in the fuselage chines along the forward fuselage, or in the nose compartment. The radar had a 12-inch resolution (30cm) and the cameras had a resolution of between four and five inches (13cm). Those sensors were capable of "seeing" to ranges up to 1,500 miles (2,500km) and enabled missions to be conducted day or night under all weather conditions.

Once in an area of interest, flights were conducted at altitudes in excess of 85,000 feet (27 km), at over Mach 3.2, or 63km per minute, and generated a sensor coverage of over 100,000 square miles (260,000sq.km) each hour.

The film used in the SR-71's cameras was five inches wide and two miles

## RUSSELL SZCZEPANIK

Air crew selected to fly the SR-71 were special people. Flight crew selection was extremely strenuous. It required a volunteer for special duty assignment; a Top-Secret clearance; be under 35 years of age with fighter experience; undertake psychological assessment and pass the astronaut physical. Russell Szczepanik was one such individual. In an address to military test pilots in Canberra some four years ago he provided an insight into the life and challenges of an SR-71 pilot. The mission slides in this article were provided from his presentation.

Russell was a member of the USAF from 1964 until 1989 and during that time he qualified on many different aircraft types. He flew classified SR-71 missions at worldwide locations; was appointed Commander and Director of Operations at a foreign SR-71 operational detachment with total responsibility for airborne operational surveillance, reconnaissance and intelligence missions; and directed the operational deployment for worldwide SR-71 Blackbird surveillance and intelligence operations.

In the USAF, he was an instructor and flight examiner for SR-71, RF-4C, F4-D/E/F, T-38 and KC-135 aircraft.

In civilian life, Russ was the Business Development lead in Australia for the Air 5077 Wedgetail program. He transitioned from Seattle to Canberra and RAAF Base Williamtown for the introduction, integration and the management of the weapons system on site at Williamtown. He is a duel citizen of the US and Australia.

# SR-71 COCKPIT

**WINGS** VOLUME 72 NO.3


CANOPY SEAL PRESSURE OFF
IVSI
VERTICAL SPEED
FUEL QTY IND SELECT
STAB AUG
MACH HOLD

long (3.2km). Once an SR-71 returned to base, the photo-maintenance division removed the film and cut it into 500-feet long segments before analysing it. A time-consuming, but a critical process, if the value of the completed mission was to be achieved.

While the SR-71, was much more capable than the Lockheed U-2 in terms of range, speed, and survivability, it lacked a data link, which the U-2 had been upgraded to carry. That meant SR-71 imagery and radar data could not be used in real time, but had to wait until processed on return to base.

## SPHERE OF ACTIVITY

The area of operations for the SR-71 was global and the aircraft earned an impressive military record. The Blackbird flew adjacent to Soviet and Chinese airspace and was well within the sphere of influence of these countries' military forces. It studied Israeli and Arab troop positions during the 1973 Yom Kippur War; provided post-strike reconnaissance following the US bombing mission against Libya in 1986; and had been used over a wide range of countries, from South Africa to Nicaragua.

Throughout those missions numerous missiles were fired at the SR-71, however, they were either jammed or the Blackbird used its breakaway speed to create a gap that couldn't be closed. It was reported that the closest a missile ever came to an SR-71 was 1.5 miles.

## DEMISE OF THE SR-71

Nothing lasts forever and the SR-71 was no exception. The Air Force decision to retire the Blackbirds in 1989 was based on several factors. In a congressional testimony on 9 April 1989, Air Force Chief of Staff Gen. Larry D. Welch identified the increased survivability of reconnaissance satellites, SR-71 vulnerability to the Soviet SAM-5 surface-to-air missile and the cost of maintaining the SR-71 fleet. The cost factor was the most significant to the Air Force because it limited expenditure in other areas. It was estimated that the money used to operate the SR-71 fleet could operate and maintain two tactical fighter wings.

The 1980s saw an increase in threats capable of countering the SR-71, including improved land based enemy air defences and the introduction of the MiG-31, which was armed with the R-33 air-to-air missile (NATO Designation AA 9 Amos), which could intercept the Blackbird.

Compared with US photo-reconnaissance/imaging satellites, reconnaissance aircraft have limitations. Unlike aircraft, satellites are in orbit 24 hours a day and can overfly every nation on earth without political repercussion. The SR-71 did not overfly Eastern Europe, the Soviet Union or China for political reasons, limiting coverage of those areas to targets that could be photographed from outside national borders. Nor could the SR-71 cover other nations with the frequency attainable by satellites.

The SR-71 Blackbird is still the fastest aeroplane in the world; some 60 years after its first flight. With constellations of satellites now meeting national strategic requirements for intelligence, it is likely that the flight capabilities of the SR-71 will never be surpassed.

Today, you can find some 30 remaining A-12, YF-12 and SR-71 aircraft in museums and Air Force bases across the United States; for example, at the USAF Museum, in Dayton, Ohio, and the National Air and Space Museum, in Washington, D.C.

## COLONEL FRANK STAMPF

**Known among his SR-71 squadron mates for the saying *"You haven't been lost till you've been lost at Mach 3!", Colonel Frank Stampf also came up with the corollary: "because for every minute that you don't know where you are, you're 35 miles further away from where you think you're supposed to be!"***

**BELOW** A group of SR-71 Blackbird Pilots from NASA in 1991. Photo: NASA.

**BOTTOM** SR-71A Blackbird on display in the Boeing Aviation Hangar, with the Space Shuttle Enterprise (OV-101) visible in the background.

## VIETNAM WAR

From 1968, SR-71s averaged approximately one mission a week for nearly two years. By 1970, the SR-71s were averaging two missions per week, and by 1972, they were flying nearly one sortie every day. Two SR-71s were lost during those missions, one in 1970 and the second aircraft in 1972, both due to mechanical malfunctions. Over the course of its reconnaissance missions during the Vietnam War, the North Vietnamese fired approximately 800 SAMs at SR-71s, none of which managed to score a hit.

**BELOW** War in Vietnam – enemy SAM & Troop Movement


## OPERATIONAL HIGHLIGHTS

Operational highlights for the entire Blackbird family (YF-12, A-12, and SR-71) as of about 1990 included:

- 3,551 mission sorties flown
- 17,300 total sorties flown
- 11,008 mission flight hours
- 53,490 total flight hours
- 2,752 hours Mach 3 time (missions)
- 11,675 hours Mach 3 time (total)

Of the 12 aircraft lost only one crew member, a Lockheed flight-test reconnaissance and navigation systems specialist, was killed in a flight accident. The rest of the crew members ejected safely or evacuated their aircraft on the ground.

## THE BALTIC INCIDENT

On 29 June 1987, an SR-71 on a mission around the Baltic Sea to spy on Soviet installations when one of the engines exploded. The aircraft, which was at 20km altitude, quickly lost altitude and turned 180° to the left over Gotland to search for the Swedish coast. Thus, Swedish airspace was violated and two armed Saab JA 37 Viggens were scrambled to intercept the SR-71. Noting that the SR-71 was in obvious distress, the Viggens escorted it to Danish airspace. The event had been classified for over 30 years and when the report was unsealed, data from the NSA showed that MIG -25 aircraft had been scrambled with orders to shoot down the SR-71 or force it to land. A MiG-25 had locked a missile onto the damaged SR-71, but as the aircraft was under escort, no missiles were fired. On 29 November 2018, the four Swedish pilots involved were awarded medals from the US Air Force.

**BELOW** Warsaw Pact missions – Baltic troop rotations and placement.

**BOTTOM** Major Cold War theatres of operation.


# SKILLING UP FOR DEFENCE

A SOUTH AUSTRALIAN TECHNICAL COLLEGE IS SETTING STUDENTS UP FOR CAREERS IN DEFENCE AND OTHER INDUSTRIES WITH TAILORED EDUCATION AND HANDS-ON EXPERIENCE.

**IN 2017, ST PATRICK'S TECHNICAL COLLEGE** in Edinburgh North became South Australia's first and only P-TECH (Pathways in Technology) school with defence industry pathways as the key focus.

The Australian Government invested $5.1 million into the P-TECH pilot model of education-industry collaboration, providing secondary school students with an industry-supported pathway exploring science, technology, engineering, and mathematics (STEM).

This year, four Year 11 Metals & Engineering students from St Patrick's were among 18 senior secondary students from 10 SA schools selected in the first intake of apprentices for the ASC Shipbuilding Readiness Training Program at SA's Osborne Naval Shipyard.

The training program allows students to complete their schooling to obtain the SA Certificate of Education and attain a Certificate II in Engineering while gaining a head start on their transition to employment.

State Education Minister John Gardner says the government is focused on delivering educational outcomes that best position young people to get jobs.

"This is a great example of our new Flexible Industry Pathways providing students with an opportunity to get a head start in the workforce while completing their schooling. Starting a traineeship through the ASC shipbuilding program will deliver excellent outcomes for students, industry and the South Australian economy," the minister says.

The students form part of the workforce for the federal government's Hunter Class Frigate Program that will build the Royal Australian Navy's nine Hunter-class anti-submarine warfare frigates.

Student candidates took part in a comprehensive application process commencing in March 2020. Once shortlisted, they were interviewed virtually by an industry panel and, following medical assessments and clearances, successful applicants were officially welcomed as school-based apprentices in the Hunter Class Frigate Program on 24 June.

The students have now commenced the initial six-month readiness program incorporating comprehensive training, supervision, coaching and mentoring, and providing first-hand understanding of a range of shipbuilding trades.

**ABOVE** St Patrick's Technical College ASC Future Frigates Trainees, from left, Adrian Saliba, John Rice, Riley Read and Sabrina Agostinelli.

Vocational education and training is delivered through TAFE SA, Regency Park, which houses the Advanced Welder Training Centre, delivering virtual and augmented reality welding technology – the most advanced simulators of their kind in the world.

Meanwhile the students continue their senior secondary schooling and in the new year, they will continue within the readiness program as school-based apprentices moving into a Certificate III in Engineering Fabrication.

As a purpose-built trade training school offering education, training and apprenticeship pathways to Year 10 to 12 students, St Patrick's Technical College is an advocate for Vocational, Education & Training (VET) pathways and for providing students with hands-on experiences and flexible learning options, skilling them for jobs now and in the future. The opportunity for students to gain a head start on their transition to employment

in the defence industry not only provides them with a skilled career but creates a pipeline of skilled workers for decades to come.

The college's main charter is to assist students in completing senior secondary school while concurrently undertaking VET studies either at school or with an employer through an apprenticeship or traineeship. Since opening in 2007, the college has assisted more than 1,000 young people make the transition from school to employment. In addition to apprenticeships, graduates also go on to further study or find employment.

The college offers eight trade programs: automotive; construction; electrotechnology; food and hospitality; hair and beauty; information technology; metals and engineering; and plumbing.

Principal Danny Deptula says students develop relevant skills and training, coupled with a greater understanding of a trade, through teaching of relevance. "Core subjects, such as English, mathematics and science, are taught at the college in a way that makes them directly applicable to each trade program," he says. "Our curriculum has been developed specifically to support pre-vocational training, combining theory and practice, and is designed to both broaden and deepen the understanding of a trade while providing students with a skillset appropriate for industry needs.

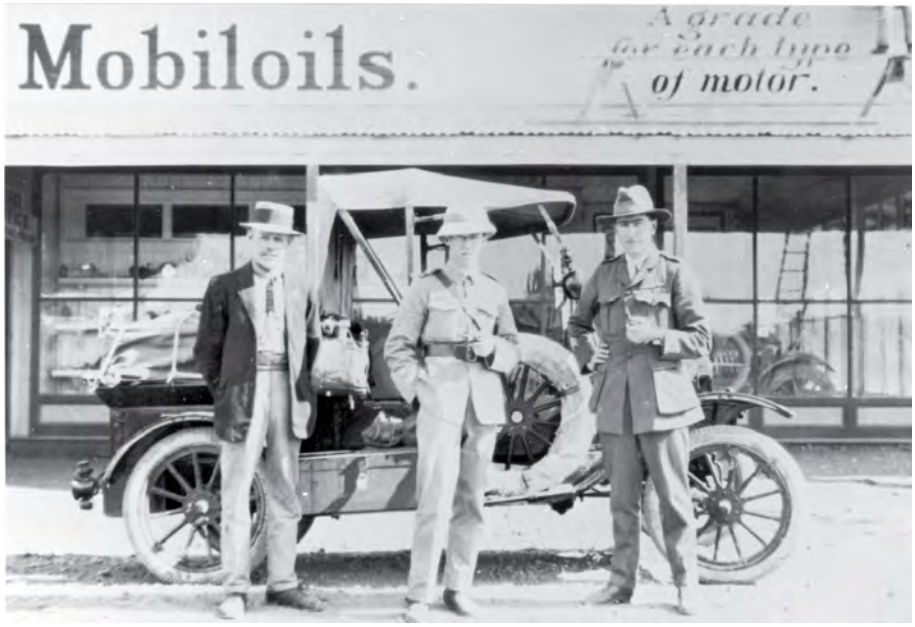
"The implementation of the ASC Shipbuilding Readiness Training Program has created an opportunity to train and skill our young people for innovative and reliable pathways into new technologies and traditional trades within defence.

"We look forward to collaborating further with industry and government as a collective strength to skill and train our young people across many rewarding career pathways in a new era of training and employment."

With defence industries an economic driver in SA, students at St Patrick's are able to tap directly into opportunities working in partnerships with TAFE SA, Defence Teaming Centre, Saab Australia, BAE Systems, DXC Technology, PMB Defence and Century Engineering.

Working in partnership with schools and tertiary education providers, industry has a direct hand in developing project-based learning to ensure skills taught in the classroom align with those required by employers and support jobs across a range of defence industry projects. Those partnerships provide opportunities for students to engage with the world of work and better understand the relevance of STEM knowledge and qualifications, local employment opportunities and post-school pathways.

St Patrick's Technical College works diligently to strengthen existing partnerships with business and industry and to develop deep relationships and a shared awareness that provide the best possible outcomes for Australia's future workforce.




# THE DRIVE THAT STARTED AN AIRLINE

IN 1919 AN EXPEDITION LEFT LONGREACH, QLD, IN A MODEL T FORD, AIMING TO SURVEY THE NORTHERN AUSTRALIAN ROUTE FOR THE GREAT AIR RACE. NINETY YEARS LATER DON HILL AND A SMALL GROUP OF VOLUNTEERS SET ABOUT RECREATING THE DRIVE IN A RESTORED 1919 MODEL T FORD.

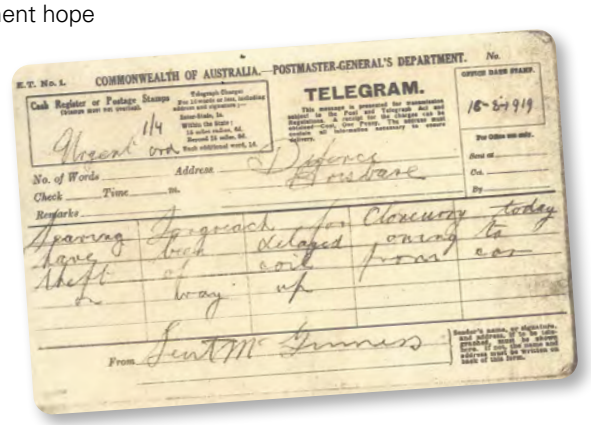
**IT IS THE 18TH OF AUGUST 1919,** day one of a two-week mission to survey the northern Australian route for the Great Air Race, and three men pose in front of an overloaded Model T Ford in the small western Queensland town of Longreach. Of what would become one of the most incredible stories of exploration, perseverance, endurance and survival, expedition leader Lieutenant Paul McGinness DCM DFC simply writes: "Leaving Longreach for Cloncurry today Stop Have been delayed owing to theft of coil from car on way up Stop".

## THE MISSION

After returning to Australia at the end of World War I, air ace pilots Hudson Fysh and Paul McGinness had decided to enter the Great Air Race from London to Australia. The race was the brainchild of the Australian Government and Prime Minister Billy Hughes, aiming to foster civil aviation by offering a prize of £10,000 for the first crew to complete the first flight between the two nations.

Given their remarkable flying skills and experiences in the war-torn skies over Palestine, the men would likely have posed a significant challenge to the eventual winners Ross and Keith Smith in their Vickers Vimy. Unfortunately, eleventh-hour circumstances conspired against McGinness and Fysh when their financial backer, Sir Samuel McCauchey, a wealthy landowner in the Riverina, passed away before plans to purchase an aircraft for the race had been finalised.

In the disappointing days that followed however, a glimmer of employment hope was forthcoming. While in Melbourne to complete formalities with the Army, McGinness had a chance meeting with Major General James Legge, a superior McGinness had served under and personally knew well from his war service in Egypt and the Sinai. After hearing of the now thwarted plans to enter the Great Air Race, Legge offered McGinness re-employment in the Army to take on a special job. The details were yet to be fully fleshed out, however the brief was to take a motor vehicle and make a ground survey of the proposed Great Air Race route in the remote section between Longreach and Darwin. The key objectives were to find navigation markers for the aviators, decide where refuelling stops would be set up and most importantly look for and prepare emergency landing sites along the route for the competitors. McGinness



immediately began planning for the expedition and enlisted the help of his war-time friend Hudson Fysh DFC. The job seemed simple enough on the face of it, but with so little known about the true nature of the country in question, it would take all their skills and experience to survive the mission.

The two men would drive a Model T Ford north from Longreach through Winton, Cloncurry and on to Burketown, before turning north west and following Leichhardt's Track to Borroloola and then on to Darwin. It is the section from Burketown to Borroloola that would test the men to their limits and define this remarkable drive.

As Fysh and McGinness prepared for the journey in August 1919, they were becoming increasingly aware that they would be the first along the track, optimistically marked on their Army survey maps, for more than 20 years. The route followed the course taken by Prussian explorer Ludwig Leichhardt in 1845, and later by a hand-full of gold seekers in the 1890s. If they survived, McGinness and Fysh would be the first to successfully cross this northernmost part of Australia by motor vehicle.

The Department of the Army provided McGinness and Fysh with a new Model T Ford and provisions for the trip. The small Ford utility was railed out from Brisbane to Longreach where McGinness would take charge of the vehicle for the expedition ahead.

The Model T was a reliable, robust and flexible vehicle, and had served the Army well during WWI, so it was ideally suited to the task ahead. Before leaving Longreach, McGinness employed a local man, George Gorham, to go along as mechanic and provide extra muscle when needed, meaning the two-seater car had to carry three men and their gear.

The Ford arrived at Longreach Rail Station in mid-August and was taken to Longreach Motors. On its train journey from Brisbane all the tools and some of its parts had disappeared, so a full service was arranged. Once ready for the track, the car was packed with camping equipment, food and other stores to last two weeks, sleeping gear, water bottles and water for the car to last up to three days, shovels, an axe, cooking utensils, rifles and ammunition. They also carried an old movie camera and rolls of film, as well as chewing tobacco, mirrors, white cotton shirts, beads and large rolls of calico to share with the locals in exchange for their help if needed. With cans of petrol fastened into special carrying racks, six new spare tyres and a large box of spare parts, the car was heavily loaded.

Using a still camera as well as the second-hand film camera, Fysh would record, photograph, film and sketch

**ABOVE** Hudson Fysh DFC and Paul McGinness DCM DFC.

**OPPOSITE TOP** George Gorham, Paul McGinness and Hudson Fysh with the heavily loaded Model T Ford outside Longreach Motors on 18 August 1919.

**LEFT** Extract from telegraph book, dated 18 August 1919: Departing Longreach for Cloncurry.

the expedition. While Fysh's writings and several of the original photographs survive, unfortunately the film of the remarkable trip had disappeared by the 1960s.

To maintain contact with Major General Legge, McGinness had been issued a telegraphic machine to tap into telegraph lines, where they existed, and send back regular reports to the Army. Each message had to be recorded in a telegraph book and presented at the next post office they passed so payment could be made for using the telegraph line. Today that book provides a unique insight to the challenging events encountered during the expedition.

What the two airmen discovered in the weeks that followed was that the country north and west of Winton and Longreach was vast, unforgiving and perilous to traverse. As they witnessed the extremes and harshness confronting those who lived and worked in the outback, the embryo of an idea was conceived – an aerial service in the bush to provide a lifeline of fast and reliable transport, news, mail, medicine and supplies.

A little over 12 months later McGinness and Fysh would win their own air race of sorts when they established a flying business based in Longreach called the Queensland and Northern Territory Aerial Services Ltd – or as it would come to be known, QANTAS.

The men completed the mission, driving 2,200km from Longreach to Katherine where they and the Ford were loaded on a train, finally arriving in Darwin on 12 October, in time to prepare a landing ground at Fannie Bay for the arrival of the victorious Vickers Vimy on 10 December. The Army had gauged the drive should take 14 days, in the end it had taken 51.

## RECREATING HISTORY

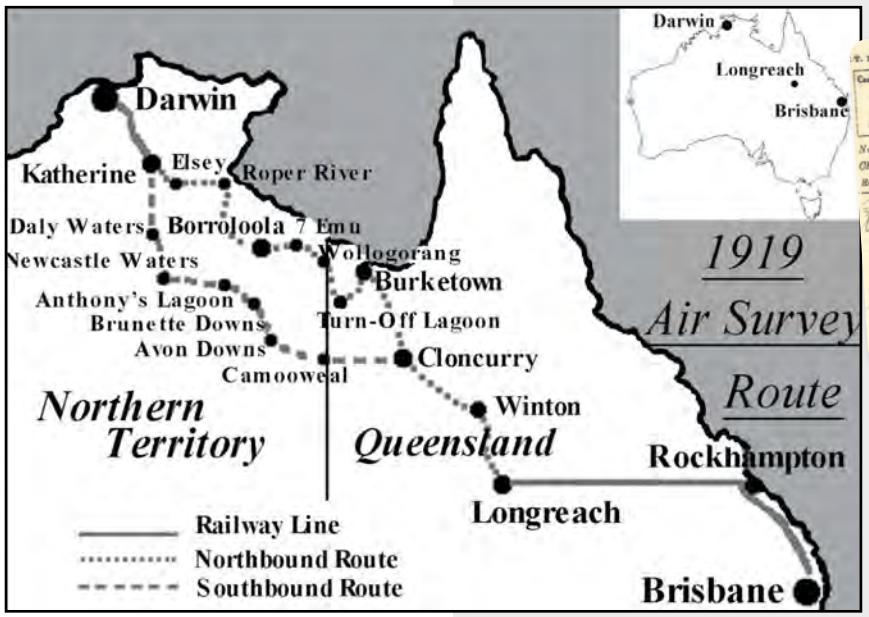
On the 90th anniversary of McGinness' expedition, the author, along with a small group of volunteers, set about recreating the drive in a restored and identical 1919 Model T Ford. Our aim was to follow the exact route, overnight in the same places and construct a documentary about a forgotten and obscure footnote in Australia's aviation heritage. Like Fysh, McGinness and Gorham, we found the first days of the trip long but easy. It was not until after leaving Burketown that we began to truly understand what the original trio had endured.

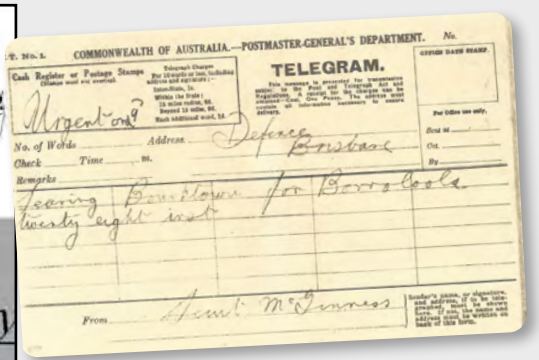
Much about the original journey is described in Fysh's book *Qantas Rising* and in a lesser-known article for *Life* magazine in 1920-21, entitled "Fording it across Australia". In his personal style, Fysh describes the section from Burketown to Borroloola in intricate detail, telling of the struggles and triumphs of crossing each sandy stretch, creek and river. He is laconic and downplays each event, but even for men recently seasoned by months of fighting at Gallipoli and the survival of an air war in the Sinai, this was still a test of survival.

Fysh writes that 350 miles (560km) of the journey had been declared impassable for a car and the stretch into Borroloola included: "190 miles, [of which] 87 miles of soft sand had to be negotiated, and over 100 miles of it had to be done in bottom gear. For 30 miles of it the car was actually pulled by horses. Six tidal rivers and over 40 creeks were crossed."

The landscape through which they travelled was a mix of sandy scrub and tidal waterways that empty into the Gulf of Carpentaria. McGinness realised early there was no possibility of clearing landing fields in such inhospitable terrain and a more southerly route for the Great Air Race flyers would have to be found. That though was a problem for later, now the mission was one of survival.

As luck would have it, a drover by the name of Higgins was also trying to get through to Borroloola with a group of horses. The outback motorists met up with him on the trail to Calvert River, some 150km east of Borroloola. Higgins, realising the optimism of attempting to drive a motor vehicle through the region, gave them two horses, which he considered likely to save their lives. Without those strong animals to help pull the Ford across rivers and out of sandy bogs, there





COMMONWEALTH OF AUSTRALIA.—POSTMASTER-GENERAL'S DEPARTMENT.

TELEGRAM.

Urgent
Defence Brisbane
leaving Burketown for Borroloola
twenty eight inst
From Henl. McGinness

**ABOVE** Extract from telegraph book dated 28 August 1919: Departing Burketown for Borroloola.

**LEFT** Map of the route from Longreach to Darwin, and back to Cloncurry.

**LEFT** The re-enactment team with their restored 1919 Model T Ford, preparing for departure 18 August 2009.

was probably little chance of success. The chance meeting probably did keep them alive, but if life teaches us anything, it is that every silver lining is surrounded by a cloud. While the horses provided much needed power, they also consumed one of their most valuable resources – fresh water.

Approaching the wide and sandy based Calvert River, the trail became indistinguishable, the sandy ground became softer and progress slowed to around 10km per day. The radiator of the Model T frequently boiled from the never-ending strain on its 20HP engine and required constant replenishment. The men straining in the sweltering heat and the horses, working hard pulling the heavily laden Ford up steep riverbanks and through miles of soft sand, quickly consumed what fresh water they could carry. By 13 September the situation had become dire. Still nearly 150km, and more than a week away from Borroloola, the men were forced to dig in the bed of a dried-up creek in hope of finding drinkable water. Fysh took a grainy photo of the moment McGinness finally struck the liquid gold some five feet below the surface. Their immediate danger had passed.

As we discovered re-enacting the drive, the trail is difficult enough to follow even with modern technology. Despite the benefit of GPS navigation and more recent mapping, it was a struggle to find a path and remain roughly on the track in our 90-year-old car. In preparing to redrive the route we could only surmise that Fysh, McGinness and Gorham had stayed on Leichhardt's track most of the time with reasonable accuracy. In reality, it is likely they criss-crossed and paralleled it much of the time, navigating by only compass bearings and following the path of least resistance through the scrub. In his writings, Fysh makes mention of the occasional stone cairn they hoped would be available as trail markers, but even these had long disappeared into the undergrowth.

Sometime around 15 September, the trio passed through the newly formed Seven Emus Station. On our re-enactment journey we sat down with the station manager and asked if he knew of any contact the then owners might have had with McGinness, Fysh and Gorham. The manager told us he had been born on the property and his father had worked there from the beginning. He was sure the motoring trio had never visited the station house. Further investigation determined that, likely unaware of the homestead's existence, they had passed less than 2km to the north. A statement in Fysh's diary about gold rush ruins they saw when crossing the Robinson River pinpointed their position. That confirmed just how close they had come to much needed help. Had they known of the small outpost, the men would have found a generous oasis of fresh food, water and a place to do proper repairs to the now heavily damaged Model T. Instead, they laboured on short of supplies until finally arriving in Borroloola several days later, on 21 September.

The Model T was always conceived as a car for the people. Henry Ford had grown up in a simple but poor farming community. His invention was designed to transport the family to town and church on Sunday and work hard on the land the rest of the week. Built of robust vanadium steel, its flexible frame and simple design meant the average handyman could rebuild and repair the machine with rudimentary tools and use ingenious substitutes for spare parts if required. Despite this, Henry had not made it bullet-proof. Frequent impacts with hidden rocks and fallen trees meant the front of McGinness and Fysh's Model T was taking a pounding. On more than one occasion the whole front end had to be pulled apart so the axle and radius rods could be beaten straight with an axe against a tree – an outback wheel alignment circa 1919.

Their spare tyres and tubes had been used up and the 30-by-3-inch tyres normally pressurised with 75 PSI of air were now stuffed with grass and mud to keep the car moving. On the steep climb-outs from the riverbeds, fuel from the petrol tank mounted under the seat would stop running to the engine. In one further act of ingenuity, the men began pressurising the fuel tank with their tyre pump to scavenge every last drop of fuel from the gravity-fed system.

The team had left Burketown with as much fuel as they could carry – some 48 gallons (approximately 220 litres). But now covering only around 10-15km per day in hard-going terrain, it would be a miracle if that was enough to get them through. Finally, 25 days after leaving

**TOP** Gorham steering, McGinness by the front wheel and several helpers who keep the Model T moving.

**ABOVE** McGinness in the saddle and Gorham at the wheel. Higgins' horses working to cross a creek bed at low tide.

**OPPOSITE TOP** Ninety years on and the track remains the same.

**OPPOSITE BELOW** Trying to avoid front-end damage is a daily affair 90 years on.

Burketown, McGinness, Fysh, Gorham and their enduring Model T arrived unceremoniously in Borroloola. The last few miles witnessed the wounded Ford being pushed by volunteer townsfolk up the long and steep riverbank and down the main street of the tiny town.

The list of damages included a split radiator, a broken fan and bent steering shaft, front axle and locating radius rods. It was undriveable. The men enlisted the help of a Mr Warren, an inventive blacksmith with a full workshop including a bellows-powered forge, to take on the job of rebuilding the Ford. It took four days to enact sufficient repairs to make the car mobile again under its own power.

McGinness' diary chronicles the trip on to Katherine in the Northern Territory through Bauhinia Downs, Hodson Station, Roper Bar and a property already made famous in Jeannie Gunn's 1908 novel *We of the Never Never*, Elsey Station. While little more than bush tracks, the roads on to Katherine were relatively easy going compared to what the team had covered. They had completed the hardest part of the journey and had become the first men to drive across the top of Australia.

From Borroloola on, McGinness and Fysh could again take time to scout for areas that could be used for landing fields. By now though there was no doubt that the air route for the race would have to be much further south. The loss of so many days traversing Leichhardt's track now made time the enemy. The first aircraft were expected to start arriving in Darwin from late November and at this stage no real progress had been made on surveying the air route to follow to Longreach, nor had any work been done on preparing a landing field in Darwin.

The Model T drove its last full day of the mission on 8 October, arriving safely at the Katherine Rail Station. Here for the first time since leaving Burketown, McGinness could make contact with Major General Legge and supply a complete report to the Army. At the conclusion of the report, McGinness told Legge that he would soon leave Darwin, proceed back to Katherine and would then be "striking out south east to Mataranka. Follow the telegraph line south, which can be clearly seen from the air, having a wide cleared belt on either side, to Newcastle Waters, thence striking out to Anthony's Lagoon, south east to Avon Downs, on then to Cloncurry via Camooweal."

In Darwin the team split up. Fysh remained to oversee clearing of the site chosen for Darwin's first airfield and to greet the Air Race competitors, while McGinness and Gorham climbed back into the Model T to return to Cloncurry and prepare several stopping off points for the aviators along the way. McGinness and Gorham work feverously, selecting sites, clearing land and marking the landing fields for the pilots. At each stop, McGinness sent navigation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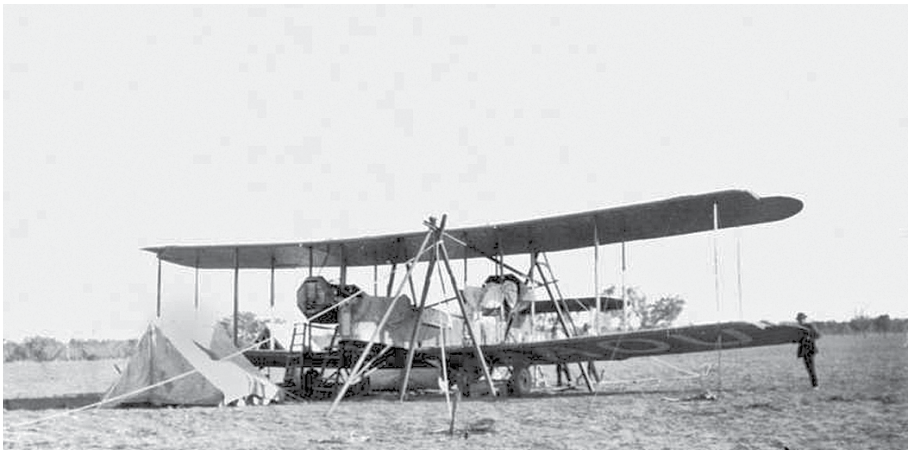



**TOP** Vickers Vimy undergoing further repairs in Cloncurry after suffering a catastrophic propeller failure.

**ABOVE** An airline is born – head office of QANTAS, Longreach, 1921.

instructions to Fysh which he was to pass on to the aviators as they arrived in Darwin. Once back in Cloncurry, Gorham was paid for his employment and returned to Longreach – with many stories to tell. Fysh awaited the arrival of the eventual winners of the race, Ross and Keith Smith, James Bennet and Walter Shiers in their Vickers Vimy, before hitching a ride back to Longreach in a different Model T.

To McGinness fell one more important task. After departing Darwin, the Vimy suffered a catastrophic propeller failure, likely caused weeks earlier by bird-strike damage on take-off from Calcutta, and was forced down somewhere south of Newcastle Waters. When it becames apparent the fliers were missing, Legge enlisted McGinness to conduct a search for the lost aircraft. Within a few days the Vimy and her crew had undertaken temporary repairs and continued on to Melbourne to claim victory – and the £10,000 prize.

Our re-enactment in 2009 gave us a humbling insight into the drive taken by Fysh, McGinness and Gorham. We gained a perspective unattainable from books and unmeasured for so many years. The Model T Ford we used in the drive, and affectionately named Molly, was returned to the Qantas Founders Museum in Longreach. After some not unsubstantial repairs, it proudly sits today both a testament to its inventor and a tribute to three men who completed a near-impossible mission.

The mission, while only a footnote in aviation history, is remarkable for its legacy. Out of that drive came an idea for an aerial service. Out of that aerial service grew a changed way of life for the western Queensland communities as well as the support needed for the beginnings of the Royal Flying Doctors Service.

Ultimately, this was the drive that started an airline. A mission lost in history, but remembered by those who have worked for, and those who have proudly worn the wings of Qantas.

*Don Hill, Qantas Pilot & Director, Qantas Founders Museum*

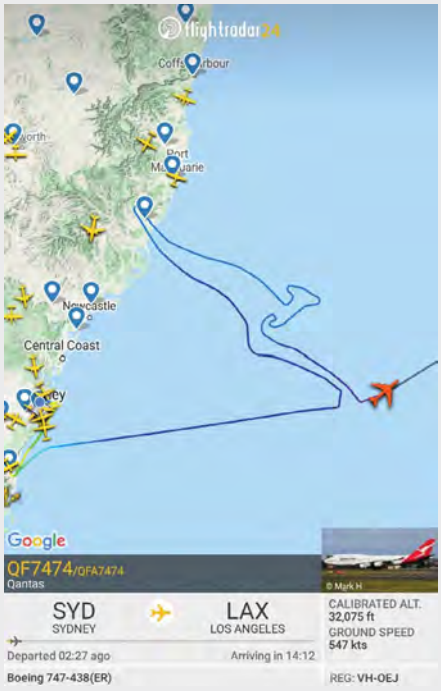
# LAST QANTAS 747-400 FLIGHT

**As Qantas celebrates its centenary year, the company has finally retired the airliner that served it for half the airline's life: the Boeing 747.**

**On 13, 15 and 17 July, Qantas farewelled its last remaining jumbo jet (VH-OEJ, a 747-438ER variant) with "jumbo joyflights" over Sydney, Brisbane and Canberra. A Melbourne flight was cancelled due to the virus pandemic. All of the $400 economy and $747 business class tickets quickly sold.**

**When the first jumbo entered Qantas service in September 1971, Billy McMahon was Australia's prime minister and the one-way airfare between London and Sydney was £276. Eventually more than 60 747s of all types were purchased by Qantas.**

**On 22 July 2020, VH-OEJ departed Sydney for storage in the Mojave Desert and painted a legacy tribute on flight-tracking aps for eternity.**

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The ACCEL electric aircraft.
Photo: : Rolls-Royce.

# THE POWER BEHIND FUTURE AVIATION

## FROM PILOTLESS ELECTRIC AIR TAXIS TO HYPERSONIC FLIGHT, ROLLS-ROYCE SEES EXCITING TIMES AHEAD IN THE EVOLUTION OF AVIATION PROPULSION.

**MORE THAN 100,000** flights took off every day last year. For many, the ability to get on a plane and travel almost anywhere in the world is taken for granted and for some it has become routine. But the recent sharp restrictions on flying due to the global COVID-19 crisis has caused many of us to rethink the value of numerous elements of our lives, including the role of aviation.

Some predict digital connectivity could reduce the need for regular travel. Certainly, we will see a change in the travel patterns going forward. However, there is no doubt that over the past few months all of us will have experienced the exasperation of technology failures, poor connection and the desire for personal engagement. For those reasons we will continue to see the aerospace industry, vital for global connectivity, develop and rise to future challenges such as mitigating its cabon footprint.

Since the first Eagle engines produced by Rolls-Royce in 1915, aviation propulsion has steadily evolved to deliver higher power and more efficiency, and adopt new technology. We witnessed that evolution with the shift from the radial piston engine to the axial gas turbine – the technology that now transports us around the world. We are now progressing to more electrification.

In civil aviation, evolutionary technological advances are driven by a need for cost efficiency and more recently a desire to minimise carbon dioxide emissions. Disruptive advances such as electrification are also revealing new market opportunities, such as the prospect of pilotless air taxis and delivery drones.

In military aviation, the demand for more advanced sensing and data integration, greater flexibility and simpler logistics has spawned new technological innovations and increasingly high-performance systems. As those new capabilities are developed, however, the industry continues to strive to maintain its gold standard in safety.

Electrification can play a role in all areas of aerospace, from all-electric trainer aircraft to hybrid-electric regional platforms to large electric aircraft, both for civil and military applications. The use of electrical power opens up a range of design opportunities to aerospace engineers.

What is electrification in aerospace? Essentially, it is progressively more powerful electrical systems, either for aircraft propulsion, or to power mission

equipment. Pure electric aircraft will contain a static source of electric power, usually a battery. Hybrid-electric platforms will also contain a mechanical generator, most likely a gas turbine, as in conventional aircraft. The gas turbine will primarily drive a generator to produce electrical power instead of direct thrust.

The electric power from either the battery or the gas turbine-generator set will drive motors, coupled to propellers or ducted fans producing thrust to move the aircraft. The hybrid configuration allows scope for either all-electric operation, for example in urban areas where noise reduction and limiting emissions are more important, or operation powered by the gas turbine where range extension is required. The dual motive power source in hybrid-electric aircraft also provides increased redundancy over an all-electric platform.

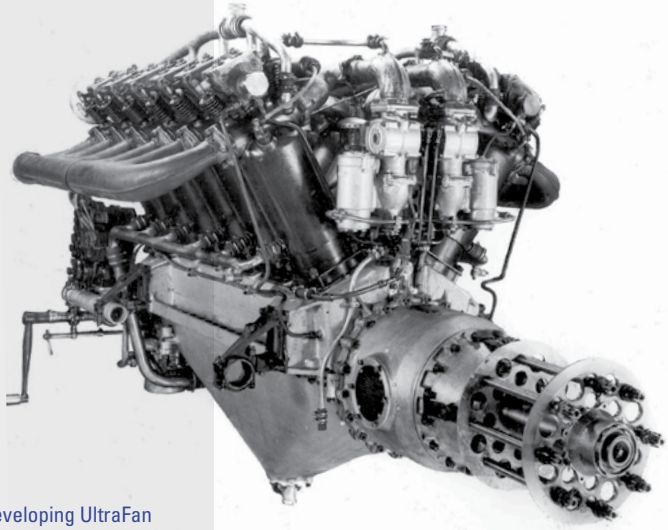
Electrification has suddenly taken off in aviation due to the rapid advances in electrical generation and storage, partially as a result of the electric car market. Increasingly more power and energy-dense electrical equipment has reached the threshold at which the electrification benefits outweigh the increased total system mass. But electrical power sources can't quite compete with kerosene yet. In fact, kerosene still has about 30 times the energy density of even a high-power battery. Because of that, electric aircraft will have a much shorter range compared to an equivalent gas turbine powered aircraft. Electric power, generated from low-carbon sources, will find a niche in short range operations and satisfy both acoustic and emission concerns. Electrification, also yields considerable free space in the platform for functional exploitation.

Those factors have created new transportation possibilities. Distributed propellers/rotors powered electrically rather than mechanically allow significantly quieter operation, meaning those platforms could be used in populated urban areas without unacceptable noise pollution. New aircraft designs with distributed propellers offer much more platform stability over the notoriously difficult to fly helicopters, allowing remote/autonomous control and unmanned operation. It is highly probable that the first air taxis will be pilotless platforms known as eVTOLs (electrical vertical take off and landing) vehicles being developed for the urban air mobility market.

Unmanned platforms are used today in military operations, and the widespread availability of unmanned eVTOL-type vehicles has the potential to revolutionise transport of personnel and equipment, freeing up pilots to engage in combat operations. Quieter operation of eVTOLs compared to helicopters would also provide acoustic stealth advantages in some combat environments.

There are three key major challenges for broad electrical systems application to aviation: thermal management, storage reliability, and safety and weight.

Thermal management is key to the safety and durability of electrical equipment. High-power electrical energy transmission generates heat due to electrical resistance in the transmission medium, wire. Decreasing the current while maintaining constant power requires a proportional increase in the required voltage. Although high-voltage systems are common for ground operations, faults occur in medium-to-high voltage systems at high altitude, due to the low pressure environment. The relationship of what is termed "breakdown voltage" and pressure is



**RIGHT** Eagle engine.

**BELOW** Rolls-Royce is developing UltraFan high-bypass-ratio engines.


Concord with a Battle of Britain Spitfire over the White Cliffs of Dover.

known as Paschen's Law. Therefore, distributing high-energy electrical power at altitude remains a significant thermal management challenge.

The aviation industry's excellent safety record has set a high bar for new technology adoption, and it is vital to ensure new platforms are able to meet the high industry reliability standards, and this poses another major challenge. Examples of battery failures and fires on demonstrators, and even in-service aircraft, have been reported, and would be unacceptable in a fully electrified aircraft. Mitigation measures to satisfy reliability and aviation safety standards would add to system complexity and weight. Safe and reliable electrical storage and transmission remains a challenge.

The power-to-weight ration of current electrical storage systems is not conducive to aviation applications. Similarly, high-energy distribution requires wires with higher cross sectional area, which also increases the weight penalty and more highly distributed systems require significant lengths of cabling. Additionally, ensuring that failure or malfunction of those systems is safety contained introduces another challenge to system mass.

It is these challenges, among others, that engineers are solving now. Rolls-Royce expects all-electric and hybrid-electric propulsion to play a significant role in the future of short-haul commercial flights and in military operations, and large aircraft to become increasingly more electric.

In all forms of transport, high speed is seen as a measure of success and one of the trendiest directions for technological advancement.

In the world of electric flight, the ACCEL aircraft is targeting the world all-electric flying speed record. Its high-power batteries are able to propel it to over 480kph – although that remains comfortably under half the speed of sound. While electrical power from a battery has its advantages, it doesn't come close to matching kerosene with regards to power; liquid fuel is required to meet the high thrust requirements for supersonic and hypersonic flight.

One of the most famous aircraft, Concorde could reach about twice the speed of sound. The limiting factor was not the power of its Olympus engine but the maximum tolerable skin temperature of the aircraft, which reached over 127°C in some areas.

## BEYOND MACH 2

Research is ongoing to move beyond supersonic speed to hypersonic, defined as over five times the speed of sound. One small company, Reaction Engines has developed a system able to cool 1,000°C air at the inlet to ambient temperature before reaching the engine.

**BELOW** CityAirbus.

That development will allow the platform to reach hypersonic speeds without melting the engine core in the process.

One problem with speed is that, generally, the faster you go, the less efficient you will be. And for the majority of aircraft applications, there is far greater emphasis on platform efficiency than there is on speed.

## ENERGY EFFICIENCY

Increasing efficiency will also reduce emissions. Although the CO2 emissions from aviation amount to only 2-3% of total global emissions, there is significant focus on the aerospace industry as a global contributor to climate change. In response, the industry has set itself a challenging target of increasing the platform efficiency by an average of 1.5% per year to reduce the amount of fossil fuels burned – about 1% of that needs to come from engine efficiency, and the rest from the integrated platform. That means the engines in 2050 will need to be 30% more efficient than those flying today.

There is also an economic driver of efficiency. A significant proportion of the operating cost of airline operation is fuel, therefore any platform that reduces fuel burn will save cost. That element becomes more vital as the aviation industry looks to more sustainable fuels, which are more expensive to produce than fossil-based kerosene.

Increasing the amount of air flowing around the core of the engine – the bypass air – compared to that going through the engine core, increases the efficiency of the engine and is the reason we see larger and larger diameter engines in service today.

As with electrical propulsion, the new era of high-bypass-ratio engines is facilitated in key technological improvements, including materials technology. Rolls-Royce next generation engine fits into an UltraFan™ family and has a bypass ratio three times that of engines in service in the early 2000s. Each individual fan blade is taller than the average person. The massive diameter means that the fan can turn comparatively slowly to push the same amount of air as other engines and that, coincidentally, reduces engine noise.

Efficiency is also vital for military platforms in order to extend their range and loiter capabilities, particularly when mission requirements have a significant emphasis on reconnaissance. Unlike civil engines, military engines often have a focus on platform manoeuvrability, and that limits the size of the fan compared to the rest of the engine.

Consequently, military combat platforms rely more on the second main method of increasing engine efficiency; increasing the temperature of the engine core. Significant developments in technologies that enable higher core temperatures are another key factor in improving engine efficiencies.

## THE FUTURE

It's clear the future of aviation propulsion is exciting, and Rolls-Royce is working at the cutting edge of technology to accelerate future possibilities into reality. Watch out for the highly efficient UltraFan™ engine, eVTOL air taxis and for hypersonic platforms.

*Jessica Poole & Paul Stein*
*Rolls-Royce Plc*

# WARHAWKS AGAINST THE ONSLAUGHT

WORDS David Armstrong

CONTINUING THE STORY OF THE BATTLE OF DARWIN, USAAF 33RD PURSUIT SQUADRON RETURNS TO THE CITY ON 19 FEBRUARY 1942, UNAWARE IT IS ABOUT TO BE DRAWN INTO A BLOODY DOGFIGHT – THE FIRST AIR COMBAT OVER THE AUSTRALIAN MAINLAND.

**RETURNING TO DARWIN** after an aborted attempt to position to Java, the inexperienced pilots of the USAAF 33rd Pursuit Squadron became embroiled in a desperate battle to protect the city.

Arriving over Darwin at around 0945, Major Floyd Pell split the formation into A and B Flights. A Flight, under his command, proceeded to land and refuel at RAAF Field – the main airstrip at Darwin that ran through the modern-day suburbs of Parap and Fannie Bay and is now Ross Smith Avenue. B Flight, under Second Lieutenant Jack Peres, along with Second Lieutenants William Walker, Max Wieckes, Elton Perry and Robert Oestreicher, were to patrol overhead. B flight flew a four-plane patrol while Oestreicher acted as a sweeper above them – a tactic used by US pilots early in the Pacific War but later discontinued.

## OESTREICHER & PERES

The morning was beautiful, with a light breeze, blue skies and some cloud, as B Flight watched the A Flight P-40s line up at the side of RAAF Field below. With A Flight safely down, Peres started his preparations for landing and Oestreicher assumed command of B Flight in the air. The time was 0955 and Oestreicher, who was still well above the other members of B Flight at approximately 15,000ft watched on as Peres and Perry started their descent followed by Wieckes and Walker.

Ten minutes earlier, the lead Japanese Zeros, just ahead of the main strike force, had engaged a US PBY Catalina flying boat above Bathurst Island (part of the Tiwi Group, 80km north of Darwin) and shot it down. The pilot, Lieutenant Moorer, survived the surprise attack and crash landing near the Tiwis. He went on to achieve the rank of Admiral and served as Chairman of the Joint Chiefs of Staff before war's end.

Just as A Flight had landed, the lead Japanese fighters arrived over Darwin ahead of the main bomber group and, seeing the patrolling P-40s below, pounced. The distinct height advantage encouraged the experienced Zero

**LEFT** Mitsubishi A6M2 Zero, armed with two 7.7mm machine guns and two 20mm cannon.

**FAR LEFT** Darwin city today with Fannie Bay and East Point in the background. The Parap Field is now Ross Smith Avenue (behind the two larger buildings rear of picture).

pilot Petty Officer 1st Class Yoshikazu Nagahama (also responsible for the direct attack on the PBY over Bathurst Island) as he dove to the attack. Both A and B Flights remained oblivious to the presence of the Zeros and continued either taxing, refuelling or preparing to land.

Moments before the patrolling B Flight pilots encountered substantial enemy action, Peres was shot down either on approach as the first B Flight aircraft to line up to land (some research suggests his aircraft had become problematic in flight) or just after taking off with A Flight once they were scrambled moments later (that is, he had already landed). However, according to Oestreicher, Peres had not landed at that stage. There are reports substantiating both scenarios, regardless, his wreckage remains where it was found in September 1942, at Tree Point near Hope Inlet not far from Darwin city and Fannie Bay. Troops identified his body by the engraving on his wristwatch (later returned to his mother in the US).

Seconds before, as Oestreicher scanned the skies above, he glanced over his left shoulder and to his horror, saw a single plane diving towards him, large red Hinomaru national insignia clearly visible on its wings. He screamed into his mic "Zeros, Zeros, Zeros!", jettisoned his drop tank and immediately dove away to gain vital speed before climbing towards the sun.

As he gained altitude, he was able to fire briefly on a Zero. It quickly rolled and gained the positional advantage, firing back on him, and he momentarily lost control of his P-40 as he twisted away. He regained control at about 4,000ft and again climbed to around 12,000ft, the powerful Allison engine of the P-40 screaming as Oestreicher tried for a height advantage, at the same time calling for B Flight to head for the clouds. There was no response – B Flight were already in a fight for survival.

## PERRY, WIECKS & WALKER

The other B Flight P-40s had attempted to follow Oestreicher, but Nagahama was too quick. In seconds, he had shot down Perry in aircraft #51, which was seen crashing into the sea about 1km off Casuarina Beach. He is now considered the first pilot killed over mainland Australia (although some accounts suggest Peres holds that tragic honour). Peres' aircraft #189 was hammered by Nagahama and he peeled away in a low shallow dive, crashing on the far side of Hope Inlet east of Fannie Bay.

There was now a full-blown dogfight developing and enough confusion to push the inexperienced young pilots into a fight for survival. Wieckes found himself surrounded by "wild and frenzied" air action, his P-40 riddled with bullets and virtually unresponsive. He was forced to bail out at a low level and seconds later heard the thud of his aircraft hitting the water. Wiecks stated that he initially knew things were not right when he saw Perry (immediately ahead of him) unexpectedly pull out of formation: "Another plane cut between us and this one had a large red insignia. I turned on my gun rheostat and tried to get behind him but before I could fire, I saw the Zero putting strikes on [Perry]."

After exiting his aircraft at about 4,500ft with some difficulty due to excessive airframe vibration, Wiecks descended under the chute unmolested, landing approximately 6km out to sea. Momentarily pulled along the surface by his chute and buzzed by a menacing Zero, Wieckes floated all day in his Mae West off the coast of Fannie Bay. Finally, he was washed up at East Point where he then walked back to RAAF Field, parachute slung over his shoulder.

Nagahama weaved through B Flight, firing at everything in front of him and carving up the Americans. Apart from shots on Oestreicher and downing Peres, Perry and Wieckes, he also seriously damaged the plane flown by Walker (#46). Barely out of flight school, under incredible pressure for a first combat experience, Walker was unable to shake the Japanese pilot. Badly wounded with a damaged aircraft, with no height to play with, he barely managed to crash-land his mangled plane back at RAAF Field.

Likely adding to the confusion and turmoil of combat was the requirement for P-40 pilots to activate and engage a hydraulic priming system for their gun firing mechanisms. Some aircraft had the priming system bypassed (a task performed by willing ground crew), so the guns were ready to go from the moment the aircraft was airborne. Unfortunately, in that case, a jam meant the pilot could not re-arm his guns inflight and would have to land and have ground crew perform the task. It is unclear if this was the case with the P-40Es of the 33rd, but it is a factor Oestreicher mentioned in his report.

## PELL

On the ground, Major Pell waiting in the shade of the wing of his just landed P-40 heard over the aircraft radio Oestreicher's call of "Zeros, Zeros, Zeros". He immediately ordered his men to work up their aircraft and scramble. P-40s required a sustainable oil pressure to be reached before full power could be applied, and although Pell's A Flight aircraft were still warm, there would be some minor delay before take-off.

A pilot was considerably more aware of his mortality by his mid to late 20s, the ages of those in the 33rd, so their






response was remarkable – there was no hesitation. Pell was first up (in the commandeered P-40 #28) with 2nd Lt Charlie Hughes (in #94) right behind him. Pell desperately tried to gain speed and height and was seen zig-zagging frantically in an effort to avoid fire by a flight of three Zeros, under the command of Lieutenant Shigeru Mori, from the Imperial Japanese Navy aircraft carrier *Hiryu*.

After taking considerable hits from Mori, at around 130ft altitude and 15km east of the northern end of the airfield, Pell bailed out over Cameron's Beach (close to the entrance of the Howard River and not too far from Peres' crash site). His P-40 crashed into a mud flat, Pell landing close to the wreckage. A gunner (Sergeant Les Bushby 19th Machine Gun Regiment) from a nearby anti-aircraft battery raced to the scene to find Pell deceased, although his parachute had opened.

The Zero that brought Pell down then flew a strafing run over the wreck at ground level, cannon firing causing Bushby to dive for cover.

## HUGHES, RICE & GLOVER

Hughes, after being strafed on take-off, managed to escape a pursuing Zero by flying hard and fast at treetop level. However, the experienced Japanese pilot banked hard and was on the tail of the P-40 within seconds. Hughes' aircraft, riddled with bullets and trailing smoke, banked slightly and slammed into the bush just north of the airstrip, killing him instantly.

2nd Lt. Burt Rice (in #31) got airborne but was immediately engaged by the marauding Zeros. He managed to climb to around 3,000ft before gaining enough speed from a shallow dive at full throttle to get clear of the incoming fire. He tried to gain height once again but was outflanked by the Japanese who had gained on him in a tight turn. Machine gun and cannon fire slammed into Rice's P-40, smashing the elevator control system. In a split second, he decided to get out, released his harness, pushed up and rolled over the side of his aircraft. As he fell past the tail his head glanced the fin, badly damaging his right eye.

2nd Lt John Glover in #36 was seconds behind Rice, frantically trying to pinpoint the Zeros overhead as he raced down the runway, colliding with a 44-gallon barrel at the side of the strip. Incredibly, he regained control of the now bucking aircraft, pulled back on the stick and roared into the air. He banked hard to the northeast gaining height to around 4,000ft, then turned right to the east before accelerating in a shallow climb. He noticed a parachute being fired on by three Zeros below, and immediately dove into attack. In his later report, Glover says he made strikes on the closest Zero and thought that it had exploded – although as he had banked away, he could not be sure. He then started to fly a protective orbit around the pilot in the chute whom he now recognised as his good friend Burt Rice.

As Rice hit the water alive, Glover

broke off in an attempt to lead the still attacking Zeros back over RAAF Field and hopefully through a line of fire from the Australian machine gun crew stationed at the end of the strip. The Zeros gained on him and were making hits on his P-40. He was now at tree-top level and at full power. Furiously glancing left and right over his shoulder and weaving as best he could, he flew through a canopy of tall gum trees at the northeast boundary of the field. His starboard wing was ripped off and he skipped and then cartwheeled along a cleared area at the end of the runway. Miraculously, Glover managed to get himself clear of the wreckage, falling into the arms of the Australian gunners who had run to his aid. Suffering a severe gash that ran from his forehead to his chest, he needed to be dragged to the relative safety of the gunner's nest.

## MCMAHON

2nd Lt Bob McMahon (in #22) managed to get airborne as well, just avoiding the incoming Walker from B Flight who was trying to land his shot-up P-40. As the dogfight reached its peak with Zeros swarming all over, he stayed low and fast, sliding directly under a passing Zero, and at full power headed northeast over Fannie Bay. He witnessed a low opening chute to his left (likely Pell over Cameron's Beach), as he turned sharply in an attempt to get onto the Zero he had narrowly avoided seconds before.

McMahon gained some initial altitude but was embroiled in a swarm of Zeros which were by then ordered to 'hunt and kill' any allied aircraft in the vicinity.

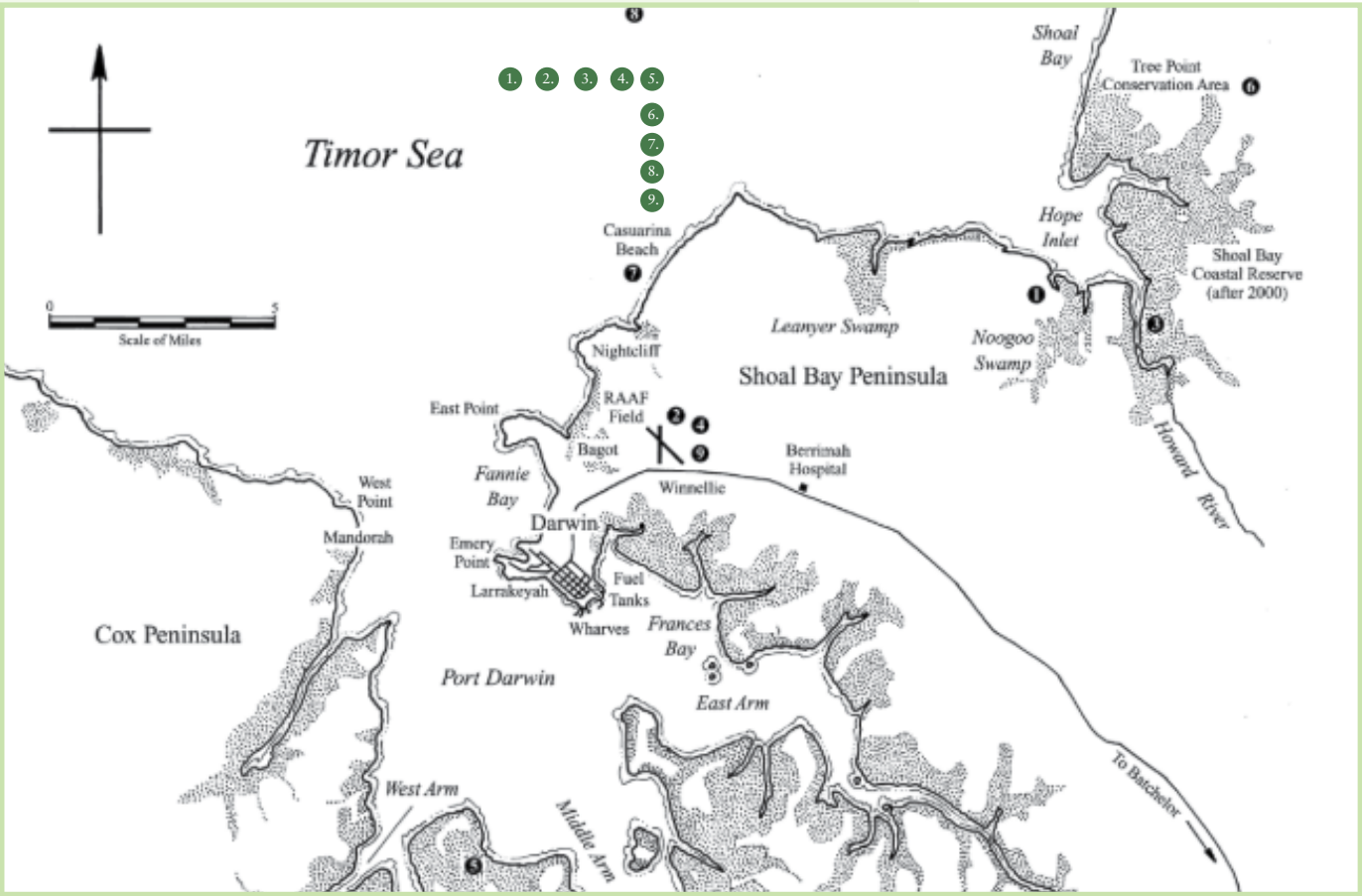
The skies over Darwin Harbour and nearby Fannie Bay were awash with swarming Zeros chasing down the embattled P-40s, but McMahon managed to again pull tight and close, and was now heading directly towards an incoming Zero. Both pilots fired at each other, and McMahon saw his tracers strike the Zero. As they closed to within 500m, he saw part of the

**ABOVE**
2nd Lt Bob McMahon's P-40E (#22).

**TOP LEFT**
AIF personnel at Pell's crash site on Cameron's Beach. Photo: S. Johnston.




**FROM FAR LEFT**
2nd Lt Jack Peres,
2nd Lt Elton Perry,
2nd Lt Max Wiecks,
2nd Lt William Walker,
Major Floyd Pell,
2nd Lt Burt Rice,
2nd Lt Charlie Hughes,
2nd Lt John Glover,
2nd Lt Bob McMahon,
2nd Lt Robert Oestreicher.




*Locations of Downed P-40s at Darwin, February 19, 1942. 1. Pell; 2. Hughes; 3. Rice; 4. Glover; 5. McMahon; 6. Peres; 7. Perry; 8. Wiecks; 9. Walker (strafed on ground). Locations courtesy Shane Johnston.*

**ABOVE** Walker's P-40 shortly after landing and being shot up. Photo: B. Alford.

Zero's engine cowling breakaway as the Japanese flashed past him. Breaking off that engagement and glancing down, he saw a P-40 being chased by two Zeros racing low across the Parap Field – likely Glover just before crashing through the tree canopy.

Running down via East Point and Fannie Bay towards Darwin Harbour, witnessed by members of the 14th AA Battalion, 2nd AIF, McMahon flew at mast height alongside ships in the harbour to gain some protection from the pursuing Zeros. He whizzed past USS *Peary* and SS *Zealandia*, trying to get some clear air and space to get back in the fight.

He climbed to engage a Nakajima B5N Kate which had just started its bombing run on shipping, duelling

with and taking hits from numerous Japanese fighters before his shot-up aircraft could fly no more. His hydraulics shot out causing his undercarriage to extend, put him in a precarious position.

In the rush to get airborne moments before, McMahon hadn't clipped his harness on. When the undercarriage extended, he slid forward into his gunsight as his airspeed slowed. Hits from a pursuing Zero eventually caused his engine to fail and burn, and combined with his newly acquired 'air brakes', he knew the game was up.

Wounded in the leg, he flipped his P-40 upside down and fell clear at only 1,500ft, parachute opening almost immediately just before he hit the water of Darwin Harbour. His plane spiralled into the mud flats between Middle and West Arm on the far side of the harbour, west of the RAAF Field. In a matter of 15 minutes, the 33rd was decimated; only "Miss Nadine" (#43) piloted by 2nd Lt Robert Oestreicher remained.

The second element of the main Japanese bomber formation now arrived over the port and almost immediately encountered Lieutenant Oestreicher's lone P-40. He made a number of attacks, shooting down one bomber, pouring fire on another which he thought could not survive, and firing on numerous Zeros in a scene of utter chaos. Although his own aircraft was damaged by return fire, he was able to eventually land safely at Darwin after taking evasive action once his ammunition was exhausted.

The Fannie Bay dogfight was the first air combat over the Australian mainland. It was a short and frantic engagement fought by inexperienced young American pilots against combat experienced Japanese pilots flying what was considered by many as the best fighter aircraft of the day.

The Western Pacific Campaign, in early 1942 was a shambles from an allied point of view. Undersupply of aircraft, parts and pilots with combat experience made these desperate times. The pilots of the 33rd deserve great recognition for outstanding valour in the face of overwhelming odds.

William Walker survived the Fannie Bay dogfight but was killed later in the war. Robert McMahon, Burt Rice, John Glover, Max Wiekes and Robert Oestreicher all survived the conflict. However, it was Oestreicher who gained the most attention from that infamous day, and has now become a subject of much debate.

Those airman were brief visitors to Australia's tropical jewel, the first to defend Darwin's skies though not the last. Another 21 months of air combat would ensue before the Top End skies would be safe again, and Robert Oestreicher still had a role to play. W

*• To be continued next edition.*

**LEFT** Chief of Air Force Air Marshal Mel Hupfeld congratulates WOFF-AF Fiona Grasby on her appointment as the ninth WOFF-AF.

**BELOW** WWII recruiting poster for the WAAAF.


# MOVING ON UP

## AIR FORCE IS WORKING TO INCREASE THE PARTICIPATION RATE OF WOMEN AND IS ON TRACK TO REACH 25% BY 2023.

**THE FIRST FEMALE** Warrant Officer of the Air Force (WOFF-AF) celebrated International Women's Day with a thought-provoking presentation at RAAF Base Williams, Victoria.

Speaking at a Women's Integrated Networking (WINGS) event in early March, WOFF-AF Fiona Grasby OAM highlighted the increasing acceptance and role played by women in the service.

"The importance of International Women's Day is the opportunity for us to celebrate not just women but also diversity and to recognise how far we've come," WOFF-AF Grasby said.

"Defence is moving in the right direction when it comes to diversity and equality because we recognise what it brings to the whole Defence Force.

"We're making great grounds to ensure we have a balanced workforce, and this is evident in our recruiting and in the success rate in our courses."

All careers in the Air Force are open to women. As of January 2019, women represented 22.9% of Air Force personnel and the target of 25% by 2023 is within reach.

Event attendee Squadron Leader Mark Pentreath commented: "It's not a women's issue, it's a men's issue as well. The more we can be inclusive and understand what our females are going through, the more we can support each other for the betterment of the Air Force."

Flight Lieutenant Barrie Bardoe from the Defence Aviation Safety Authority agreed. "The presentation on the history of women in the organisation underscored the huge contribution women made to capability at our nation's time of greatest threat," he said. "It was fantastic to see so many men supporting this event because we all need to be involved in this journey. We can't afford not to draw upon half the population for the widest possible range of intellects and ideas."

Recognising women to be a largely untapped source of talent, especially in fields such as technical trades and aircrew roles, Air Force has established several initiatives:

- Project WINTER (Women in Non-Traditional Roles), which aims to increase the participation rate and support of women in Air Force jobs
- A Graduate Pilot Scheme to attract women to become Air Force pilots
- Air Force Sponsored Flying Scholarships awarded to two young women under the age of 24 each year to assist with the costs of pursuing a career in aviation.

The WINGs program brings Air Force women of all employment groups and ranks together to provide them with opportunities, and to be encouraged to achieve a successful and engaging career in the organisation.

*Claire Burnet*
*Flying Officer*
*Specialist Reserve Public Affairs*
*No.28 Squadron*

# History of women in the Air Force

**The need to engage women in new avenues of employment became apparent during the early years of World War II when wireless telegraphists were urgently needed to fill a temporary shortage of men.**

In February 1941, the Women's Auxiliary Australian Air Force (WAAAF) was created and a training depot was established at Malvern in Melbourne. Recruitment was intentionally slow until Japan entered the war and it was decided that more women were needed to release men for operational duties.

Airwomen were accepted into 73 different musterings (trades): armament workers, electricians, fitters, flight mechanics, fabric workers, instrument makers and meteorological assistants, besides using skills in many clerical, medical, transport, catering, equipment, signals and radar fields of employment.

By October 1944, the number of women in the WAAAF had increased to a peak strength of 18,667 officers and airwomen serving in all states of Australia. More than 700 women held commissioned rank and, like airwomen, worked in a great variety of administrative, technical and professional roles. Some commanded units in operation rooms.

Wherever women were needed, they served. However, airwomen were paid two-thirds of RAAF male pay for equivalent positions and female officers were paid a good deal less than male officers of equal rank.

The 27,000 women who served in the WAAAF between March 1941 and July 1947 paved the way for gender equality today by proving women could fulfil tasks and roles previously undertaken solely by men. The success of the WAAAF allowed for the formation of a permanent, non-auxiliary Women's Royal Australian Air Force (WRAAF) in November 1950, which functioned until 1977 when female personnel were absorbed into the mainstream RAAF.

**EQUAL PAY:** The National Wage Case of 1969 established the principle of the gradual introduction of equal pay for identical work. WRAAF officers prior to 1970 received 66-68% of male officer rates. That was increased to 76-78% later that year. Women of the RAAF today are paid equally to men, across all musterings and categories.

**EQUAL ROLES:** Gender restrictions from ADF combat roles were removed for serving female members during 2013 and 2016 for new female recruits.

# THE LEGACY LIVES ON

## OPEN ARMS IS AUSTRALIA'S LEADING PROVIDER OF FREE AND CONFIDENTIAL COUNSELLING AND SUPPORT SERVICES FOR VETERANS AND THEIR FAMILIES.

**THE VIETNAM WAR** was a difficult chapter in Australia's history. For those who served, the experience forged strong bonds and a commitment to look out for each other.

That deep sense of mateship led Vietnam veterans to lobby for a specialised counselling and support service for veterans and their families, leading to the establishment of the Vietnam Veterans' Counselling Service (VVCS) in 1982.

Over time access to VVCS was extended to veterans of all conflicts, their families and other members of the ADF and ex-service community, resulting in a name change in 2007 to Veterans and Veterans Families Counselling Service.

In recognition of the impact of contemporary deployments and a focus on suicide prevention in the veteran community, the ability to access the service was expanded to individuals with at least one day of full-time service and their families. That has resulted in a period of innovation and revitalisation and, following a national consultation process lead by the Open Arms National Advisory Committee, the name was changed to Open Arms – Veterans & Families Counselling.

The name was chosen as a tribute to Vietnam Veterans and acknowledges the long periods spent in the jungle during the war, where their lifeline was the Huey helicopter. They would call the Huey's in to take them to safety at the end of an operation, medical evacuation or to provide critical supplies. Often to let the pilot know where to land, one soldier would stand in a field with raised open arms, completely vulnerable. The new name is a symbol of the courage it sometimes takes to seek support.

Today, Open Arms is Australia's leading national provider of high quality, free and confidential counselling and support services for Australian veterans and their families. Clients seek help for a range of issues including depression, anxiety, substance use challenges, workplace struggles, relationship concerns and parenting and family issues.

Open Arms staff members have specialist training in the military experience and while they support families experiencing routine daily challenges, they also understand the unique stressors military and veteran families experience relating to the posting cycle, training exercises, deployments, partner employment, and more.

Open Arms services include:

- 24/7 counselling support through a dedicated support line
- Face-to-face and video counselling for individuals, couples and families
- Care coordination for clients with multiple and/or complex needs
- Peer support and veteran community engagement by those with lived experience of ADF service and mental health recovery, as either a veteran or family member
- Online and face-to-face group treatment programs to develop skills and enhance support for individuals and couples
- Suicide prevention and intervention workshops and online training
- Mental health training programs
- Crisis accommodation support
- Referrals to other services or specialist treatment programs, as needed
- Information, education and self-help resources on the Open Arms website.

With 38 office locations and over 1,300 community-based mental-health providers, nationwide support is available where it is needed.

A unique service offered by Open Arms, the Community and Peer Program involves veteran and family community and peer advisors working together with veterans, family supports, community agencies, ex-service organisations and mental-health clinicians to complement other services. Community and Peer teams are available in Canberra, Sydney, Newcastle, Brisbane, Townsville, Cairns, Darwin, Perth, Adelaide, Melbourne, Wodonga, Hobart and Launceston, and also provide video and telehealth services nationwide.

If you or someone you know wants someone to talk to, even just for a chat, Open Arms is available 24/7 by calling 1800 011 046. The service is free and confidential and there is always a team member, who understands the military experience, available to answer your call.

**SAFE ZONE SUPPORT**

**FREE ANONYMOUS COUNSELLING LINE CALL 1800 142 072**

**Open Arms hosts an anonymous 24/7 support line – Safe Zone Support. Specialist counsellors who understand the military can offer help to veterans and their families without needing to know who you are. Calls are not recorded. For more information visit openarms.gov.au/safe-zone-support.**

# CASE STUDY

Here's an example of how Open Arms helped one family.

John, a 37-year-old Infantry Sergeant in the Australian Regular Army, enlisted 17 years ago. He and his wife, Jenny, have two teenage children, Sally and Jack. John had been posted to various locations around Australia and was always accompanied by his family. Shortly after posting into a Townsville based unit, he was deployed overseas for six months. He was involved in a life-threatening vehicle accident and sustained a back injury. Despite that, communication between John and the family was kept relatively upbeat and focused on the positives, including when the family would be reunited. Both John nor Jenny prided themselves on their resilience and 'can do' attitudes.

Jenny initially managed well but after being retrenched from her job, she wasn't sleeping well and was drinking more alcohol than usual. She'd also withdrawn from social activities and exercise. Sally's behaviour also changed. She was irritable, sometimes tearful, less talkative, and retreated to her bedroom. Jack became increasingly worried about his mother and sister and frustrated as he did not know how he could support them. But he did not want to worry his dad and became withdrawn when talking with John by phone.

When the family reunited, the supportive, fun and relaxed family dynamics appeared to have been replaced with tension and disconnection. At a friend's suggestion they contacted Open Arms. After an intake assessment, each family member was assigned a counsellor. Following a comprehensive assessment, goals were set with the family and treatment plans put in place.

John was working with his usual medical officer to manage his lower back pain, but found great benefit in the Open Arms Managing your Pain group. With individual counselling he worked through the life-threatening experience using a trauma focused approach, finding his mood and sleep significantly improved. He also found it helpful to connect with a peer support worker who shared strategies and insights about what helped him manage similar mental health struggles related to military experiences.

Jenny worked with her counsellor on a range of focused psychological strategies. She reduced her alcohol intake and returned to a healthier, more social lifestyle. She and John attended couple counselling and noticed an improvement in their communication and also their intimacy.

Jenny was able to share her understanding from the Engaging Adolescents workshop with John and both parents noticed Sally's responses improving. Sally enjoyed working with her counsellor and completing the skill-training homework activities she was assigned to help her improve her self-esteem and assertiveness. And, through counselling it was revealed that Jack was worried about his father being killed overseas and having to step up to support his mother. Using a model that focuses on the whole family unit, the family learned practical problem-solving skills and strategies to assist Jack manage his fears and connect with school-based supports.

LAC Ian Castles, Cpl Pat Mildren and A/Sgt Bill Beckett.

# AN AIRMAN'S VIEW

READING *WING*'S THREE-PART SERIES ON UBON PROMPTED **RETIRED F/SGT PAT MILDREN** TO WRITE HIS ACCOUNT OF TIME SERVED IN THE UBON BASE SQUADRON.

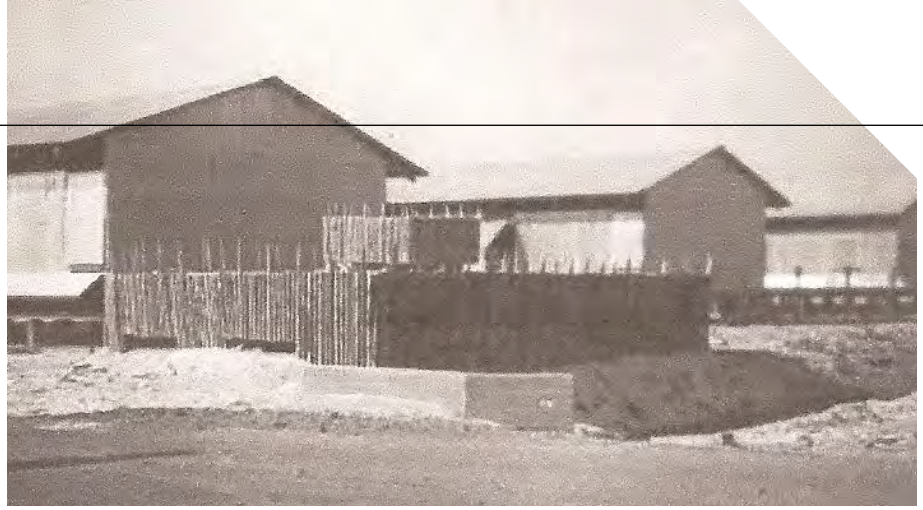
**IN EARLY JANUARY 1963,** when I was a Corporal Firefighter, I was told to proceed to medical to have my injections bought up to date. I was then to depart Townsville by civilian aircraft for Sydney, board a Qantas flight to Singapore, then a Malay Air flight to Butterworth. From there I would board a C130 to Ubon, Thailand.

The journey was unusual for several reasons. At the time, it was mandatory to travel in uniform, but I was told to travel in civilian clothes and was given an allowance to purchase them. I was not to divulge my destination to anyone other than my wife and parents, and was given a Sydney GPO box number for all correspondence. Instead of a passport, I and about 20 RAAF members bound for Ubon left Sydney with only our ID cards for identification. One of the RAAF members on the flight was a fellow firefighter, Ian Castles, who I knew as we had graduated from the same Basic Fire Course.

The Qantas aircraft made a fuel stop at Djakarta where all passengers had to walk across the tarmac between two lines of armed troops. We had noticed on the landing run some 80 to 100 Russian-built military aircraft. Yugoslavia's President Tito was due to visit the following day and security was tight. After more than 90 minutes' delay, we returned to the aircraft and proceeded to Singapore. That was the last Qantas aircraft to land in Djakarta for several months.

On arrival at the Ubon Base camp, we were allocated to an open hut which contained eight timber-framed hessian beds and open lockers down each side. On our first day we received a briefing on the role the Base (made up of 77 Sabre Squadron and Base Squadron), which was to assist with security of the large US Air Force (USAF) Radar unit located on the other side of the RAAF Base, and the Thai border.

The Cambodian border was approximately 100km away, the Vietnam conflict was in its early stages and troops had entered Cambodia, and there were known communist sympathisers in Ubon, a large area of which was known as Commie Corner and was strictly out of bounds.



We were instructed to wear civilian clothes when visiting Ubon town and were taken to town by truck. Our usual haunt was a bar down a small street, adopted by the Australians, with a large sign proclaiming the "Kangaroo Club".

The administration section of the Base was on one side of the runway with the aircraft repair and parking areas, refuelling facilities and a large marquee, part of which was the fire section's office and standby area. I was replacing another Corporal from Townsville, Alf (Dutchy) Holland, who handed over to me and left a week later. The following week Corporal Bill Beckett arrived from Australia and was promoted to acting sergeant two weeks later.

The fire section was manned by approximately six USAF, three RAAF (gradually increased to eight) and three Thai firemen. Initially we operated a USAF fire vehicle known as an O11A, which was later replaced with a RAAF TFA flown in from Butterworth.

On the morning after our arrival I received my first driving instruction in the O11A. As I was driving down the runway to carry out a strip check, my instructor kept looking up. When I asked why, he informed me a squadron of Thai Air Force Trojan fighters normally carried out a border patrol before daylight and should be returning. He said they did not radio in and would buzz us when they were ready to land. They did and I swear they were within two metres over the vehicle. I almost needed a change of clothing.

One road crossed the runway and we provided a control point to prevent vehicles and pedestrians crossing when the runway was active. Aircraft activity consisted mainly of 77 Squadron Sabres and the Thai T28 Trojan fighters.

We received a weekly supply visit by a C130 from Butterworth plus casual USAF freighter Aircraft based at Udon to our north, and a variety of Air America aircraft including DC3 Gunship, helicopters and Helios, which flew across the borders with supplies and returned on most occasions with several bullet holes.

I became friends with a Helio pilot who informed me he and his aircraft carried no identification and if he crashed across the border and was captured he belonged to no country. He told me he would pick up supplies and troops and deliver them to various areas in Cambodia

**LEFT** Gun pit at entry.

**BELOW** Hut 13, home.

**MIDDLE** Card game, with Jim Cousins on the left and Pat Mildren second from right.

**BOTTOM** Side of an US 011A, RAAF TFA and our tent.


# RAAF 79SQN PARADE

79 SQUADRON WILL BE HOSTING A PARADE TO CELEBRATE THE CONSECRATION OF A NEW SQUADRON STANDARD WITH BATTLE HONOURS RECOGNISING 25 YEARS SERVICE AND BATTLE HONOURS FROM WORLD WAR II AND UBON. THE PARADE WILL TAKE PLACE AT THE RAAF BASE PEARCE PARADE GROUND ON WEDNESDAY 18 NOVEMBER 2020 AT 0930 AWST. THE PARADE WILL BE AN APPROPRIATE OPPORTUNITY TO CELEBRATE AND REMEMBER THE ACHIEVEMENTS AND THE SACRIFICES OF THE MEMBERS OF NO. 79 SQUADRON.

*Past members of 79 Squadron are invited to express their interest in attending the parade; please send Expressions of Interest and/or questions to 79SQN.colour@dpe.protected.mil.au ASAP. Subject to COVID number restrictions, EOI applicants will be contacted closer to the parade date with further details.*

and Laos. He always left alone after an hour or two on the ground. We now know those pilots were members of the CIA.

When the Ubon Sabres needed major servicing, which had to be carried out at Butterworth in Malaysia, a scheme was devised where two Sabres departed Ubon and another two departed Butterworth under the cover of a patrolling Canberra jet bomber. At the border the Sabres would swap call signs so it would not appear Malaysia was involved and also helped cover up the activities out of Ubon.

Life was fairly simple as we were on duty for 24 hours Monday to Friday and took turns to have weekends off as long as there was no flying. When off duty we could go into town and usually ended up at the Kangaroo Club. Of course, there were several night clubs offering music, drinks and girls – the subject of constant warnings from the medical officer. Several were out of bounds as it was feared Communist living in the area may be tempted to present us with a grenade if we gathered in one place.

On one occasion, I and about four colleagues were taken to an establishment we thought was clear. Suddenly we were visited by the patrolling Service Police, made up of Australian, US and Thai military and local police. Not wishing to front the CO the next morning we retreated. The warning "Stop or we will shoot", followed by a pistol shot above our heads, inspired us to demolish a bamboo fence but we failed to escape. The next morning a member of the Service police who had been on the patrol and who shared our hut congratulated me on our rapid action, and we did not suffer any repercussions.

On another occasion a group of about 10 of us hired an open bus-like truck to take us to the Mun and Mekong Rivers which formed the border with Cambodia. The Mekong at this point is approximately 80m across and crystal clear. We were advised not to swim as the residents on the other side may not be too friendly.

During my time at Ubon there were some minor alerts including rifle shots fired in the runway area one night, however we were never informed why.

I left Ubon by C130 on 26 April 1963 and landed back in Townsville on the 29th. I was granted two weeks' leave and my debriefing was that I was not to tell anyone any details of my service at Ubon.

**LEFT** Trojan fighters.

**BELOW** 77 Squadron Sabres.

**MIDDLE** Fire Crew, from left, LAC Bob Cross, Cpl Ces Levine and LAC Bernie Winkle

**BOTTOM** Pat (in hat) and Ian (pith helmet) at Mun River.

# LIVING WITH SOCIAL DISTANCING

**SINCE MARCH,** the Australian Air League (AAL) has had to suspend all face-to-face activity due to COVID-19, presenting a unique challenge.

In the beginning, we assumed it might last a few months and some Squadrons started planning to return to normal operations under strict guidelines, but with second wave infections it looks like it could be some time before things return to something approaching normal in all states.

One of the first events affected was Anzac Day. For more than 80 years, AAL cadets have taken part and assisted in Anzac Day dawn services and parades across the country. The Air League was itself founded by Anzac George Robey, who was awarded a Distinguished Conduct Medal for conspicuous bravery at the Gallipoli Landing.

Like so many organisations and individuals, AAL Squadrons took part in the Light Up the Dawn movement on 25 April, with cadets and Officers joining in from their driveways, verandahs and balconies. In the lead up, members submitted photos and videos of themselves reciting the Ode and their effort was featured on the *Today Show*'s dawn service coverage on Channel 9.

While Squadrons cannot meet physically, most are now using technology to stay in touch and keep their activities going. One popular activity has been a regular online Q&A session with guest speakers from aviation and defence industries. Panellists to date have included airlines pilots, an aeronautical engineer and an RAAF F/A-18 pilot, but the most popular session so far has been a virtual tour of the Central Flying School at RAAF Base East Sale including over an hour for cadets to talk to FLTLT Aimee Heal (Roulette Seven) and ask her questions about flying with the RAAF.

As some states relax restrictions, a number of Squadrons are preparing to restart operations in school term three. While most regular scheduled events for 2020 have been cancelled, all Squadrons should be congratulated on the resourcefulness and initiative they've shown in these difficult times.


**ABOVE** AAL cadets taking part in the Light Up the Dawn service featured on the *Today Show*.

WORDS Flying Officer (AAFC) Paul A Rosenzweig

## AIR AMBULANCE EXPERIENCE

**DURING A PILOT EXPERIENCE** flight activity in February, cadets from No.413 Squadron visited the Helicopter Emergency Medical Service (HEMS) facility at Warrnambool airfield to learn more about pathways to potential aviation careers.

Helicopters and fixed-wing aircraft are operated for Ambulance Victoria by Air Ambulance Victoria (AAV), based at Essendon Airport and strategic locations throughout regional Victoria. Warrnambool's HEMS4 has been providing an air ambulance service to south-west Victoria since July 2009.

Since 2015, the AAV fleet has comprised AgustaWestland AW139 twin-engine helicopters, capable of transporting two stretcher patients at a time. The helicopters are used to respond to everything from major trauma incidents and life-threatening medical emergencies, to search and rescue operations. They also transfer critically ill patients to major Melbourne hospitals. The cadets learnt the mantra, "Every second counts in a life-threatening emergency".

The Commanding Officer of No.413 Squadron, based out of Tel el Eisa Barracks in Warrnambool, PLTOFF(AAFC) Jane McDonald said: "The HEMS crew gave 413 SQN a fantastic briefing and then the cadets got in the cockpit, had a go on the winch simulator and even got to wash the helicopter.

"There were many, many questions and the HEMS team were fantastic and very gracious with their time."

The tour was arranged by Matt Doyle, a flying instructor with the Elementary Flying Training School of Aviation Operations Wing, AAFC. Matt, now a SQNLDR in the Air Force Reserve, is also Executive Officer of No.418 Squadron, AAFC, an ADF Recruiting Officer and an Air Ambulance pilot. Matt and the aircrewmen are employed by Babcock Mission Critical Services Australasia in support of AAV.

"We discussed career pathways for ADF aviation roles, as well as civil aviation roles (including pilot, aircrew and engineer)," Matt said.

In addition, Andrew Osborne, a Mobile Intensive Care Ambulance Flight Paramedic with HEMS4, spoke with the group about careers in paramedicine, including the study required to become a flight paramedic.


**ABOVE** Air Force Cadets from Warrnambool's 413 Squadron with the HEMS4 AgustaWestland AW139 helicopter. Photo by PLTOFF(AAFC) Jane McDonald.

## DEMON PROPELLER

**LEFT** The refurbished 1930s Hawker Demon Propeller on display at the Macclesfield Sub-Branch RSL. Photo by Pilot Officer (AAFC) Paul Lemar.

**A HAWKER DEMON** propeller once owned by the Air Force Cadets is now fully refurbished and on display at the Macclesfield RSL in South Australia.

The Hawker Demon was operated by the RAAF from 1935, and 64 were acquired between May 1935 and May 1938.

The 1930s propeller had long been in the possession of No.608 (Town of Gawler) Squadron, but after a depot clean-up it was donated to No.622 (Rural City of Murray Bridge) Squadron, which was in a better position to refurbish it. Due to the nature of the work involved however, the propeller was in turn donated to a local RSL to safely restore and mount. The restoration was completed by the local Men's Club, which included a few RSL members and the son of a gentleman who had worked in the Hawker Aircraft factory in the UK that originally made the Hawker Demon airframes.

The team obtained specifications and schematics from the UK to help with the restoration, which included soaking the prop in a special solution for six months and manufacturing special metal fly pins and a replacement metal cutting edge for the propeller.

The propeller was mounted inside the historic Macclesfield RSL by a licensed stone mason, at no cost. In due course, a commemorative plaque acknowledging the AAFC and all involved in the propeller's preservation will adorn the display.

Flying Officer (AAFC) Paul Lemar, Commanding Officer of No.602 Squadron and Temporary Commanding Officer of No.622 Squadron, said: "The Australian Air Force Cadets have had a special bond with the Returned & Services League, Macclesfield Sub-Branch for nearly 10 years, with members from both 622 and 602 Squadrons attending every Twilight Anzac Service since 2011."

# CADET PILOT Q+A

**WHILE THERE HAS** been an operational pause in cadet activities, some have taken the opportunity to reflect on the milestones they have achieved to date.

Cadet Under Officer Lachlan Davis currently serves as the Cadet Executive Officer of No.428 Squadron in Newtown, Victoria. Last year, he received an ADF Long Tan Youth Leadership and Teamwork Award, and earlier in the year he became one of a small group of Air Force Cadets to have flown solo in the new Diamond DA40 NG aircraft.

CUO Davis spoke to the Public Affairs Officer for Aviation Operations Wing, Flying Officer (AAFC) Paul Rosenzweig, about his cadet career to date.

### WHAT MADE YOU WANT TO BE A CADET?

When I was 12, my father mentioned the idea of cadets, since a few fathers from his workplace had their sons and daughters participating. Really, for me it was the idea of putting on the uniform, learning how to march and learning a lot about how aircraft worked. My 12-year-old self would never have imagined what he was going to achieve in his cadet career.

### WHAT WAS YOUR FIRST EXPERIENCE OF FLYING?

A Pilot Experience flight on a recruit training weekend back in 2015, in a Piper Warrior. Years of training beforehand, reading books while travelling along the Great Ocean Road in the family car served me well that day. I never did feel sick while flying. Was I nervous? Definitely. But I told myself I could learn how to do this one day. Nothing is impossible if you try hard enough.

### WHAT WAS YOUR FIRST EXPERIENCE OF FLYING THE DA40 NG LIKE?

Stepping into the aircraft for the first time was an awesome experience. Before me lay so many buttons, switches and two massive iPad-like screens. I felt as if I was in a jet with all those screens. When in flight, the aircraft was very responsive and I was surprised at how smoothly she flew.

### WHAT WAS YOUR EXPERIENCE OF FLYING SOLO?

I made sure to thoroughly go through my checklist and be on point with all my radio calls while taxiing to the runway. Before I knew it, I was up in the air and flying. I was concentrating so hard that I failed to realise the significance of what I was doing until much later after the flight. Upon landing and taxiing back to the apron, I was greeted with a big grin from the instructors who immediately grabbed my hand to shake it once the canopy was open and the keys were on their hook. It all felt surreal.

**ABOVE** Lachlan Davis, a Cadet Sergeant at the time, is congratulated by his instructor WGCDR (AAFC) Stephen Pepper (Officer Commanding Aviation Operations Wing) following his first solo flight in the Diamond DA40 NG on 18 April 2019. Photo courtesy Elementary Flying Training School, Point Cook.

# CADETS SAY "TANKS"


**SOME OF ADELAIDE'S** Air Force Cadets started the year with a Pilot Experience flight from Balaklava airfield and on return to RAAF Edinburgh posed to say "tanks" to their flying instructors.

The cadets flew in the DG1000S two-seater sailplane glider operated by No.906 Aviation Training Squadron, a unit of Aviation Operations Wing, AAFC. The squadron has now been redesignated as Balaklava Glider Training Flight of the AAFC's new Gliding Training School. Balaklava Flight is one of three centres of excellence around the country that enables AAFC cadets to experience the exhilaration of glider flying.

**FROM LEFT** CDT Nandini Agnihotri, CDT Iknoor Khurana, CDT Hayden Peel, CDT Fynn White, CDT George Rarichan, CDT Mark Gul, LCDT Ben Bryant and LCDT Mithusha Lansakara Mudiyanselage.

# 10 TAX TIPS

PREPARING AND LODGING A TAX RETURN ISN'T A FAVOURITE PASTIME OF MOST AUSTRALIANS, BUT IT IS A DUTY MOST OF US MUST UNDERTAKE. SO WHY NOT REDUCE THE STRESS AND COST BY BEING WELL-INFORMED AND ORGANISED? FOLLOWING THESE TIPS COULD INCREASE YOUR TAX REFUND OR AT LEAST MINIMISE YOUR BILL.

**1 DO IT ON TIME.** Your tax return must be lodged no later than 31 October, unless you get an extension through a registered tax agent (RTA). If you lodge your return after that date, you are likely to receive a penalty.

**2 DON'T WAIT TO GET CAUGHT.** If you should have lodged a tax return last year and failed to do so, or if you haven't lodged one for many years, it's strongly recommended that you lodge any outstanding returns voluntarily, rather than getting caught by the Australian Tax Office (ATO). That way, penalties will generally be lower and arrangements may be made to pay off any outstanding tax in a manageable way. In many cases, refunds will be due, so lodging outstanding returns can even be financially positive.

**3 LOOK INTO USING A RTA.** If you're not confident about preparing your own return, you need specialist tax advice or you'd like an extension of time to lodge your return, you can use the services of a registered tax agent.

**4 CONSIDER AN ACCOUNTANT.** If your tax affairs are complex, a qualified accountant may be helpful, but make sure the person or organisation you choose is a RTA. If you do not have an accountant, you may be able to find a suitable one through a professional body such as CPA Australia or the Chartered Accountants Australia New Zealand. Both bodies have high minimum levels of experience and qualifications. We also suggest members should speak to their colleagues or family to find out if they have a tax agent or accountant they are willing to recommend.

**5 BE ORGANISED.** RTAs/accountants generally charge for the preparation of your tax return by reference to the time they spend on it. Therefore, it's important to be well-organised when you meet them. Taxpayers who accumulate random bits of paper in the proverbial "shoe box" to justify their claims, or who have insufficient evidence of claims they wish to make, will end up paying far more in professional fees than they should, more tax than they need to or will receive a tax refund that is lower than it should be.

**6 UNDERSTAND FEES AND CHARGES.** There are hundreds of options available when choosing a RTA/accountant. Make sure you understand their fee structure and get it in writing. Fees should be a flat amount, not a percentage of any tax refund to which you're entitled.

**7 WATCH OUT FOR INVESTMENT SPRUIKERS.** Some RTAs/accountants are also licensed financial advisers, mortgage brokers and real estate promoters. Some will even offer to do your tax return for free, or at a heavy discount, in return for your agreeing to a "financial health check" or the purchase of investment products from which they will earn a commission or other incentive. You need to be aware of the motives of such advisers before you engage them to prepare your tax return. They may not be acting in your best interests.

**8 DON'T FORGET HOME-OFFICE CLAIMS.** This year during the Covid-19 pandemic, be aware of the more liberal arrangements for claiming tax deductions arising from working at home. The ATO website (ato.gov.au) has more on this.

**9 KEEP YOU DOCUMENTS.** You should only make claims that are genuine and can be proved with documentary evidence (e.g. receipts, invoices, logbooks). Our tax system is based on self-assessment, which means you won't necessarily be asked to provide evidence of your claims. However, each year many taxpayers are selected at random for audit and those who make larger claims are often flagged for closer scrutiny. Therefore, keeping evidence of your claims is important. Making false or undocumented claims can lead to substantial fines and regular audits of your tax affairs in following years.

**10 PAY ATTENTION TO DETAILS.** Generally speaking, your income from interest, dividends and salary (including tax deducted by your employer), will be known to the ATO before you lodge your return. This is called pre-filled. However, you should check that the pre-filled information is correct and up-date it if necessary. You should also ensure that any rental income or capital gains you have made from, for example, the sale of an investment property or shares, are properly disclosed. This process can be quite technical, especially when it comes to claiming deductions against rental income, so you may need to seek advice from a RTA/accountant before completing your return.

The moral of the story is to be sensible and sleep well at night. As with all things in life, honesty and moderation are key when it comes to your tax affairs. Sleeping well, knowing your tax affairs are in order, is more beneficial than a few extra dollars in your pocket from a dubious claim or undisclosed income.

*Robert M C Brown AM FCA*
*Chair, ADF Financial Services Consumer Centre*
*adfconsumer.gov.au*

# AIR COMMODORE STAFFORD THOMAS JAMES AFC

*23 June 1944 – 11 May 2020*

**STAFFORD THOMAS JAMES** (known to all as Staff) hailed from Temora, NSW, a place well known to Australian aviators. He received secondary education as a boarder at Newington College before entering the RAAF Academy in January 1962. His boarding school experience possibly prepared him better than his peers for life as a first-year cadet, although maybe not for the 0600 roll calls, the polishing of boots, belts, gaiters, rifles, urinal fittings and corridors, nor the extra drills received for shortcomings in achieving these menial but presumably character-building tasks!

Following graduation, Staff joined No.59 Pilots' Course, where he unfortunately suffered from chronic airsickness, a handicap that would have convinced lesser men to change their career path. However, with his grit and determination (and with AVMED assistance), Staff overcame his problem to earn his pilot's brevet.

**LEFT** As Officer Commanding No.92 Wing. Photo: Department of Defence.

Staff's first flying posting was to 10 Squadron where he blossomed as both aviator and leader, achieving a captaincy on the Neptune before the end of his first tour. Then, after a year as ADC to the Chief of Air Staff (Air Marshal Sir Colin Hannah) he joined instructors' course at Central Flying School, East Sale.

In the next four and a half years at No.2 FTS Pearce, he rapidly progressed from line instructor to Flight Commander, directing special assistance to several individual trainees experiencing unique difficulties. His own background, his genuine interest and his natural instructional ability ensured their eventual success. For that dedication, as well as his exceptional courage and skill in recovering a Macchi with a rear fuselage fire, Staff was awarded the Air Force Cross, a rare honour granted only to highly capable individuals in recognition of excellence and their contribution to Service Operations.

Clearly destined for senior rank, Staff was selected for the maritime command trilogy: CO of No.11 Squadron, OC No.92 Wing and then Commander Maritime Patrol Group, as well as attending staff college and national defence college, both in Canada, adding fuel to the popularly held, cynical view that you can't be posted overseas unless you've been before. Three senior staff appointments in both AFHQ and the Defence Materiel Organisation rounded out 35 years of outstanding service before retirement in 1997. Throughout this enviable career, Staff proved to be a popular leader, winning the respect and admiration of subordinates, peers and senior officers with a quick wit, innate compassion, integrity and professionalism.

Owing to the COVID-19 restrictions, most of his many friends were prevented from attending a last farewell. However, as a testament to the high regard in which he was held, especially in the maritime world, the crew with whom Staff flew as CO 11SQN organised a virtual vigil for him on the day of his funeral, where we all joined with Elizabeth and family in toasting and remembering a true professional, an absolute gentleman, and a wonderful mate.

*Neil Smith, with the willing assistance of Roy Phillips, Phil Byrne and Des Long.*

**ABOVE** As a student pilot on Vampire. Photo: courtesy RAAF Museum.


REVIEW BY Michael Nelmes

## WE TOGETHER: 451 and 453 Squadrons at War

By **ADAM LUNNEY**
*Tempest Books, RRP $39.95*

**READERS MAY BE** familiar with the histories of the RAAF's World War II 'Article XV' squadrons – those in the 450 to 467 number range – some of which have been covered in worthy fashion by AIRCDRE (Retd) Dr Mark Lax. Now military and aviation historian Adam Lunney, too, has proven equal to the task. His second book is more extensive in covering two 'sister' squadrons: from 451's time in North Africa in 1941, through its operations from Corsica before D-Day until joined in France by 453 after the invasion, and post-war occupation duty in Germany. The earlier period of 453 Squadron, flying Brewster Buffaloes in Singapore-Malaya and Spitfires with RAF Fighter Command in England, is not included.

Lunney's research is extensive and impressive. The core of the human interest of the book is the oral history interviews with the few remaining veterans, including GPCAPT (Retd) Alec Arnel, who in April celebrated his 100th birthday.

A large book at 319 pages plus photographs, it is a definitive and very creditable history of two of the less-researched yet important RAAF squadrons. It will serve as both a day-to-day diary and a source of veterans' recollections. Photographs have been grouped into 16 glossy pages in the middle and a useful epilogue gives detailed technical notes on the fighter types flown by the squadrons: Hurricanes, various marks of Spitfire between 1 and 21, and Typhoons.

While there are numerous tables in the book, a useful addition would have been a short chronology of the movements of each squadron, which can be confusing in the text.


REVIEW BY Bob Treloar

## HUNTERS OVER ARABIA

By **RAY DEACON**
*Pen and Sword Aviation, RRP $53*

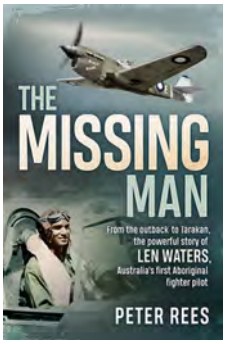
***HUNTERS OVER ARABIA*** provides an in-depth account of the operations performed by Royal Air Force Hawker Hunter squadrons policing the desert wastelands and high mountain ranges of the Middle East from eight airfields in South Arabia between 1960 and 1971.

In the 1960s, that responsibility extended over South Arabia, Muscat and Oman, the Trucial States, Qatar and Kenya, with the importance of Aden bought into sharp focus by the discovery of oil in the Persian Gulf and the nationalisation of the Suez Canal in 1956. To maintain the peace, the RAF deployed three fighter ground-attack Hunter squadrons, a flight of photo reconnaissance Hunter aircraft, a squadron of Shackleton bombers and various transport squadrons and support flights.

While describing the many types of operations conducted by the Hunter squadrons, the author conveys the tedium and the excitement of operating in an unforgiving environment. The book provides an excellent insight into the use and flexibility of airpower and its ability to police a recalcitrant population in a rugged, remote and inhospitable region. In the 1960s air power enabled the size of the land force to be limited to one brigade.

Ray Deacon's RAF career included service in Aden, working on a front-line operational squadron equipped with ground-attack and fighter reconnaissance versions of the Hawker aircraft.

A beautifully presented book, well populated with photographs of the aircraft, it will have a strong appeal to those who have been associated with flying operations or have an interest in military aviation activities.




REVIEW BY Bob Treloar

## THE MISSING MAN

By **PETER REES**
*Allen & Unwin, RRP $32.99*

**THE MOTTO OF** the Royal Australian Air Force, *Per Ardua Ad Astra* – through struggle to the stars, could not be more apt for Len Waters, an Aboriginal man whose parents left the Toomelah Aboriginal reserve to move beyond the reach of authorities who could forcibly remove their children.

Len Waters was the only Indigenous Australian to qualify in the RAAF as a fighter pilot during World War II. He flew 157 hours with No.78 Squadron, flying from Noemfoor, Moratai, Balikpapan and Tarakan; 104 sorties were on operations, including 41 strikes and attacks.

He finished the war as a warrant officer having served with distinction and was a much-respected member of the Squadron.

Waters commented that he never experienced racial discrimination during his time in the Air Force, but instead had a strong sense of belonging to a team with an intense camaraderie.

*The Missing Man* addresses Waters' steadfast ambition, his perseverance in the face of adversity, fortitude and daring to dream. The author confronts the racial prejudice that dogged Waters throughout his life – except while in the Air Force. Waters was very much "the missing man".

Peter Rees has been a journalist for 40 years, federal political correspondent for several newspapers and is the author of numerous books.

*The Missing Man* reminds us of many things we need to hear. It is an easy-to-read book and absorbs the reader into the life of Len Waters, fighter pilot, family man, shearer, Kamilaroi man. I recommend it to all Australians.

#HOMETOWATERLEA

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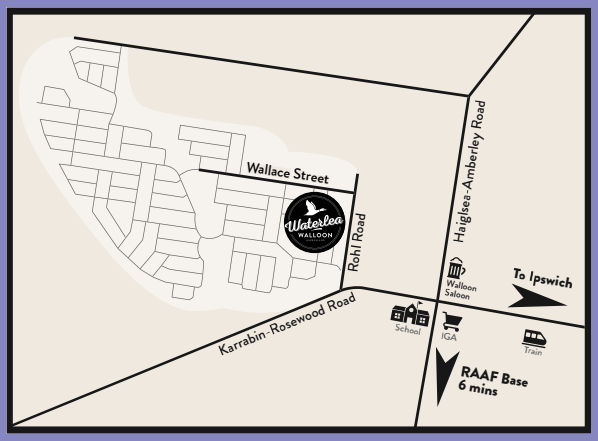


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