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ON THE COVER

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AIR FORCE ASSOCIATION

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MESSAGE FROM

RAAF BASE WILLIAMTOWN

AS THE SENIOR AUSTRALIAN DEFENCE FORCE (ADF) OFFICER for RAAF Base Williamtown, NSW, it is a privilege to introduce the spring edition of *Wings* magazine.

This edition offers me opportunity to personally reflect and recollect my own times as a military Air Traffic Controller for 33 years with the included article about Ground Controlled Approaches (GCA, see page 60).

The GCA was something military pilots relied upon before the instrument landing systems (ILS) were introduced and was developed to meet military requirements for a 'blind-landing' system that enabled air traffic controllers to position the aircraft on final approach to the runway for the pilot to become visual and effect a landing.

Many might remember the old Quadradar system, better known as 'Noddy and Big Ears' situated on the side of the runway. In fact, there are a number of countries that still use GCAs to recover aircraft, including here in Australia whereby a modified version known as a ship surveillance radar approach is used by Navy Anti-Submarine/Anti-Surface Tactical Air Controller staff aboard both HMAS *Adelaide* and *Canberra*.

As the Air Force celebrates its 100th year of service in 2021, many of our celebrations have been either cancelled or significantly curtailed, but the enthusiasm to recognise our achievements and importantly what our future holds in delivering airpower as a best small Air Force has not diminished. That is where *Wings* comes into its own by allowing readers to keep up to date.

I trust this edition will pique many a reader's interest as *Wings* magazine continues to deliver a quality and valued aviation magazine that not only informs but entertains its readers, both serving and veteran, with interesting articles about all things in the military aviation world: past and future.

GPCAPT Anthony Stainton.
Senior Australian Defence Force Officer
RAAF Base Williamtown

EDITOR'S NOTE: RAAF Base Williamtown was selected as the base feature for this edition but the article was not released by Defence Media in time for publication and has been deferred for a later edition.

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LETTERS TO THE EDITOR

NEVER AN AVIATOR

I read, with interest, of the RAAF's change of name from "airman" to "aviator". Having spent two years plus in the Air Training Corp and 17 years plus in the RAAF, I have been a cadet, an apprentice, an airman and an officer, but I have never been a member of General Duties Branch, so I have never been an aviator.

I have been a proud member of the RAAF. And I am still proud of my service.

There may well be a need for a better word that covers all members of the Air Force but is aviator the right word? The uniform changed from RAAF blue to English/American blue, but finally back to RAAF blue. Change is not necessarily a good thing.

William Downton
A Proud ex-RAAF member

HAPPY BIRTHDAY

No.30 (City of Sale) Squadron recently had the honour of being presented with the Queen's Colours by the Governor-General, His Excellency General the Honourable David Hurley AC DSC (Ret'd). Sadly, I am the only original member of the squadron left, after losing two of my best mates, who I went off to war with, within a couple of weeks of each other in 2020.

When, after delays due to COVID-19, we were given the latest date, I could not believe it, 23 March 2021 – the consecration was to be held on my 101st birthday!

To see and be part of the event was most enjoyable for everyone.

Bruce Robertson
President 30 Squadron RAAF Beaufighter Association

• *Turn to page 12 for more on the event.*

ABOVE Bruce with the Governor General and his wife Linda Hurley.

MANAGER'S MESSAGE

Welcome to another edition of *Wings*. The new-look magazine has achieved wide acclaim and, as a consequence, RAAFA Publications Pty Ltd has decided to entrench the magazine's value and distribute it for retail sale through newsagents and public outlets, commencing this edition.

In concert with that evolution, online access for non-association members will attract a small subscription fee, managed through the wingsmagazine.org.au portal. Access for AFA members, cadets and serving veterans will be available via respective websites and the Defence Restricted Network.

In this edition, we were unable to publish the fourth and final chapter on the history of Qantas, as the author Don Hill is in the midst of a transition to Command of a Boeing 787. Don will complete the series next edition. We wish him smooth skies and fair winds through the demanding promotional training program.

Ron Haack
Wings magazine manager

• *Please send letters to editor@raafapublications.org.au, including your name and details. Letters may be edited for length and clarity.*

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EDITED BY Bob Treloar

RAAF to establish DEFENCE SPACE DIVISION

IN JULY 2017, the Department of Defence created an Information Warfare Division responsible for military cyber operations, military intelligence, joint electronic warfare, information operations and Australia's military's space operations. In May this year, the RAAF announced it will establish a Defence Space Division (not a full US-style space force) in early 2022, employing personnel from all three services.

Chief of Air Force, Air Marshal Mel Hupfeld said: "We use space daily for understanding the weather, navigating, access to geospatial information and sharing information across Australia or across the world. Defence is delivering capabilities including space domain awareness, sovereign-controlled satellite communications and space-based Earth observation and navigation."

There are increasing problems concerning space debris and space traffic management. For example, SpaceEx launches every two weeks and there are about 3,800 operational satellites in orbit, with an estimated 128 million pieces of debris [smaller than 1cm].

AM Hupfeld is conducting a review to improve how space capabilities are managed, acquired and operated. The government is committed to significantly increasing Defence's space capabilities and will invest about $7 billion this decade to ensure sovereign access to space, space services and geospatial information.

Defence will need capabilities that directly contribute to outcomes in space as a contested domain. AM Hupfeld said that does not mean Defence encourages the militarisation of space. All space operations are conducted consistent with international and domestic legal obligations.

Source: Shepherd Media

ABOVE AVM Cath Roberts has been appointed Commander of the Defence Space Division.

STINGRAY PASSES FUEL to Super Hornet

BOEING-OWNED TEST MQ-25 T1 Stingray passed fuel to a Boeing F/A-18F Super Hornet receiver during a test event in June, marking not just a milestone for the Stingray program but a first for unmanned aviation.

Prior to engaging, the F/A-18 flew in close formation behind the MQ-25 to evaluate receiver performance and stability. Both aircraft were flying at operationally relevant speeds and altitudes. With the proximity evaluation safely completed, the aerial refuelling store (ARS) hose and drogue was extended and the F/A-18 pilot 'plugged' and received a scheduled fuel offload.

According to Boeing, the milestone came after 25 T1 flights evaluating both the MQ-25 platform and ARS aerodynamic behaviour throughout a representative flight envelope, and extensive simulations of aerial refuelling using MQ-25 digital models.

MQ-25 T1 will continue flight test qualification prior to transfer to Norfolk, Virginia, for deck handling trials aboard a US Navy carrier later this year.

Source: Janes

BELOW A screenshot from a Boeing video showing the first refuelling contact between MQ-25 T1 Stingray and a Super Hornet receiver aircraft on 4 June.

Pairing autonomous AND MANNED SYSTEMS

Triton UAS.

THE RAAF IS working to integrate manned aircraft with remotely piloted and autonomous systems and has acquired Triton and Loyal Wingman, two autonomous flying platforms designed to operate in a manned-unmanned team.

The Air Force is exploring totally new concepts of operations, whereby autonomous systems will pair with manned capabilities, such as the F-35, Growler and E-7 Wedgetail, to bolster a relatively small but potent Air Force.

Air Marshal Mel Hupfeld said: "Defence can gain significant advantage through leveraging autonomous systems, to make better decisions faster, more effectively allocate resources, and discover new ways of delivering military effects. Artificial intelligence and human-machine teaming will play a pivotal role in air and space power into the future.

"It is not about replacing people with machines. The RAAF has a shortage of people and the work in this space is about freeing up people so they can be employed in areas that humans do best."

The Defence Force will be one integrated AI-enabled system of systems using robotics to augment roles, and humans working with machines, to optimise performance. The scarcest resource, people, will focus on higher value and the creative tasks.

Source: SLD.info.com

ABOVE Loyal Wingman teamed with Hornet fighters.

F-35As in 'BEAST MODE'

The RAAF operated a pair of Lockheed Martin F-35A fighters carrying a full complement of internal and external weapons for the first time in June. The aircraft flew the sortie from RAAF Darwin as part of Exercise Arnhem Thunder 21.

According to Lockheed Martin, the F-35A has an armament load of 5,700lbs (2,585kg) when configured only with internal weapons (stealth mode), but up to 22,000lbs (9,979kg) of both internal and external ordnance comprising air-to-air and/or air-to-surface munitions in 'beast mode'.

Besides an unspecified internal weapon load, each of the two fighters carried four inert, laser-guided GBU-12 bombs on their underwing pylons which were dropped on targets at the Delamere Air Weapons Range, about 120km south of Katherine, Northern Territory. F-35As were expected to drop more than 50 inert GBU-12 bombs during the entire exercise.

Source: Flight Global; Janes

F-35A Lightning II in 'beast mode' weapons load.

ABOVE A new CH-47F Chinook heavy-lift helicopter is unloaded from a C-5 Galaxy at RAAF Base Townsville. Photo: Trooper Lisa Sherman, ADF.

Army expands heavy-lift helicopter fleet

THE AUSTRALIAN DEFENCE FORCE has committed $595 million to purchase four new CH-47F Chinook helicopters and upgrade its heavy-lift battlefield aviation capability to 14 aircraft by mid-2022, once the third and fourth helicopters are delivered. The first two were delivered to the Army's 5th Aviation Regiment, Townsville aboard a US Air Force C-5 Galaxy aircraft in July this year.

The helicopters will strengthen Army's airlift capability into the future and increase the ADF's ability to support operations globally. The Chinook is Defence's largest helicopter, with a long and proven track record. Chinooks were an important lift and troop transport capability on operations in Afghanistan from 2006 to 2013, and were employed during Operation Bushfire Assist in 2019-2020 to deliver humanitarian assistance to remote and isolated communities in South Australia and Victoria.

Source: Australian Times & Defence Connect

NEW LEADERSHIP AT CASA

ACM (Retd) Mark Binskin AC.

THE CIVIL AVIATION Safety Authority (CASA) has a new leadership team. Experienced government administrator Pip Spence assumed the role of CASA CEO and Director of Aviation Safety (DAS) in May, while Air Chief Marshal (Retd) Mark Binskin AC will join the board as chair in August when the term of current chair, Tony Mathews expires.

Spence was Deputy Secretary at the Department of Infrastructure, Transport, Cities and Regional Development, with responsibilities including aviation and airports, transport policy and portfolio research.

ACM Binksin served as Chief of Air Force from 2008-11, then as Chief of Defence Force from 2014 to 2018, after which he retired from the ADF. He began his career in the Royal Australian Navy as a Skyhawk pilot and qualified on Mirages during an exchange with the Air Force. After the Navy disbanded its fixed-wing capability, ACM Binskin transferred to the RAAF, later serving as CO No.77 Squadron at Williamtown and Air Commander Australia. He also held senior command positions during operations in Iraq. He is a member of the Temora Historic Flight Club and owns an O-1A Bird Dog and an amateur-built F-1 Rocket sports aircraft.

Source: Australian Flying

LEFT Pip Spence.

Apache purchase approved

THE US STATE DEPARTMENT has approved the sale of 29 AH-64E Apache gunships valued at $3.5 billion to the ADF to replace the Airbus Tiger as Army's new Armed Reconnaissance Helicopter. Defence considered several helicopters against key criteria of proven ability, maturity and an off-the-shelf operating system. The Apache Guardian was considered to be the most lethal, most survivable and lowest risk option, meeting all of Defence's capability, through-life support, security, and certification requirements.

Source: Vertical

AH-64E Apache Guardians.

Answering THE CALL FOR HELP

ON APRIL 11, Tropical Cyclone Seroja made landfall north of Geraldton, WA, devastating homes and businesses, and damaging key infrastructure.

The following day, Air Mobility Group despatched a C-130J Hercules transport aircraft from RAAF Base Richmond to RAAF Base Pearce with a Defence medical crisis assessment team. The Hercules served as an 'air bridge' to reach cyclone-affected communities and, with support from No.25 Squadron air movements personnel, delivered generators, recovery vehicles and equipment, and emergency services personnel to disaster locations. On 19 April, a No.36 Squadron C-17A Globemaster transported five SES vehicles from Melbourne to Geraldton.

In April, Air Force also assisted Timor-Leste after catastrophic floods submerged thousands of homes. Again a No.36 Squadron C-17A was called on, delivering 30 tonnes of disaster-relief supplies, including emergency rations, personal protective equipment, shelters and hygiene kits.

Source: Air Force News

ABOVE Air Force personnel load relief supplies on a C-17A Globemaster III.

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TRAINING FOR WAR

THE RAAF DEPLOYED more than 300 personnel and 30 aircraft to Darwin and Tindal to conduct Exercise Rogue Ambush 21-1 from 15 June to 2 July. Aircraft deployed from RAAF Bases Williamtown and Amberley included F-35A Lightning II, E-7A Wedgetail, Hawk 127 lead-in fighter and a KC-30A Multi-Role Tanker Transport.

Exercise Commander Group Captain Matthew McCormack said Rogue Ambush 21-1 was the final phase of the first F-35A operational conversion course to be run in Australia since the introduction of the fifth-generation fighter.

F-35A pilots from No.2 Operational Conversion Unit and E-7A Wedgetail aircrew from No.2 Squadron were faced with challenging air combat scenarios during the final phase of their six-month operational conversion courses.

The exercise provided new F-35A pilots and Wedgetail Battlespace Management crew with a complex offensive counter-air environment to support high-performance precision strike, airborne command and control, and air-to-air refuelling training.

Source: Department of Defence

F-35A Lightning II afterburner take-off. Photo: Department of Defence.

Wedgetail participates in Pacific Edge 21

THE RAAF'S E-7A WEDGETAIL deployed to Hawaii and participated in a multi-faceted, air-combat exercise with US forces during Exercise Pacific Edge 21 in April.

The cutting-edge aircraft demonstrated its battlespace management capabilities by providing airborne early warning support for the 199th and 19th Fighter Squadrons, units of the Hawaii Air National Guard operating F-22 Raptor aircraft. F-16 Fighting Falcons of the 442nd Training and Evaluation Squadron provided an adversarial role during the exercise.

Exercise Pacific Edge provided a key opportunity to operate with allied force elements to test, evaluate and fine-tune tactics, focusing on F-22 and E-7 integration against advanced threats.

Source: Air Force Technology

RIGHT Wedgetail with a USAF F-22 Raptor.

Exercise Arnhem THUNDER

THE RAAF DEPLOYED approximately 50 aircraft and more than 500 personnel to the Northern Territory in May as part of Exercise Arnhem Thunder 21, one of the ADF's largest domestic training exercises.

The exercise provided force generation training, with a particular focus on high-end collective training involving multiple Force Element Groups. Conducted from RAAF bases Darwin and Tindal from 17 May to 15 June 2021, the exercise incorporated Mount Bundey Training Area and Delamere Air Weapons Range facilities in mission profiles.

Ten F-35A aircraft from No.3 Squadron; 10 F/A-18F Super Hornets from No.1 Squadron, six EA-18G Growler aircraft from No.6 Squadron, a KC-30A Multi Role Tanker Transport from No.33 Squadron, and two E-7A Wedgetail aircraft from No.2 Squadron were deployed to RAAF Base Darwin. It was the first time F-35A Lightning II fighters operated from RAAF Base Darwin.

Five Hawk 127 from No.76 Squadron, a C-27J Spartan from No.35 Squadron, a C-130J Hercules from No.37 Squadron, and a C-17A Globemaster from No.36 Squadron were deployed to RAAF Base Tindal to join 12 No.75 Squadron F/A-18A Hornets.

Source: Defence Connect

BELOW F/A-18A Hornets operated by No.75 Squadron taxi at RAAF Base Tindal, NT during Exercise Arnhem Thunder 21. Photo: LAC Stewart Gould.

Extended grounding OF MRH-90

THE ADF HAS extended the grounding of its fleet of 47 MRH-90 Taipan multirole helicopters due to maintenance and safety issues related to the application of the helicopter's maintenance policy. The grounding began in May and normal operations now seem unlikely to resume for some time. The MRH-90 fleet was also grounded in 2019 following serious tail rotor vibration and delamination that required remediation of the tail rotors on all 47 aircraft.

Army and Navy aviation continue to support their exercise and operational commitments with Tiger armed reconnaissance, Chinook CH-47F heavy-lift, S-70A-9 Black Hawk utility and MH-60R naval helicopters.

Source: Janes

MRH-90 at RNAS Nowra.

Black Hawk boost for aerial firefighting

AIR SERVICES COMPANY Aerotech has unveiled two ex-US military Black Hawk helicopters, the first of their kind to be used for firefighting in Australia. They are the first Australian commercially owned and operated Black Hawks.

The Sikorsky Aircraft-built helicopter first entered service with the US Army in 1979 and the Australian Army operates about 40 Black Hawks.

The Black Hawk's tank can be filled with 4,000 litres of water from a lake, dam or storage tank using a special snorkel in about 35 seconds. It has a top speed of 360km/h.

Based at Parafield Airport in Adelaide, Aerotech has a fleet of 25 aircraft and 10 helicopters. The Black Hawk helicopters will remain in Australia all year round – a recommendation of the Royal Commission into the devastating fires of 2019-2020 – overcoming the need to rely on northern-hemisphere based Type 1 helicopters.

Source: Aerial Fire

ABOVE An Aerotech Black Hawk demonstrates its fire-fighting capability.

Sculpture of FOUNDING FATHER

THE AIR FORCE ASSOCIATION (AFA) is proud to be supporting the establishment of a life-size sculpture of Air Marshal Sir Richard Williams, the founding father of the RAAF, at Moonta, South Australia, where he was born. Air Force Association, South Australia has worked with the Moonta community in ensuring Air Marshal Sir Richard Williams is appropriately memorialised.

As the first-ever Australian-trained military pilot, Sir Richard Williams saw distinguished service in the Middle East before completing the war as the Australian Flying Corps's foremost operational commander. Returning to Australia, he was instrumental in establishing the RAAF as an effective organisation.

The sculpture will be positioned on a granite park bench in Queen Square, Moonta, allowing people to sit beside one of Moonta's greatest achievers. A plaque will detail his impressive biography.

The sculpture has been largely funded through fundraising by the Moonta community, supported by the SA Government and AFA.

Noted SA sculptor Tim Thomson created the clay sculpture used to produce a series of molds for the final bronze cast. Originally scheduled for 29 August, the unveiling has been postponed until 7 Novemeber due to COVID-19.

ABOVE From left, AFA-SA President Robert Black, sculptor Tim Thomson and Robyn Knight, Deputy Chair, Sir Richard Williams RAAF Centenary Celebrations Committee.

RIGHT 97-year-old David Leicester beside an Air Force centenary banner featuring a photograph of him in front of a Lancaster bomber.

BOMBER COMMAND COMMEMORATIONS

ON 5 JUNE, AFA-SA joined with No.462 Squadron, a RAAF Edinburgh-based Bomber Command Unit, to hold the annual Bomber Command Commemorative Ceremony at the Air Force Memorial. About 150 people joined to honour the 10,000 Australians who served, and more than 3,500 who gave their lives, in Bomber Command in WWII.

The ceremony was attended by SA Governor His Excellency Hieu Van Le AC and representatives from government, the ADF and veterans organisations. Key attendees were SA Bomber Command veterans including David Leicester DFC and Bar, Ray Merrill DFC, Angus Hughes, Don Looker, Ern Milde and Frederick Brown. David Leicester survived 68 missions and was awarded a DFC in both of his operational tours. Ray Merrill and Angus Hughes survived over 30 missions.

30 SQUADRON QUEEN'S COLOURS CONSECRATION

IN MARCH, No.30 (City of Sale) Squadron was presented with the Queen's Colours by the Governor-General, David Hurley AC DSC (Ret'd) at RAAF Base East Sale, Victoria.

The original 30SQN was formed at RAAF Base Richmond in March 1942, with about 300 airmen. Sadly Bruce Robertson, President 30 Squadron RAAF Beaufighter Association, is the only original member left. After delays due to COVID-19, the consecration was held on 23 March 2021, which happened to be Bruce's 101st birthday.

A group of 30 Squadron RAAF Beaufighter Association members drove from Sydney and others from parts of Victoria for the event. At lunch after the official ceremony, the Governor-General's wife, Linda Hurley, helped Bruce cut his birthday cake, then she and her husband sang a special birthday song they had written for their grandchildren.

30 Squadron RAAF Beaufighter Association Secretary Yvonne Holt OAM also attended the event. She has been involved in the association since 1999, and secretary since 2005. Yvonne's father, Don Kirkwood, was the navigator of A19-141 which was lost in action in December 1943. He was executed by the Japanese in Rabaul POW camp. Yvonne very recently discovered that her father was part of the Talili Bay Massacre. Bruce knew Don and was in New Guinea at the time he went missing.

ABOVE Bruce Robertson and Yvonne Holt with four of the five COs of 30 Squadron since its reformation in 2010. From left, WGCDR James Svede, WGCDR Neil Foate, WGCDR Sharyn Bolitho and WGCDR Martin Quirke.

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CENTENARY BOOK LAUNCH

THE AIR FORCE ASSOCIATION (South Australia) (AFA-SA) has supported the release of two South Australian-focused books for the Air Force centenary, launched on 31 March 2021 by SA Governor Hieu Van Le AC.

South Australian Eagles by Greg Weller briefly introduces 30 South Australians who contributed to the Australian Flying Corps and the RAAF over the past 100 years. The 42-page booklet is a not-for-profit initiative for the Air Force centenary, aimed at inspiring the community to learn more about the proud legacy of South Australians in the Air Force. It is available free as a flipbook at raafa.org.au/saeagles and as a PDF download from raafasa.org.au. A limited number of hardcopies will be available at SA centenary events and for purchase (email Annette on raafaad@internode.on.net).

Also launched was SA military aviation historian Peter Ingman's *The RAAF in South Australia during World War 2*. The book provides a definitive look at the significant RAAF presence across SA during WWII, including the three major bases at Port Pirie, Mallala and Mt Gambier, training unit at Victor Harbor and RAAF elements at Gawler, Parafield and the Adelaide CBD. Retailing at $29.95, it is available from avonmorebooks.com.au.

ABOVE Greg Weller and Peter Ingman at the launch.

MEDIEVAL TRADITION ON PARADE

AS PART OF the Air Force centenary in South Australia, No.24 Squadron exercised its right to Freedom of Entry to Adelaide on 7 May to mark the 70th anniversary of the city giving the squadron permission to carry its name. Freedom of Entry traditions date back to medieval times and, upholding those traditions, South Australian Police Chief Superintendent Stuart McLean challenged No.24 Squadron as the parade neared Adelaide Town Hall. In an addition to the traditional challenge, City of Adelaide Kaurna Custodian Robert Taylor and RAAF Base Edinburgh Indigenous Liaison Officer and Kaurna man Flight Lieutenant Steve Warrior brokered a cultural relationship allowing No.24 Squadron access to the traditional lands of the Kaurna people.

RIGHT Commanding Officer No.24 (City of Adelaide) Squadron Wing Commander Alison Tinker leads the Freedom of Entry parade, Photo: Corporal Brenton Kwaterski.

80th Anniversary of RAAF Station Port Pirie

RAAF STATION PORT PIRIE was formed on 16 June 1941 and operated until 1946, training several thousand aircrew trainees. The base was home to No.2 Bombing and Gunnery School and No.3 Air Observers School.

For the 80th anniversary of the base's formation, the Port Pirie community partnered with RAAF Edinburgh and AFA-SA to hold several commemorations of the town's WWII service to the RAAF. More than 22 RAAF personnel perished while serving at Port Pirie; 20 are buried in the Port Pirie War Cemetery.

SA Governor His Excellency Hieu Van Le AC, GPCAPT John Grime, Officer Commanding 92 Wing, and RSL Port Pirie President John Chesson laid rosemary at each of the war graves adorned with a RAAF Ensign. A plaque was unveiled at the cemetery cenotaph in memory of SGT Reubun Plummer who perished on the 16 August 1942 along with LAC Leslie Price when their Fairey Battle crashed into Spencer Gulf. While the body of LAC price was recovered, tragically SGT Plummer is the only RAAF member to perish while serving at Port Pirie who has no known grave.

A commemorative service was held at the Air Force Memorial, followed by lunch at the Port Pirie RSL.

ABOVE Rosemary was laid at the graves of the 22 RAAF airmen buried at the Port Pirie War Cemetery.

PRESIDENT'S DESK

THE FEDERAL BUDGET 2021-22 contains a financial and health support package for ADF Firefighters who served at the RAAF Base Point Cook Fire Training School between 1 January 1957 and 31 December 1986. The ADF Firefighter Scheme, as it is known, recognises the potential health effects from exposure to a wide range of hazardous substances during fire training when personal protective equipment was not of the standard available today.

A group of former RAAF Firefighters lobbied government for nearly two decades to investigate and recognise the likelihood of serious health issues from their training and duties. Although epidemiological studies into the ground samples from the former RAAF fire school site commissioned by Department of Veterans' Affairs (DVA) revealed serious contamination, the former firefighters could not provide the level of proof required under the applicable veteran support legislation linking the exposure to the health conditions suffered by many. Regularity and extent of exposure to the noxious chemicals in the soil were impossible to determine. Consequently, they were beyond the help of existing veteran support legislation.

In 2018, Air Force Association (AFA) prosecuted the case arguing the existence of presumptive provisions in various federal and state legislation covering firefighters, including those employed by the Commonwealth. Those Acts acknowledged the hazardous nature of firefighter employment and provided for 12 cancerous and non-cancerous conditions that would be accepted without proof of a definite link between the disease and firefighting.

Following many engagements with DVA and finally the Minister for Veterans' Affairs, the government directed DVA to consult the Association on the design of a financial and health support package. About 300 former firefighters are now covered for 31 health conditions with the opportunity for compensation, treatment and access to health support programs and are expected to benefit from the ADF Firefighter Scheme.

The establishment of the ADF Firefighter Scheme demonstrates the Association's commitment to the wellbeing of veterans and their families.

In June, I signed the Air Force Association Foundation Trust Deed that formerly established a foundation to financially support veteran-care initiatives. AFA Ltd (the national board) is the trustee of the foundation that will be administered by a board of management. Chief of Air Force (CAF) has agreed for Air Force to be represented on the foundation's board. AFA Ltd has a contract with Dalton Garland Blanchard, a professional fundraising company that specialises in the not-for-profit sector, to raise money for the foundation.

The national board agreed the foundation's objects should have a wide scope to provide its board of management with the necessary flexibility to approve proposals that will address whole of life well-being of veterans and/or their dependants. The foundation will support all veterans regardless of their service origin.

A start-up project for the AFA Foundation is intended to be the development of an AFA national homeless veteran and family support scheme. Initially, the foundation will focus its support and fundraising for a WA Division's veteran homeless initiative and any other division that wishes to embark on a similar endeavour. Further initiatives will be considered once the foundation has sufficient funding.

CAF has supported the idea of an Air Force/AFA alumni group to provide an opportunity to better connect former serving and serving members. AFA has established a working group to design the alumni organisation and function.

COVID-19 continues to interfere with our fellowship and commemorative events. However, it has and will not stop the Association supporting its members and the wider veteran community

Carl Schiller OAM, CSM
National President

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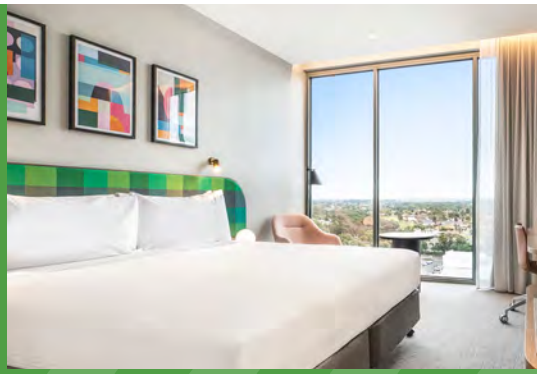

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EDITED BY John Kindler

Boeing expands Queensland's TECH HORIZONS

Loyal Wingman prototype.

BOEING AUSTRALIA HAS launched a new initiative as part of its HorizonX program, aimed at discovering local start-ups with technologies capable of advancing aerospace development and innovation. The three-year initiative, launched with the support of the Queensland Government, is expected to primarily focus on: advanced robotics; space; industry 4.0 techniques – automation and data exchange; sustainability; and autonomous systems.

Boeing has committed to provide eligible start-ups with direct engagement, mentoring, further technical and business evaluation, and the prospect of future investment.

It aims to identify 10 Queensland start-ups in the first year, before offering the incentives nationally.

At present, approximately 1,700 Boeing employees are based in Queensland along with 400 suppliers.

Source: Defence Connect

Maritime UAS FLIGHT TRIALS

AUSTRALIAN-OWNED AND operated Innovaero Industries announced that its maritime unmanned aerial system (UAS), dubbed the Innovaero FOX, has completed a series of tests and will progress to vertical take-off and landing, and conventional take-off and landing, trials later in the year.

While FOX is still in the developmental phase, the company has a proven track record of aeronautical commercialisation success, which has led to a number of promising discussions with defence primes regarding potential collaboration. To date Innovaero Fox research and development has been privately funded.

Innovaero expects to launch the Innovaero FOX at the Avalon Airshow.

Source: Defence Connect

Innovaero FOX UAS.

AVT Australia TO SUPPORT LAND 129

AUSTRALIAN DEPARTMENT OF Defence has confirmed that Ascent Vision Technologies (AVT) Australia has been selected to supply its advanced CM234 Spitfire camera gimbal for incorporation into the Australian Army's future tactical unmanned aerial systems (UAS) as part of the Tactical UAS Replacement and Enhancement Project – LAND 129 Phase 3.

The Spitfire gimbal incorporates electro-optical, short wave and medium wave infrared cameras, laser range finding and target designation functions.

The technology is set to support UAS platforms developed by either Insitu Pacific Limited or Textron Systems Australia, the final two competitors in the tender evaluation process for LAND 129 Phase 3. The government is expected to announce the winning tender later this year.

Source: Defence Connect

ABOVE CM234 Spitfire camera gimbal.

RAAF TRITON DRONES DELAYED

THE FIRST OF the RAAF's MQ-4C Triton drones will arrive in Australia a year late, in 2024, because upgrade work needs to be completed on the two bases at which the Triton will be based. The work required at RAAF Base Edinburgh comprises accommodation, operating and support engineering services facilities, while RAAF Base Tindal requires hangars and maintenance facilities alongside pavement works.

The Northrop Grumman Triton unmanned aircraft system (UAS) can support missions lasting 24 hours and is equipped with a sensor suite that provides a 360-degree view of its surroundings for more than 2,000 nautical miles. Australia has initially purchased three Triton high-altitude long-endurance UASs to be employed in surveillance roles.

Eventually, seven Tritons will be based at RAAF Base Edinburgh and will operate operate incooperation with the P-8A Poseidon maritime patrol aircraft.

Source: Australian Aviation

Northrop Grumman MQ-4C Triton in Australian Defence Force colours. Photo: Department of Defence.

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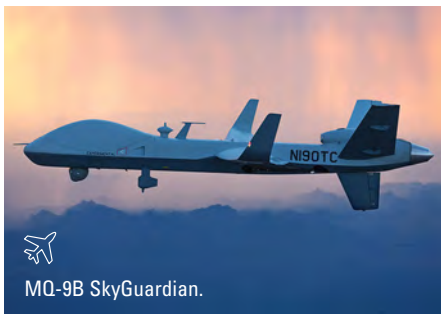
US gives greenlight for SKYGUARDIAN SALE

THE US DEFENSE SECURITY Cooperation Agency has approved Australia's request to purchase up to 12 weapons-ready MQ-9B SkyGuardian/SeaGuardian aircraft for an estimated US$1.65 billion ($2.1bn). The deal also involves the provision of mission equipment.

The Australian government is proceeding with the acquisition despite manufacturer General Atomic's failure to demonstrate the aircraft's capability in urban environments. The Department of Defence has dismissed concerns over regulatory compliance, aviation safety and airworthiness, which it noted would be addressed "well ahead of achieving initial operating capability", currently scheduled for the mid-2020s. "The variant of SkyGuardian that Defence is purchasing will be certified to similar standards as manned aircraft to ensure the safety of people on the ground and other airspace users," a spokesperson said.

Source: Defence Connect



MQ-9B SkyGuardian.

BAE SENSORS FOR JOINT STRIKE MISSILE PROGRAM

NORWEGIAN PRIME KONGSBERG Defence & Aerospace has ordered an additional 180 passive radio frequency sensors (PRS) from BAE Systems Australia to support its Joint Strike Missile (JSM) program.

The additional order follows the completion of the first full-rate production order for 200 PRS units, delivered by BAE Systems Australia over the past five years.

Kongsberg's JSM can be employed against both maritime and land targets and is billed as the only anti-ship cruise missile that can be carried internally by the F-35 Joint Strike Fighter, enabling the aircraft to retain its range and stealth capabilities.

The JSM is a variant of the Naval Strike Missile selected by the US Navy and is being proposed for selection for the Royal Australian Navy's SEA 1300 project.

Source: Defence Connect

DEFENCE GRANTS FOR SMALL BUSINESSES

THE COMMONWEALTH GOVERNMENT has awarded a total of $837,000 in Defence Global Competitiveness Grants to six Australian small businesses, in a bid to support their expansion in the global market.

Victorian UNEEK Bending secured $216,389 to purchase and install equipment to meet the manufacturing requirements of major global chains. SMETEC Services, NSW secured $208,332 to establish an advanced manufacturing facility for processing specialised Australian armoured steels and composite products. Heat Treatment, Qld secured $131,447 for the construction of a cleaning and assembly facility for vacuum brazed chassis for the manufacture of cold plates for the F-35 program. Acacia Systems, SA secured $40,944 for the acquisition of Zone 3 Security Infrastructure Accreditation. Laserdyne, Qld secured $180,125 to purchase and install equipment to increase production output. Intellidesign, Qld secured $59,908 to upgrade the company's cyber and physical security certification.

Source: Defence Connect

Integrating technology for air battle managers

RAYTHEON AUSTRALIA HAS partnered with Australian AI and robotics company Agent Oriented Software (AOS) to enhance the ADFs battlespace management capability. Raytheon has successfully integrated AOS's newly developed Intelligent Battlespace Advisor (IBA) with the Raytheon Solipsys' in-service Battlespace Command and Control Centre (BC3) as part of the Raytheon Missiles & Defense command and control portfolio.

It is the first time a commercially developed third-party product has been successfully integrated with BC3 outside the USA.

IBA has been developed to provide time-critical information about unusual airspace activity to air battle managers, enabling accelerated and informed decision-making. IBA's intelligent software agents are reportedly able to continually monitor all tracks in the Asia-Pacific airspace and classify them as routine or flag them for further investigation by an air battle manager.

IBA technology is expected to increase the capability of BC3, which has been in operation by the US Air Force since 2008. IBA allocates an intelligent software agent to each track to 'reason' with the available data. If a track is of concern, the IBA agent alerts the air battle manager.

BELOW Operators interface with the battlespace management system.

C-390 MILLENNIUM

SUCCESSFULLY ACCOMPLISHING MISSIONS

The C-390 Millennium multi-mission aircraft is in-service with Brazilian Air Force delivering exceptional performance and fulfilling all expectations, most notably with support during the Covid-19 pandemic. The C-390 is also the aircraft of choice for Portugal and now Hungary too. Both these air forces have selected the C-390 to meet their own unique and demanding operational requirements. By combining state-of-the-art systems and proven technologies with a worldwide network of reputable suppliers, the C-390 Millennium is a versatile addition to any air force. The C-390 is the most reliable, easy to operate and efficient aircraft in its class.

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Photographic record made by the Brazilian Air Force on one of the missions to combat COVID-19 in Brazil.

New direction for navigation training

RAAF NO.32 SQUADRON and Air Mission Training School (AMTS) have received a new mission airborne training system (MATS).

The console-based system installed in KA350, King Air aircraft replaces a navigator training system that had been in use since the early 2000s.

The new MATS was developed by Jet Aviation in partnership with Sydney-based software company Cirrus and Defence's Capability Acquisition and Sustainment Group and received specialist design and technical input from the Institute of Aviation Medicine.

AMTS C Flight commander Squadron Leader Charles Tomlinson said the way navigators used to be trained involved a lot of paper maps and charts.

"MATS is a very different approach that allows us to inject training scenarios directly into the on-board console so trainees can fly realistic, high-fidelity missions taking all the aircraft's technical requirements into account," he said.

"This is a comprehensive and immersive next-generation training system that sets students up for success, whether they go on to specialise in air combat, maritime or air mobility roles."

Source: Airforce Technology

BELOW Air Mission Training School instructors conduct functional tests on the new Mission Airborne Training System. Photo: SQNLDR Charles Tomlinson.

Lockheed Martin's long-range anti-ship missile emerging from the cannister.

Defence seeks input on sovereign GUIDED WEAPONS PUSH

DEFENCE HAS PUBLISHED a new request for information seeking input from defence industry and academia regarding capacity and interest in supporting the government's $1 billion Sovereign Guided Weapons and Explosive Ordnance Enterprise.

The initiative aims to address gaps outlined in the *2020 Defence Strategic Update* by providing stakeholders with opportunities in advanced manufacturing through the establishment of industry partnerships. It is expected to support Defence's inventory of guided weapons and explosive ordnance, encompassing: manufacture; research and development; education and training; test and evaluation; maintenance and repair; storage and distribution; and disposal.

Several stakeholders have already expressed interest, including local munitions company NIOA, which has set up the Australian Missile Corporation (AMC). A number of firms have joined the AMC, including Quickstep, Moog Australia, Black Sky Aerospace and Thomas Global Systems.

Lockheed Martin Australia and Thales Australia have also finalised a teaming agreement to facilitate co-operation in the design, development and production of Lockheed Martin's long-range anti-ship missile – surface launch variant. The agreement will focus on booster and rocket motor technologies.

The establishment of a sovereign enterprise, accelerated earlier this year amid mounting regional threats, forms part of the government's investment in the early development of long-range anti-ship missiles, extended-range surface-to-air missiles, advanced lightweight torpedoes and land strike capabilities.

The investment will also see the nation's current and future submarine and surface fleets fitted with anti-ship and surface-to-air missiles with a range of approximately 370km, and maritime land strike missiles with a range of approximately 1,500km.

COVID forces AVALON 2021 cancellation

THE AUSTRALIAN INTERNATIONAL AIRSHOW, AVALON 2021, has been cancelled, due to increased uncertainty created by the impacts of the Delta variant of COVID-19. Organisers are now focussed on planning and preparation for AVALON 2023 which will be held from 28 February to 5 March 2023 at Avalon Airport, Victoria.

QUICKSTEP'S SUPER HERCULES MILESTONE

ASX-LISTED AEROSPACE composites company Quickstep has confirmed delivery of 200 shipsets of wing flaps for the Lockheed Martin-built C-130J Super Hercules as part of a five-year contract, scheduled to conclude in 2024.

Quickstep has also been tasked with supplying composite parts for Lockheed Martin's F-35 Lightning II Joint Strike Fighter program and has supplied the prime with 10,000 parts since securing the contract.

In February, Quickstep completed acquisition of the aerospace maintenance, repair and overhaul (MRO) business of Boeing Australia Component Repairs, based in Tullamarine, and relaunched it under its own brand, Quickstep Aerospace Services, to expand its capacity to support domestic and international clients.

The firm has also signed a non-binding memorandum of understanding as part of a proposed aftermarket services agreement with Triumph Aviation Services Asia, a subsidiary of Triumph Group. The companies are exploring a strategic alliance aimed at expanding regional coverage for MRO airline customers.

Source: Defence Connect

ABOVE Quickstep crew with a packaged C-130J wing flap shipset.

Aussie Invader 5R.

ENGINEERING AN EARTH-BOUND ROCKET

AFTER A RAF PILOT BROKE THE SOUND BARRIER ON LAND, AUSTRALIAN ***ROSCO MCGLASHAN*** AND HIS TEAM SET ABOUT EXPLOITING AEROSPACE TECHNOLOGY TO BUILD THE WORLD'S MOST POWERFUL CAR, WITH THEIR SIGHTS SET ON EXCEEDING 1,600KPH (MACH 1.3).

OUR WINTER EDITION *told the story of Rosco McGlashan's triumph in setting a new Australian land speed record, and his continuing wretched run of luck with the weather that denied him a shot at the world record before Thrust SSC raised the bar and broke the sound barrier. An ordinary person would have resigned himself to 'a goal not realised' and eased into retirement. However, as readers may have guessed from previous instalments, Rosco is no ordinary bloke. Here he takes up the story...*

In 1997 our good friend and exceptional RAF pilot Andy Green was the first man in history to drive a car at supersonic speed: 1,227kph (763mph) and Mach 1.02.

As in the history of our chosen sport, many cars that have taken years to develop can't reach their speed potential before a rival exceeds their target speed, ours at that time for *Aussie Invader III* was 1,100kph (685mph) and Mach 0.89.

Being involved in land speed racing is a bug you can never shake; all of the past record contenders will admit that when the bug grabs you, you're hooked.

On hearing the news of Andy's mind-blowing supersonic record the Aussie Invader team immediately started design work on a brand-new project, setting our sights on a never-before-tested concept of constructing a car that would reach 1,000mph (1,609kph) and Mach 1.3. With a budget that would struggle to feed a guinea pig and a professional team of volunteers whose only reward was coffee and a ham sandwich, we got back to work. As you can imagine, there were numerous challenges to overcome before we could build *Aussie Invader 5R*.

SOURCING THE ENGINE

The first task was to find an engine that would provide sufficient thrust to do the job – the most likely place being the USA. Getting our hands on an ablative rocket engine, together with the Atlas ICBM injector that we need for our propellant mix, test firing it in Mojave, California and shipping it out of the US was an outstanding achievement by our team. It also required some favours from the personal US contacts I've developed over the years of our Aussie Invader projects. The result is a NASA/HMX liquid rocket that produces 62,000 lbf thrust (equivalent to about 200,000hp) which we predict will accelerate the car from 0 to1,000mph in 22 seconds.

ABOVE A computer-generated image of *Aussie Invader 5R*.

THE 'FUSELAGE'

Our car is built around a 12m long, steel pipe with a 36 inch (914mm) outside diameter. The pipe is 10mm thick and was rolled from a flat sheet and seam welded and weighs a massive 2.5 tonnes. It is hard to imagine, but the point of keeping the weight of the car up (minimum weight is 6.3 tonnes fully fuelled), is to slow *Aussie Invader*'s acceleration down to under 3g, otherwise the 140kg wheels cannot spin up fast enough, and loss of traction could cause the wheels to all be spinning at different speeds, pulling the car off course.

Our first challenge was to re-roll the pipe to achieve a straightness of within 3mm end to end, and build a number of internal bulkheads to contain our high-energy propellants in a completely sealed bay, protecting the driver and adding stiffness to our 14m wheelbase and 16m total vehicle length.

WHEELS

The wheels are probably the most critical element of any race car, especially one that can travel at such high speed. In the case of *Aussie Invader 5R*, the wheels must be able to withstand 50,000g centrifugal loading at the rim at 1,000mph, and they're the culmination of many years work by our team. Machined from a solid billets of 7050 aluminum, their profiles vary slightly due to different car weight bias from front to rear; the front wheels have a more rounded profile than the more v-shaped rear wheels.

The best possible bearing solution for *Aussie Invader 5R* was the result of extensive work undertaken by Swedish bearing and seal manufacturier SKF with its engineers worldwide designing and researching. Each wheel runs on a matched set of four super-precision high-speed wheel bearings produced exclusively for our car by SKF in Italy, and incorporating a special lubrication solution.

Braking is another critical function. It takes 13km to progressively slow *Aussie Invader 5R* in three stages (see page 25). In an emergency created by a braking system failure, we use our 'Fred Flintstone' brake, which is a hydraulic steel ram primarily used to lift the front of the car for maintenance. However, it can be lowered by the driver (or remotely) to dig into the ground to stop the car as a fail-safe measure.

CANARDS

The car has two floating canard winglets either side of the nose cone just aft of the front wheels. The canards addressed two critical considerations: one the positive pitching moment created by deployment of the airbrakes that could flip the car backwards; the other to alleviate an increasing downward force on the front wheels, thereby increasing the rolling drag or, at worst, forcing the front wheels to plough into the lakebed. A fixed canard could compensate for one or the other of those adverse effects, but not both.

By exploiting the known aerodynamic effects of delta planforms, our expert aerodynamicist, Paul Martin, has come up with an innovative design for a floating canard that will do both jobs. I don't pretend to understand his exhaustive analysis, but for the academically inclined, his work can be found on our website (aussieinvader.com/canards).

SUPERSONIC AERODYNAMICS

The aerodynamics on a ground-hugging vehicle at supersonic speeds were studied extensively by several Australian universities and two of Aussie's cleverest computational fluid dynamics scientists, both of whom are working on defence projects in both the US and the UK. Many of the features of the car (including the canard design) are the result of their work, but the most notable is the v-shaped underbelly which is designed to deflect the shockwave that bounces off the ground once the car reaches sonic speed.

FUEL STORAGE & FEED

We decided on using a pressure-fed rocket feed system which utilises pressurised inert gas, nitrogen, to force the propellants into the engine combustion chamber. The fuel is turpentine with a furfural alcohol additive and our oxidiser is 98% HNO3 (white fuming nitric acid). Those propellants undergo a hypergolic reaction (spontaneous combustion on contact) to create full power five milliseconds after mixing.

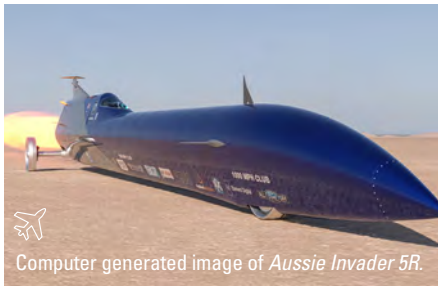
Our propellant tanks have been a huge obstacle. After many years of trying to construct a light-weight baffled cylindrical fuel and separate oxidiser tanks, it became obvious that the blowdown pressure required for our rocket engine to function could not be contained using the best-known alloys in the aerospace industry.

We visited Mojave to study the design of different combined propellant module solutions, which typically use a cluster of tubes mounted around the outside of the rocket's structural system, where gas pressure and gravity force the propellants downwards and into the combustion chamber. However, we found they were unsuitable for our vehicle operating horizontally.

We therefore set out to develop our own orbital propellant module (OPM). The solution uses 7 x 7075 aluminum alloy tubes (3x fuel, 4x oxidiser) all fitted with pistons driven by gas pressure stored in four onboard filament-wound nitrogen tanks designed to operate at 4,000psi. To ensure safety during refueling, the fill points are on opposite sides of the car and recharging of the two propellants is carried out at different times.

We are now performing a number of pressure and electronic tests on those components before final fitment into the car. We believe the OPM technology could gain interest in the space industry as a satellite refueller.

Rosco in his garage with *Aussie Invader 5R.*



Computer generated image of *Aussie Invader 5R.*

WHEELS AND BEARINGS

- SPONSORS: Calm Aluminium and SKF
- MATERIAL: Machined from 7050 billet alloy by machined in WA by VEEM
- WEIGHT: 140kg per wheel
- DIMENSIONS: 900mm diameter x 198mm wide
- MAXIMUM ROTATIONAL SPEED: 10,000 RPM +/- 5%
- PREPARATION: Shot peened, balanced and spun tested
- FORCE AT WHEEL RIM: 50,000G at 1000 mph/1600+ kph
- WHEEL PROFILES: Vary slightly due to different weight bias from front to rear
- BEARING TYPE: SKF 7020 ACD/P4AQBCA series angular contact
- BEARINGS PER WHEEL: Matched set of four super-precision high speed wheel bearings.

THE BRAKING SYSTEM

- Hydraulic air brakes start to be deployed at about 800mph (1,287kph), after the engine is shut down by the driver, taking 4 seconds to fully open. The air brake design is unique to *Aussie Invader 5R*, with a series of holes on the lower fin edge increasing the efficiency by about 30% over conventional air brakes.
- High and low-speed chutes are deployed by explosive charge drogue guns at 600mph (965kph) and 400mph (644kph) respectively.
- High-speed disc brakes fitted to the rear wheels are applied at 200mph (322kph) to bring the car to a stop.

ABOVE Deployed speed brakes, parachutes and rear-wheel disc brakes.

PARAMETERS MONITORED

- Individual wheel speeds
- Front and rear axle load
- Centre of gravity position change with propellant usage
- Nitrogen pressure
- Orbital propellant module piston positions
- Temperatures: ambient, nose and engine
- Steering input
- Vision from four cameras: forward facing; aft facing; two cockpit
- Driver's vitals

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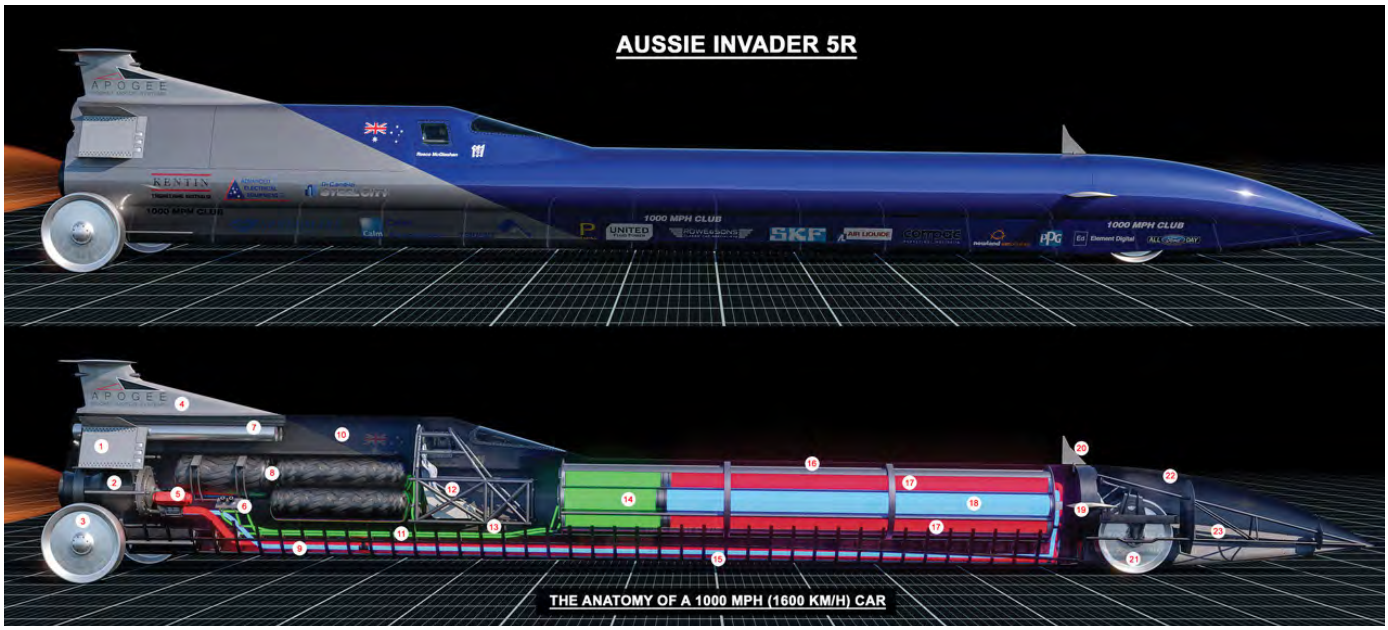

MAJOR COMPONENT OVERVIEW OF *AUSSIE INVADER 5R*

1. AIR BRAKES
2. ROCKET ENGINE
3. REAR WHEELS
4. TAIL FIN – Vertical fin and horizontal stabiliser with adjustable pitch, honeycomb construction, containing forward and aft replay cameras.
5. PROPELLANT VALVE ACTUATORS
6. PROPELLANT PRESSURE REGULATORS
7. BRAKE PARACHUTES
8. BLOWDOWN TANKS – for gaseous nitrogen, rated at 4,000psi.
9. PROPELLANT FEED LINES
10. SERVICE BAY – for electronics and hydraulics (detail not shown).
11. NITROGEN FEED LINES
12. DRIVERS COCKPIT – enclosed by reinforced roll cage.
13. DRIVER'S SYSTEMS – onboard fire suppressant systems, air breathing and communications equipment.
14. GASEOUS NITROGEN TANKS
15. V-SHAPED UNDERBELLY
16. ORBITAL PROPELLANT CHARGING MODULE – unique to *Aussie Invader 5R*.
17. OXIDISER TUBES – 4 tubes holding about 2 tonnes of white fuming nitric acid.
18. FUEL TUBES – 3 tubes holding about 800 litres of turpentine.
19. CANARDS
20. VERTICAL STABILISER – front stabiliser assists directional control.
21. FRONT WHEELS
22. NOSE CONE – angled down one degree.
23. NOSE CONE FRAME – supports the nose and houses Doppler radar and avionics equipment.


Cockpit.

ELECTRONICS

Once under power, the only information displayed in the cockpit is the run time and speed in mph. However, a host of other information is also collected and transmitted to a control cabin over a Tait-supplied military-grade telemetry system.

Building the vehicle, always going cap in hand to our great sponsors, working with a brilliant lifelong team of guys and riding the highs and lows of the mission has made us all resolute in our ambitions to be the fastest team in the world. Our progress has been slow but steady and we're almost there. While no race date or location has yet been determined, we are working day and night to win the 1,000mph milestone for Australia.

Rosco McGlashan

MD'S NOTE. To observe *Aussie Invader 5R* at close quarters, as I have been privileged to do, and to consider the engineering challenges in building a car of its capability, you release the project is akin to a prototype aerospace development. I am filled with awe that such a vehicle can be developed from a garage (admittedly an oversized one) at a home in suburban Perth. To better comprehend the research and technology behind Aussie Invader 5R, visit aussieinvader.com/the-car. While on the website, if you would like to join the 1000mph Club or make a donation, your participation would help Rosco realise his ambition to be not only the fastest Aussie, but the fastest man on Earth. *Wings* is a member.

Neil Smith

Scan the QR code to view a YouTube video about *Aussie Invader 5R*'s design and the unique features that will help it break the world land speed record.

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INTO THE COLD WAR

IN THE THIRD PART OF OUR SERIES OF EDITED EXCERPTS FROM THE RAAF PUBLICATION *THE AUSTRALIAN EXPERIENCE OF AIR POWER*, WE EXAMINE THE COLD WAR ERA, 1945-1991.

PHOTOS Courtesy of the Australian War Memorial except where noted.

THE RAAF CAME of age during World War II. By war's end, it was the world's fourth largest air force, but after Japan's surrender in August 1945, it was dramatically downsized.

In the following decades, the RAAF underwent a resurgence in effectiveness and played its part in the struggle against communism. Over the battlegrounds of Korea, Malaya and Vietnam, its contributions were out of all proportion to its size.

POST-WAR DEMOBILISATION

During the war, the RAAF had established an identity and reputation for operational effectiveness, and a justifiably proud record as an independent air force. Although it had not taken part in the final push towards Japan, due to US posturing, and by war's end was still largely based in the Netherlands East Indies, particularly on the island of Morotai in the Halmahera group (not the adjacent Celebes, as stated in part 2 of our RAAF history series), its role in the Allied victory should not be understated.

At the time of Japan's surrender, the RAAF had some 130,000 personnel, 6,200 aircraft and 76 squadrons on strength. Yet by 1948, demobilisation had reduced the Air Force to about 8,000 personnel and 13 flying squadrons, virtually the same as when the war began.

Australia's post-war strategic environment was significantly different and needed a new approach. The nation had emerged as a player on the world stage and, as well as defending Australia's sovereignty, the RAAF was to be available when needed for operations with the new United Nations (UN) organisation to help preserve international peace.

To effect the new strategy, the government approved the rebuilding of the RAAF; 12 squadrons were to be manned by Permanent Air Force (PAF) personnel while four interceptor fighter squadrons would be operated by the Citizen Air Force. The PAF squadrons included a mix of heavy bomber, long-range fighter, transport and reconnaissance assets and were also committed to a range of additional sustainment and national support roles including search and rescue, target-towing and aerial survey operations.

Technological advances had rendered many of the RAAF post-war aircraft obsolete and a program of re-equipment began almost immediately. In 1946, orders were placed for jet-powered Vampire fighters, and in 1950 Australia ordered Canberra twin-jet bombers to complement the existing force of 1944-designed Lincolns.

OCCUPATION OF JAPAN

A RAAF wing of three Mustang fighter squadrons, maintenance and base support units were despatched to Japan as a contribution to the British Commonwealth Occupation Force in the Allied occupation of Japan. A fighter control unit and an airfield construction squadron were also deployed. With more than 2,000 personnel, the RAAF element was the largest of the national contingents comprising the British Commonwealth Air Group.

The RAAF commitment finished in 1950, but No.77 Squadron remained on station, primarily to establish Australia's right to influence the drafting of a peace treaty with Japan.

ABOVE No.1 SQN Lincolns bombing a terrorist camp in Johore, Malay Peninsula, 1955.

Presentation of Arms by No.77 SQN as the British Commonwealth Occupation Force commander, LTGEN John Northcott, enters RAAF Headquarters at Iwakuni Airfield, Japan in 1946.

TOP LEFT No.3 SQN Sabre on alert at RAAF Base Butterworth, 1962.

LEFT Meteors of No.77 SQN leaving Kimpo Airfield over a South Korean village, July 1952.

BERLIN AIRLIFT

In June 1948, the Western powers in occupied Germany were forced to mount an airlift to sustain sectors of the city of Berlin under their control after the Soviets imposed a blockade intended to force its former wartime allies out of those zones. That power play was the beginning of the Cold War that continued until the break-up of the Soviet Union and the unification of Germany in 1990.

A total of 57 Australians joined Royal Air Force (RAF) transport squadrons in the Berlin Airlift, demonstrating Australia's solidarity with the position adopted by Britain and America. Hundreds of RAF, US Air Force and civil aircraft delivered a daily average of 8,000 tons (7,257 tonnes) of food and supplies such as fuel until the Soviets lifted the year-long blockade.

MALAYAN EMERGENCY

In April 1950, Britain asked Australia for transport aircraft and heavy bombers to join the campaign they had been waging since 1948 against a communist-led insurgency in Malaya. The RAAF sent eight Dakotas of No.38 Squadron to

TOP During 1948-49, RAAF crewmen flew RAF Dakotas in the Berlin Airlift. Photo: National Museum of the US Air Force.

ABOVE Vampires of No.78 Fighter Wing over Malta's Grand Harbour.

Singapore and those aircraft and crew played an important counterinsurgency role, dropping supplies by parachute to Commonwealth forces operating in the Malay jungle.

In July, Australia also deployed No.1 Squadron Lincoln heavy bombers to Singapore's Tengah airfield. The squadron flew day and night sorties to bomb and strafe insurgent hideouts and dropped about 15,000 tonnes of bombs over the eight-year commitment.

In 1958, the Lincolns were replaced by No.2 Squadron operating Canberra jet bombers which flew strike missions for a further six months from Butterworth air base in Malaya.

KOREAN CONFLICT

The RAAF meanwhile became involved in another conflict, this time in Korea. After the communist state of North Korea invaded its southern neighbour on 25 June 1950, Australia was asked to contribute to a US-led UN force sent to aid an embattled South Korea. Australia offered No.77 Squadron, which was preparing to return to Australia from Japan. The squadron uncrated its piston-engine Mustang fighters and commenced war operations across the Korea Strait.

The RAAF commitment lasted three years and included Dakota transports which were diverted from the effort in Malaya. Early in 1951, No.77 Squadron converted to Gloster Meteor jet fighters purchased from Britain and was soon engaged in clashes with Soviet MiG-15 jet fighters flown by communist Chinese, North Korean and Russian pilots. The unit was withdrawn from the air defence role after it was established that the Meteor was inferior to the MiG-15 in air-to-air combat. The squadron continued ground attack operations, mainly in the interdiction role, until the end of conflict.

Those No.77 Squadron aerial engagements are the only jet aircraft air-to-air combat operations conducted by the RAAF to date.

GLOBAL TENSION

In 1951, the RAAF was committed to a third concurrent overseas assignment, to bolster British forces garrisoning the eastern flank of the North Atlantic Treaty Organization (NATO) due to increasing tension with the communist bloc. No.78 Fighter Wing was deployed to Malta and operated Vampire fighters leased from Britain.

The deployment supported not only Australia's traditional ally Britain, but also the US with whom it had joined in a new agreement – the Australia, New Zealand, United States Security (ANZUS) Treaty – in circumstances in which nuclear war seemed a possibility.

In response to global uncertainty, Australia reintroduced national service to begin the partial military training of its young men in 1951. Australia had invoked national service or conscription to fill the ranks of its armed forces on four previous occasions. However, compulsory military service in the RAAF lasted only from 1951 to 1957. The program called for 5,000 18-year-old men to be trained annually for Air Force service before transferring to the RAAF

ATOMIC TESTING

For a time during the 1950s, the RAAF entertained the idea of becoming a nuclear force. The British atomic tests in Australia seemed to offer an opportunity to develop firsthand knowledge of nuclear weapons, possibly facilitating a future acquisition.

During 1952-57, five test programs were conducted at Monte Bello Island, WA, and at Emu Field and Maralinga, SA. RAAF Lincoln aircraft and their crews, without suitable protection or decontamination procedures, sampled the expanse and track of the radioactive 'mushroom' clouds that billowed from the nuclear detonations.

ABOVE The first detonation of a nuclear device near Monte Bello Island, WA, as part of Operation Hurricane, 3 October 1952.

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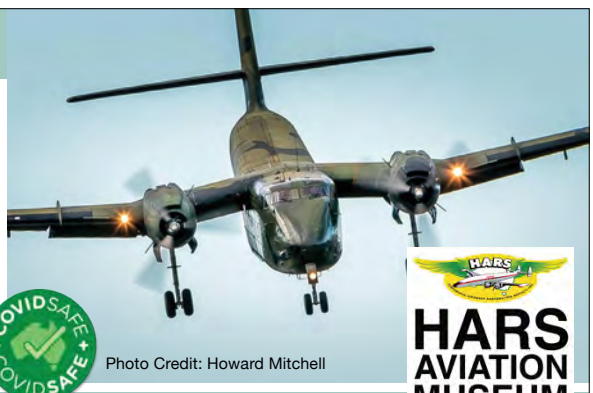

COVIDSAFE

Photo Credit: Howard Mitchell

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Reserve for five years. Only half the targeted figures were ever reached.

During 1953-54, the RAAF was reorganised along functional rather than geographical lines. The five area commands set up in 1939 to cope with mass mobilisation were integrated into three functional commands: Home, Training and Maintenance. In 1959, the latter two commands became a single Support Command, while Home Command became Operational Command.

FAR-EAST STRATEGIC RESERVE

In 1954, Australia shifted its focus to the Asia-Pacific region and signed the Manila Pact which brought the South-East Asia Treaty Organization (SEATO) into effect. It later joined Britain and New Zealand to create a British Commonwealth Far East Strategic Reserve on the Malayan Peninsula to oppose further communist expansion in the region. The Butterworth air base was enlarged and, from 1958, it became the base for Canberra bombers of No.2 Squadron and Nos 3 and 77 Squadrons operating CA-27 Sabre fighters.

In June 1962, fears of a possible invasion of Thailand from across its north-eastern border with Laos led to a rushed commitment of air elements drawn from the US, Australia, Britain and New Zealand. Australia raised No.79 Squadron at Ubon, North-East Thailand and equipped the squadron with Sabres despatched from RAAF units based at Butterworth, Malaysia for the next six years.

Although the feared invasion of Thai territory never materialised, a related insurgency in neighbouring Indochina was sufficient to keep the squadron in Ubon as a safeguard against an escalation of the conflict.

In 1964, the Indonesian Government aggressively opposed the formation of the Federation of Malaysia. The prospect of conflict prompted an Air Board order raising the fighter squadrons at Butterworth, Malaysia to a state of operational readiness. A detachment of four Iroquois helicopters from No.5 Squadron was also despatched to Malaysia, ostensibly to strengthen Australian ground forces protecting Malaysia's border with Thailand from communist incursions.

Although there were some tense moments which prompted fighter deployments to Darwin and Labuan in British Borneo, there were no actual aerial clashes before a new regime in Indonesia ended the policy of Konfrontasi in 1966.

THE VIETNAM WAR

More than 4,000 RAAF personnel served in Vietnam, with peak presence totalling some 750 personnel and 34 aircraft.

Transport Flight Vietnam (No.35 Squadron from 1966) undertook short-haul supply tasks throughout South Vietnam carrying freight and passengers over a set of regular routes. While the unit's Caribou aircraft remained based at Vung Tau, detachments also operated from northern airfields.

Following the arrival of the 1st Australian Task Force (1ATF) in 1966, the squadron periodically provided tactical airlift for Australian ground operations. Effective completion of those tasks, often exposed to enemy ground fire, built a unit reputation out of all proportion to its small size.

Meanwhile, from 1965 a flight of No.38 Squadron Caribou operated out of Port Moresby providing transport support for the Papua New Guinea Defence Force for 10 years.

No.9 Squadron, equipped with UH-1 Iroquois utility helicopters, was designated to work most directly in support of Australian forces in Vietnam. In addition to troop transport and resupply, its mission included casualty evacuation and air rescue, aerial spraying, reconnaissance, and the insertion and extraction of Special Air Service patrols.

The squadron quickly found its role and employment a cause of hot contention. The Army's initial dissatisfaction with the perceived manner in which the RAAF allocated its limited airlift capacity, however, eventually gave way to a more harmonious and workable relationship.

From 1968, the squadron's role widened as later-model Iroquois were delivered. Some were modified to

NO.2 SQUADRON LOSSES

Magpie 91 (Canberra bomber A84-231) flown by FLGOFF Michael Herbert and PLTOFF Robert Carver was lost on a Skyspot (radar guided) mission on 3 November 1970. The cause of the loss has not been determined and the wreckage and crew were not recovered until February 2009. A second Canberra, A84-228, flown by WGCDR John Downing and FLTLT Al Pinches was shot down by an SA-2 Surface-to-Air Missile (SAM) in March 1971, both crewmembers ejected and were rescued by a 'dustoff' UH-1H Huey the next day.

ABOVE Medical evacuation by a No.9 SQN Iroquois at Nhut, South Vietnam, following a mine explosion in February 1967.

LEFT Viewed from another aircraft, a No.2 SQN Canberra drops its 750-pound bombs over the Mekong Delta in April 1969. The aircraft and its crew were later lost in action.

FAR LEFT Montagnard people at Plei Mrong, South Vietnam with a No.35 SQN Caribou transport, November 1966.

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ABOVE A Bird Dog observation and FAC aircraft.

RIGHT Mirages of No.2 Operational Conversion Unit at RAAF Base Williamtown. Photo: Department of Defence.

operate as gunships able to provide direct airborne firepower and the Squadron forged an impressive record of effective support to Australian soldiers.

In 1966, the Australian Government decided to increase its Vietnam commitment, adding a battalion to 1ATF and deploying No.2 Squadron, equipped with Canberra bombers, to Phan Rang.

Arriving April 1967, the squadron joined the US 35th Tactical Fighter Wing and was employed initially on night, high-altitude, radar-controlled bombing missions. Later daylight, low-level, visual bombing under direction of Forward Air Controllers (FACs) became the regular mission. Crews honed their skills on operations and achieved outstanding bombing accuracy, regularly accounting for a disproportionately high share of inflicted damage.

In effect, Nos 2 and 35 Squadrons served as elements of the USAF in Vietnam, as did a range of other RAAF personnel. From 1966, the RAAF had a small cadre of fighter pilots employed in American tactical air support squadrons as FACs, a specialist role directing close air support strike operations against forces in contact to ensure effective engagement while ensuring the safety of allied forces in close proximity. FACs, operating low-speed light aircraft type platforms such as the O1-A Bird Dog, were frequently exposed to hostile fire.

Also serving with the USAF was a small group flying F-4 Phantom fighter/bombers and occasionally operating deep into North Vietnam, Cambodia and Laos. From 1967, the RAAF also supplied photo interpreters to assist the intelligence staff of the US Seventh Air Force, along with radar controllers and ground defence personnel.

Sustaining the Australian force in Vietnam required considerable support from outside bases. From 1964, RAAF Dakotas from Butterworth, Malaysia and C-130 Hercules from Richmond, NSW made regular supply and passenger flights to and from Vietnam. From 1965 to 1972, the RAAF operated a regular courier service from Australia at Army request. In addition to flying in relief personnel, mail and freight, C-130 transports made aeromedical evacuation flights and effected the evacuation of Vietnamese orphans and refugees in 1975.

MODERNISATION

Concern that Australia might become engaged in a conflict with Indonesia drove a program to modernise the RAAF inventory. Beginning in 1958, the RAAF acquired surface-to-air missiles and replaced practically every major aircraft type. As Chief of the Air Staff (CAS) from 1957 to 1961, Air Marshal Frederick Scherger guided the RAAF through that period of major re-equipment.

In 1960, the Australian Government broke with tradition by selecting the Dassault Mirage III French interceptor fighter, rather than a US or British option to replace the Sabre. Produced by the Government Aircraft Factory in Melbourne, the Mirage was delivered in equal numbers of interceptor and ground-attack versions, which served in four squadrons between 1965 and 1989. Eventually all aircraft were modified for multi-role operations.

Meanwhile, in 1963, an overseas mission evaluated potential replacements for the Canberra bomber and the US General Dynamics TFX/F-111 was chosen. Twenty-four were ordered at an estimated total price of US$124 million (some $7 billion in 2021 dollars), almost the entire annual budget for the RAAF, and by 1967 that figure had doubled.

Technical problems with the aircraft delayed the order for five years after the first RAAF airframe had flown in 1968. In the interim, 24 F-4E Phantoms were leased from the US for three years. When the F-111Cs finally arrived in 1973, their acquisition proved to be well founded. The cutting-edge aircraft gave Australia unprecedented supersonic strike capability for nearly 40 years and helped transform the RAAF into one of the most modern and capable small air forces in the world.

In 1981, the government chose the US twin-engine McDonnell Douglas F/A-18A Hornet to replace the Mirage. The RAAF ordered 75 of the multirole fighter/attack aircraft, 73 of which were assembled by the Government Aircraft Factory at Fishermans Bend and Avalon, Victoria.

BELOW The F/A-18A Hornet replaced the Mirage from 1984. Photo: J. Torcasio.

No.10 SQN P2V-7 Neptune over the Coral Sea. Photo: Trevor Millard.

BELOW F-111s in formation for the bicentennial celebrations in 1988. Photo: Department of Defence.

The Hornet introduced capabilities such as pulse-doppler look-down radar with shoot-down capability, an inertial navigation system, a head-up display for both flight and tactical information and improved ergonomics through a hands-on-throttle-and-stick (HOTAS) systems management concept. HOTAS enabled the pilot (single crew) to operate the communications, navigation, weapons and electronic warfare systems efficiently without taking his/her hands from the primary flight controls.

MARITIME PATROL

Patrolling the maritime approaches to Australia's vast coastline has always been a primary role for the RAAF. During WWII maritime reconnaissance, coastal surveillance and search and rescue operations were the domain of long-range aircraft such as the Catalina flying boat and Liberator bomber. Those aircraft were soon replaced by an Australian-made maritime version of the Lincoln specialised for anti-submarine warfare.

From 1951, the Lockheed Martin P2V Neptune added more maritime surveillance capability with magnetic anomaly detection and longer range.

In the 1970s, the P-3B Orion four-engine aircraft was introduced and brought a new level of electronic surveillance and detection to the role. In modified AP-3C form, the Orion served until replaced recently by the Boeing P-8 Poseidon.

DEFENCE STRATEGY

The everchanging global geopolitical situation in the late 20th century forced a more direct focus on the defence of Australia itself, and an increased self-reliant military strength. In 1973, the single-service departments (Navy, Army and Air Force) were united within the Department of Defence, and the Chief of the Air Staff then answered directly to the Minister for Defence.

A 1986 review argued that Australian forces should seek to stop any attack in the 'air-sea gap' to the north. The review recommended a layered defence that relied on wide area surveillance, mobile land forces and bare air bases in the north, from which the RAAF could launch counter air and surface incursion denial missions. The review formed the basis for the landmark 1987 White Paper: T*he Defence of Australia*, which put air power at the centre of Australian strategic policy with a defensive focus.

In the years after the Vietnam War, the RAAF had built up an enviable reputation in rotary wing operations but had consistently failed to promote its role in the expected theatre that was increasingly evolving into a joint domain. A study into the transfer of battlefield helicopters to the Army found such a move could not be justified on the grounds of cost. However, a political decision in 1986 transferred control of rotary wing assets from Air Force to Army over the ensuing five years.

In 1987, the RAAF reorganised its functional distribution and command structure to better align its contribution to the national defence strategy. Five Force Element Groups were established: Tactical Transport Group, Air Lift Group, Maritime Patrol Group, Strike Reconnaissance Group and Tactical Fighter Group. The latter two merged to form Air Combat Group in 2002.

Under the direction of then CAS, Air Marshal R.G. Funnell, the Air Power Studies Centre (later Air Power Development Centre) was founded in 1989 as a permanent think tank for doctrinal development. Its first publication, *The Air Power Manual* (AAP 1000), was the RAAF's first officially published air-power doctrine. Its historical volume, AAP 1000H *The Australian Experience of Airpower*, is the basis for this RAAF history series.

NEXT EDITION: We'll delve into the RAAF story of peacekeeping operations, humanitarian aid and the war on terror.

MIDDLETON VC:
UNSURPASSED DEVOTION TO DUTY

FOR THE THIRD IN OUR SERIES ON THE AUSTRALIAN AIRMEN AWARDED THE VICTORIA CROSS, WE LOOK AT THE FIRST OF ONLY TWO RAAF RECIPIENTS.

ALTHOUGH THE SHORT STIRLING heavy bomber was obsolescent by late 1942, it was still a main-force bomber with Royal Air Force Bomber Command in the war against Germany and Italy. Its primary drawback was its reluctance to climb to altitude when fully loaded – a liability when the Swiss Alps had to be crossed during the long haul between England and Italy. And when over the target area, Stirling crews could find themselves running the gauntlet through the falling bombs of higher bombers.

On the night of 28 November 1942, the Fiat factory in the northern Italian city of Turin was targeted by 228 bombers, including 47 Stirlings. Captaining one of those with No.149 Squadron RAF was a former jackeroo from central New South Wales, PLTOFF Rawdon 'Ron' Middleton. Most of his crewmen had completed their tour of 30 bombing operations but had stayed on for two more ops in solidarity with their captain, who was on his 29th.

Over Turin, Middleton brought his aircraft down to the dangerous height of 2,000 feet and overflew the city three times to identify the target. An anti-aircraft shell tore a gaping hole in the right wing. Another exploded in the cockpit just before bomb release, seriously wounding Middleton, his co-pilot and wireless operator. "Oh my God, I've been hit," he gasped before losing consciousness.

Middleton soon revived, but was weak and had trouble seeing. His fellow crewmen saw the explosion had taken out his right eye and part of his face. He also had difficulty giving instructions over the gale-force wind coming through the smashed windscreen. The dazed co-pilot gained height and jettisoned the bombs. The pair then attempted to fly home to Britain.

Somehow, the two wounded pilots coaxed the stricken bomber across the Alps and to the French coast. Still at only 6,000 feet, they had to take evasive action as anti-aircraft fire exploded around them. Crossing the channel, they were almost out of fuel when they made landfall near Dover. Middleton ordered his crew to parachute out over the coast. Five did so and survived, but his front gunner and flight engineer stayed to assist him. To avoid hitting houses, Middleton flew away from the land and attempted to ditch. The Stirling crashed

TOP Middleton (right) during elementary flying training course No.7 at Narromine, NSW in 1940. He was raised in the region.

ABOVE LEFT Middelton's medals (VC at left) are held by the Australian War Memorial.

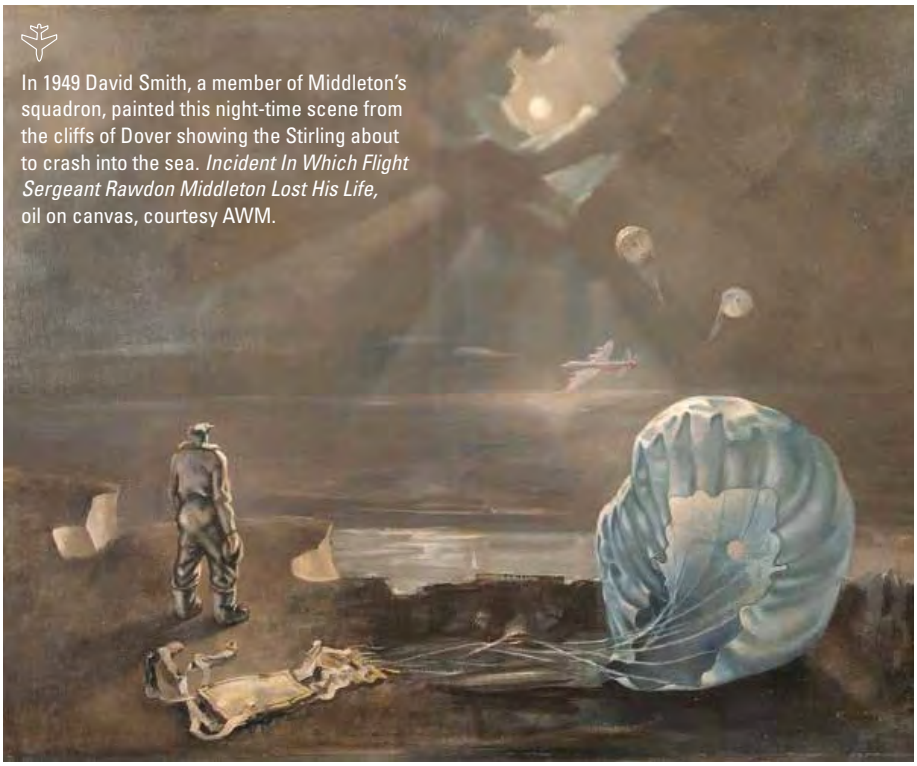
ABOVE RIGHT A posthumous 1943 portrait of Middleton by Harold Freedman. Image: AWM.

into the sea, killing the three crewmen.

The RAF bomber force returned to Turin the next night to finish off the Fiat factory. Two months later, Middleton's body washed ashore at Dover, and he was buried with full military honours in a churchyard in Mildenhall. He was 26 years old.

Middleton was awarded a posthumous Victoria Cross. The last line of the citation reds: *His devotion to duty in the face of overwhelming odds is unsurpassed in the annals of the Royal Air Force.*

In his home region, a public school in Parkes was named after him, and a memorial trust was started at his old Dubbo High School. Also in Dubbo, the Middleton tree grove was planted in Victoria Park by AIRMSHL David Evans on the 50th anniversary of his death. A bronze bust by Brett Garling was also dedicated there in 2014. RAAF Base Wagga has a Middleton VC Club, and at RAF Mildenhall, UK is the Middleton dining hall.



In 1949 David Smith, a member of Middleton's squadron, painted this night-time scene from the cliffs of Dover showing the Stirling about to crash into the sea. *Incident In Which Flight Sergeant Rawdon Middleton Lost His Life,* oil on canvas, courtesy AWM.

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VAMPIRE A79-636

WINGS VOLUME 73 NO.3

Second flight of Vampire A79-636 after Restoration by No.21 City of Melbourne Squadron – Port Melbourne, 28 February 1988. Flown by SQNLDR Ron Haack, Wings Manager.


A79-636

MISSILE

WITH A MAN IN IT

THE F-104 STARFIGHTER WAS THE FIRST INTERCEPTOR DESIGN OF THE 1950S PRODUCED BY KELLY JOHNSON AND HIS ADVANCED DEVELOPMENT PROJECTS (SKUNK WORKS) TEAM. IT WAS VASTLY MORE POTENT THAN THE P-80 SHOOTING STAR THAT PRECEDED IT, AND CAPABLE OF SPEEDS THREE TIMES GREATER; LOCKHEED'S ANSWER TO THE SOVIET MIG-15.

IN MAY 1952, Lockheed was offered a contract to build two fighter-interceptor prototypes to have a gross takeoff weight of about 32,000 pounds (14,515kg), and be powered by two Wright J65 turbojet engines. The company declined for several reasons.

Firstly, the US Air Force (USAF) had insisted on a contract forfeiting all patent rights, thus permitting the government to award production rights to any airframe contractor. Secondly, Lockheed was already under USAF contract to develop test data and design aids for the experimental Douglas X-3 Stiletto. And thirdly, Kelly Johnson was developing a design for an uncomplicated single-seat, single-engine fighter with a thin, straight wing. Johnson submitted that design, TDN CL-246, to the USAF in November 1952 as an unsolicited proposal.

The USAF did not have a requirement for the CL-246 design, however, it was enticing enough for the service to invent a requirement calling for a new lightweight, air-superiority day fighter to ultimately replace the F-100 Super Sabre from 1956. In the interests of fairness, competitive bids were invited from other airframe contractors.

Lockheed had already met all USAF requirements for a high-speed, lightweight fighter by designing its aircraft (by then Model 083-92-01) with an empty weight of just 11,500 pounds (5,215kg). It was a lean machine, with every possible ounce stripped from its airframe and equipment. At half the weight of aircraft proposed by other contenders, it had an excellent thrust-to-weight ratio.

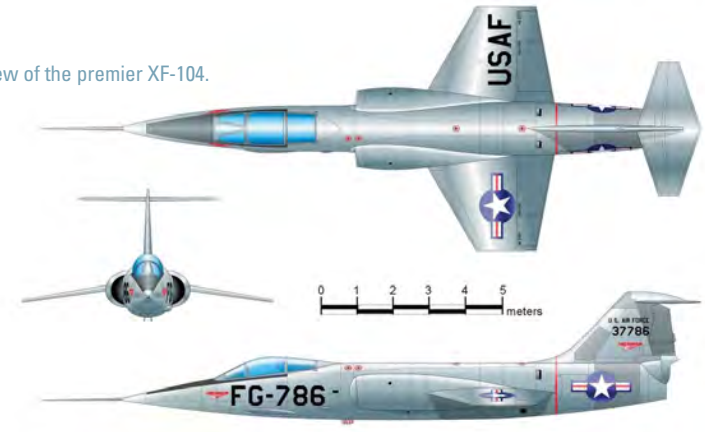
Under Weapon System 303A, Air Research and Development Command (ARDC) Secret Project MX-1853, the USAF ordered two XF-104 prototypes from Lockheed on 12 March 1953 (USAF serial numbers 53-7786 and 53-7787). The full-scale engineering mockup was inspected and approved on 30 April.

Lockheed chose a single Buick-built, axial-flow Wright Aeronautical J65 turbojet engine rated at 15,000 pounds thrust (67kn with afterburning) as the power plant. The Buick was a license-built version of the British Armstrong Siddeley Sapphire. Initially, however, only the non-afterburning J65-B-3 version was available.

FIRST FLIGHTS

Secretly trucked at night from the Skunk Works factory at Burbank, California to Edwards Air Force Base (AFB) in late January 1954, the first XF-104 was prepared for initial flight tests. A high-

ABOVE
XF-104 with drag chute deployed after a high-speed taxi run, February 1954. Photo: National Museum of the USAF.



Three-view of the premier XF-104.

speed taxi run followed by a short test hop was made on 28 February, when test pilot Tony LeVier raised the aircraft just a couple of metres off the dry lakebed. During its first official flight on 4 March, the landing gear refused to retract and LeVier landed after 20 minutes. The problem was traced to low pressure in the hydraulic system and was soon corrected. In further flight tests, LeVier found that with the non-afterburning engine the aircraft could not exceed Mach 1 in level flight, although it could do so in a shallow dive.

Once the afterburning J65-W-7 turbojet engine was installed in July, performance dramatically increased. The XF-104 could now attain Mach 1.49 in level flight at 41,000 feet and Mach 1.6 in a dive, and it could zoom climb to 55,000 feet.

Lockheed test pilot Herman Salmon took the second XF-104 on its first flight on 5 October, and in March 1955 Ray Goudey took the aircraft to Mach 1.79 (2,130kph) at 60,000 feet. By that time, 17 service-test YF-104As had been ordered to fully investigate the aircraft's capabilities. Those, and an additional seven preproduction F-104A-1-LO airframes ordered in March 1956, were modified in various ways to solve problems, including armament, longitudinal stability (pitch-up), low-speed handling and engine issues, revealed during the long-running test program. Thus 26 aircraft participated in the development program to mature the F-104 to its initial production block, designated F-104A-5-LO.

UNVEILING

The wraps were finally taken off the Starfighter (named to follow Lockheed's astronomical theme) on 16 February 1956, some two years after it had first flown, when the second service test YF-104A was rolled out for public viewing. At the time, a new sound called rock 'n' roll was in the air – and the Starfighter rocked those in attendance at its unveiling. They were astounded by what they saw. At first glance, it didn't look like it had any wings. It did, but they were remarkably short, and were angled down in anhedral. It sported a high T-tail mounted at the rear of a rocket-like fuselage. In truth, it

XF-104 SPECIFICATIONS

PROPULSIVE SYSTEM: Buick-built J65-B-3, axial flow, non-afterburning, 7,330-lbf (32.6kn) turbojet engine (Aircraft #1): Wright-built J65-W-7, non-afterburning 7,500-lbf (33.4kn) turbojet engine (both aircraft).

LENGTH: 14.99m

HEIGHT: 4.11m

WINGSPAN: 6.69m without wingtip fuel tanks

EMPTY WEIGHT: 5,216kg

GROSS TAKEOFF WEIGHT: 7,575kg

MAXIMUM SPEED: Mach 1.79 (2,193kph) attained

MAXIMUM RANGE: 800km

ARMAMENT: One General Electric 20mm T-171E-3 (later redesignated M61A1) six-barrel rotary action Vulcan cannon (Aircraft #2 only)

THE STARFIGHTER AND AUSTRALIA

Eventually more than 2,500 F-104s were built for the air forces of some 15 nations; license production was carried out in Canada, Europe and Japan.

Soon after its first flight in 1954, the F-104 was the aircraft recommended by a mission led by AVM Alister Murdoch to replace the RAAF's Sabre jet fighter, which had not yet entered service. The Chief of the Air Staff, AIRMSHL Scherger, was a strong advocate: it was a superior Mach 2 interceptor with a ferry range of 3,700km and one which could also be adapted to ground and even nuclear attack.

In 1960, Scherger led a further fighter evaluation team to the Lockheed plant at Burbank, during which he took the controls in a two-seat TF-104 trainer (see a 10-minute film at awm.gov.au/collection/C345658 or scan the QR code below). The team also visited France to see the new Dassault Mirage III. Evaluating both aircraft against nine criteria, the Mirage was judged an overall stronger contender than the overly specialised F-104 and Cabinet endorsed the French fighter.

Meanwhile, during 1957-60 SQNLDR (later AVM) Jim Flemming had been flying F-104Cs on exchange with the 479th Tactical Fighter Wing USAF at George AFB, California. He became the first RAAF pilot to fly at twice the speed of sound and also managed to glide a flamed-out Starfighter down to a 'dead stick' landing on Muroc dry lake at Edwards AFB. Flemming had earlier led the first RAAF aerobatic team, the Meteorites, so the team's motif, a streaking meteor, was painted on the tails of the Starfighters of the 479th Tactical Fighter Wing. The 479th deployed to Vietnam and joined other 'century series' fighters.

looked more like a missile with a cockpit than an airplane. It almost seemed to be going supersonic just sitting on the ramp.

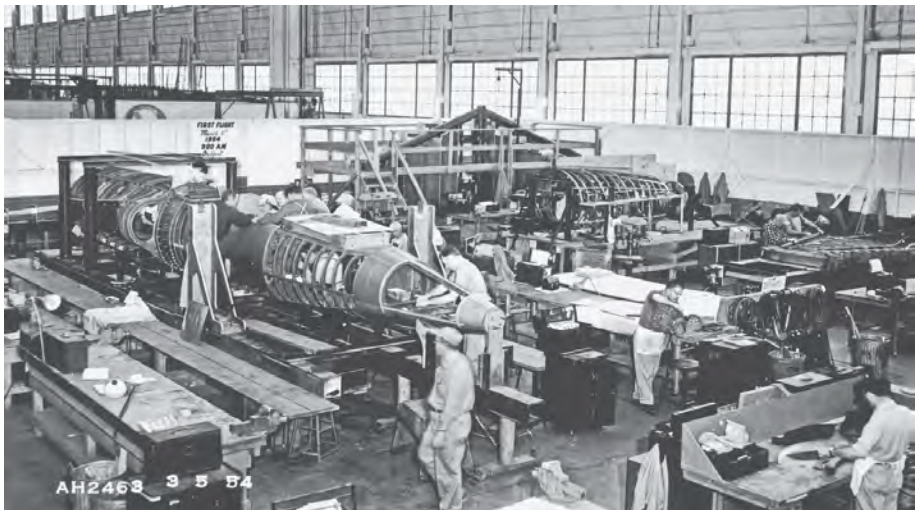
AIRCRAFT DOWN

Unfortunately, both XF-104s were lost during the development program. On 19 April 1955, Salmon in aircraft number two on a cannon-firing test flight out of Palmdale, California, in transit to the US Navy aircraft test facility at China Lake, fired a short burst of 20mm rounds from the aircraft's T-171 Vulcan cannon at 47,000ft. He heard several clunks and to his shock the emergency ejection hatch under his seat blew off. That caused terrific turbulence and sudden decompression in the cockpit, which partially inflated his pressure suit and fogged his helmet visor so he could barely see. Salmon ejected at about 15,000 feet. Parachuting to earth about 3km from the aircraft's impact point near China Lake, he survived uninjured and was found two hours later by a Navy search-and-rescue helicopter crew.

Then on 11 July 1957, aircraft number one was lost near Bakersfield, California. After logging more than 1,000 flying hours it had been sent back to Lockheed to be used as a pilot check-out, transition and chase plane in the Starfighter program. While on a chase mission with an F-104A at 12,500 feet and high subsonic speed, an unsecured fuel tank cap suddenly came off the XF-104 and struck its tail. Severe tail flutter and loss of control followed. Lockheed engineering test pilot Bill Park ejected with some difficulty. The aircraft impacted some 22km south-southwest of Bakersfield and Park landed a kilometre southeast of the impact site. He was also uninjured.

RISE OF THE STARFIGHTER

Seventeen YF-104As (Lockheed Model 183-93-02) were ordered so the air force could evaluate the true potential of the Starfighter with its design engine, the more powerful J79. The first was secretly trucked to the special-access North Base section of Edwards AFB on 16 February 1956, the same day the second example was shown to the public. The next day, with Salmon at the controls, it made its first flight and on 28 February, it became the world's first fighter to fly at twice the



THE NF-104A ASTRONAUT TRAINER

Three F-104A-10-LO aircraft (USAF serials 56-0756, 56-0760 and 56-0762) were modified at Burbank to serve NASA as high-altitude trainers for astronauts. Those AeroSpace Trainers (ASTs), designated NF-104A, were flown by the USAF Aerospace Research Pilots School (ARPS – later USAF Test Pilot School) which was relocated to Edwards AFB, California from Wright-Patterson AFB, Ohio in 1951. In 1962, the school introduced a dedicated astronaut training program.

Each NF-104A was powered by both a J79-GE-3B turbojet engine and an Aerojet Rocketdyne AR2-3 liquid-fueled rocket motor. The rocket could be throttled to produce between 3,000 and 6,000 pound thrust, allowing up to two-minutes of zoom climb into a ballistic trajectory, which then carried the aircraft to the boundary of space. For control in this negligible-atmosphere and zero-gravity environment, the aircraft featured a reaction control system of thrusters in the nose and in extended wingtips – similar to those of the X-15. Top speed was Mach 2.4.

The three aircraft established numerous zoom-climb records, including a flight to 120,800 feet on 6 December 1963 by primary pilot LTCOL Bob Smith in aircraft 56-0756.

On 10 December, aircraft 56-0762 was lost. ARPS Commandant COL Chuck Yeager was at 104,000 feet and had shut down the jet engine for the rocket-powered zoom-climb when the aircraft departed controlled flight and entered a flat spin. Yeager managed to eject successfully but was badly burned on his face and hand by the ejector seat rocket. An investigation found the spin was caused by an excessive angle of attack, due to a 'gyroscopic' condition induced by the jet engine spooling down on shutdown.

The highly successful NF-104A AST program ended in 1971. Aircraft 56-0760 is today mounted on a pylon outside the USAF Test Pilot School at Edwards AFB.

YF-104A SPECIFICATIONS

CREW: One (pilot)

PROPULSIVE SYSTEM: One experimental axial-flow, 14,800lbf (66kn with afterburning) General Electric XJ79-GE-3 turbojet engine. Production J79-GE-3, -3A and -3B engines were also tested.

LENGTH: 16.66m

HEIGHT 4.11m

WINGSPAN: 6.69m

EMPTY WEIGHT: 5,698kg

GROSS TAKEOFF WEIGHT: 11,150kg

MAXIMUM SPEED: Mach 2.3-plus (2,818kph)

MAXIMUM RANGE: 2,250km

COMBAT CEILING: 55,000ft

ARMAMENT: One General Electric 20mm T-171E-3 (later redesignated M61A1) six-barrel rotary action Vulcan cannon. Two AIM-9 Sidewinder air-to-air missiles.

ABOVE LEFT XF-104 number two (serial 53-7787) during assembly, 5 March 1954.

ABOVE A rare photograph of XF-104 number one alongside YF-104A number one. Photo: USAF.

RIGHT The original downward-firing ejection seat installed on the X-104 proved to be a conceptual design error and was eventually replaced with an upward-firing seat. Photo: LMSW.

speed of sound in level flight. In October, the USAF ordered the Starfighter into production as the F-104A; the first 35 to be used for service testing.

The YF-104A and F-104A service test aircraft played a pivotal role in the success of the Starfighter, paving the way for mass-production at Burbank for USAF Air Defense Command, Tactical Air Command, Air Training Command and the Air National Guard. Production totalled 153 single-seat F-104As, 26 tandem-seat F-104B trainers, 77 single-seat F-104Cs, 21 tandem-seat F-104D trainers, and 30 F-104F trainers prior to the definitive F-104G. To quote Tony LeVier, who knew as much about flying the F-104 as anyone and loved the Zipper (as it was affectionately nicknamed by USAF pilots), "If it hadn't been for aircraft like the F-104, which was strategically targeted at key Russian facilities, and the U-2, which let us know everything the communists were doing, there may very well have been a World War III".

Edited text and images are used (with permission) from chapter two of *The Projects of Skunk Works* by Steve Pace (Voyageur Press).

Artist impression of *Ingenuity*.

FLIGHT ON MARS

NASA'S INGENUITY MARS HELICOPTER HAS MADE HISTORY BY DEMONSTRATING POWERED, CONTROLLED FLIGHT ON ANOTHER PLANET.

NASA'S *INGENUITY* MARS HELICOPTER has completed a dozen successful flights on the red planet, expanding the space agency's understanding and knowledge as it breaks its own records.

Ingenuity, a 1.8kg solar-powered rotorcraft with twin propellers and four legs, was despatched to Mars to complete one mission: prove it could fly in Mars' atmosphere. It was launched aboard NASA's *Perseverance* Mars rover in July 2020 and arrived on the planet on 18 February 2021.

While Mars has much less gravitational pull than Earth, its atmosphere is just one percent as dense, making it difficult to generate lift. To compensate, *Ingenuity*'s engineers gave the aircraft 1.2m long rotor blades that spin at higher speeds than required on Earth.

On April 19, *Ingenuity*, operating from 'Wright Brothers Field' in Jezero Crater, successfully completed the first powered, controlled flight by an aircraft on a planet other than Earth, taking off vertically, hovering and landing.

Its second Mars flight on April 22, the 18th sol (Martian day) of its test window, lasted 51.9 seconds and achieved a higher maximum altitude (5m), longer duration and sideways movement. After hovering briefly, its flight control system performed a five-degree tilt, allowing some of the thrust from the counter-rotating blades to accelerate the craft sideways for 2m. "The helicopter came to a stop, hovered in place and made turns to point its camera in different directions," said Håvard Grip, *Ingenuity*'s chief pilot at NASA's Jet Propulsion Laboratory (JPL) in Southern California. "Then it headed back to the centre of the airfield to land. It sounds simple, but there are many unknowns regarding how to fly a helicopter on Mars."

A pair of zoomable cameras aboard the *Perseverance* rover captured the craft in flight over Jezero Crater. (Scan the QR code opposite to view the video.)

"So far, the engineering telemetry we have received and analysed tell us that the flight met expectations and our prior computer modelling has been accurate," said Bob Balaram, chief engineer for *Ingenuity*, after the flight.

The helicopter continued to set records on its third flight, flying faster and further than in tests on Earth. It rose to 5m and zipped downrange 50m, reaching a top speed of 2m/s.

During the fourth flight, NASA recorded the first-ever audio clip of an aircraft in flight on another planet, using *Perseverance*'s SuperCam microphone. The rover was parked about 80m from *Ingenuity*'s take-off and landing spot and mission control had been unsure if the noise of the rotorcraft's blades, which spin at 2,537rpm, would be audible over the sounds of the gusty Martian atmosphere. However, scientists were able to isolate the sound of *Ingenuity*. (Scan the QR code on the opposite page to listen to the buzz of *Ingenuity* operating in the Martian atmosphere.)

Ingenuity again performed exactly as

planned for its fifth flight, conducting its first one-way trip to a new patch of Martian soil, 129m south of Wright Brothers Field, and soaring to a new record height of 10m to scope and take photos of the area before landing. The flight lasted 108 seconds. The new landing zone was selected based on information recorded on *Ingenuity*'s previous test flights. NASA was able to generate digital elevation maps indicating flat terrain with almost no obstructions.

The fifth test flight marked the transition into *Ingenuity*'s operations demonstration phase, which focussed on investigating the kind of capabilities rotorcraft operating from Mars can provide, such as scouting, aerial observations, access to areas inaccessible by a rover, and detailed stereo imaging from altitude. The lessons learned could significantly benefit future aerial exploration of Mars and other worlds.

On *Ingenuity*'s sixth flight, a malfunction interrupted the flow of images from the aircraft's navigation camera to its computer. While the glitch resulted in the loss of just one image, it meant all other images were delivered with incorrect timestamps, according to Håvard Grip.

"*Ingenuity* began adjusting its velocity and tilting back and forth in an oscillating pattern," he said. "That behaviour persisted throughout the rest of the flight."

The mission team successfully addressed the timing vulnerability issue for future flights. Since then, *Ingenuity* has flown another six test flights (as of 16 August), taking off and landing at new sites. On its ninth flight, it travelled a record 625m. On the following flight, it reached an altitude of 12m, and its 12th flight lasted 169.5 seconds.

During its most recent flights, *Ingenuity* has surveyed areas of particular interest for the *Perseverance* rover to potentially explore in its hunt for signs of ancient life.

Bob Pearce, associate administrator for NASA's Aeronautics Research Mission Directorate said, "The continuing success of *Ingenuity* proves the value of bringing together the strengths of diverse skill sets from across the agency to create the future, like flying an aircraft on another planet."

Isabella Richards

To learn more about the Mars exploration program, see mars.nasa.gov.

Scan to view *Ingenuity*'s second Mars flight. Video: NASA/JPL-Caltech.

Scan to see and hear *Ingenuity* operating in the Martian atmosphere.

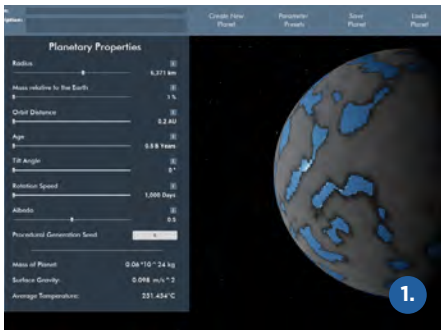
AUSTRALIA'S FIRST VIRTUAL SPACE MISSION

WHAT DOES AN ASTRONAUT WHO HAS LOGGED MORE THAN 198 DAYS IN SPACE DO AFTER HE RETIRES FROM DUTY?

AFTER 15 YEARS AS A NASA ASTRONAUT, including two missions to the International Space Station, two spacewalks and more than 198 days in space, Dr Gregory Chamitoff retired from NASA in September 2013. He is now the Zachry Chair Professor of Aerospace Engineering and Director of the AeroSpace Technology Research & Operations (ASTRO) Laboratory at Texas A&M University. His passion for space education and bringing STEM (science, technology, engineering and mathematics) to students to empower them as the workforce of the future has led to the development of a virtual-reality program called SpaceCRAFT and a STEM program called Space Teams.

SpaceCRAFT is a virtual reality/2D compatible space-simulation designed to enable users to collaborate, design, evaluate and experience the technology for future operations in space. In effect, it is enabling everyone to contribute to humanity's future in space. SpaceCRAFT provides a high-fidelity simulation of the solar system, including real planetary data

SpaceCRAFT space simulation.



from NASA's Jet Propulsion Laboratory (JPL) and correct physics for models of space and planetary environments.

After years of development, it was time to take the virtual program to students with Space Teams (space-teams.com). Participants aged 12 and over formed teams of four to exercise the SpaceCRAFT simulation in a friendly, competitive environment. The collaborative space system virtual program allowed the trainee astronauts to conduct a composite human space exploration mission including the creation of a planet, building a spacecraft, travelling across the vast expanses of space, and creating a habitat base. Once at the base, resources had to be gathered and sustainability of the mission then became critical. Throughout the program, skills such as teamwork and collaboration were mentored and developed.

Dr Chamitoff is the patron of One Giant Leap Australia, so it was logical that One Giant Leap Australia Foundation was selected to provide the inaugural STEM participants as trainee astronauts and host the first mission. The opportunity was also used to conduct a BETA test program with specialists located in Australia. Space Teams uses the latest technology to enable students to explore the space simulation from home.

The Virtual Space Mission was conducted as a six-day program, run from the United States, in Australian time zones, during the mid-year school vacation. It used cloud-based video conferencing, with program mentors provided by Microsoft in Australia.

The program commenced with a Space Exploration and Space Teams introduction by Dr Chamitoff, who discussed the vision of space exploration and shared his experiences from living and working in space. The introduction ensured participants were set up and comfortable with the online learning platform and the application environment of the SpaceCRAFT software. Students were then introduced to the Space Teams competition and the structure of the program.

The 2021 challenge had the students journey through our solar system to a rogue planet called Vulcan. Once they reached their destination, they needed to explore the planet for resources that could potentially allow construction of a habitat base to sustain human life indefinitely. The sequence of daily activities included all necessary mission steps to virtually explore the new world.

Through lessons, tutorials and daily activities, the students were introduced to a number of topics.

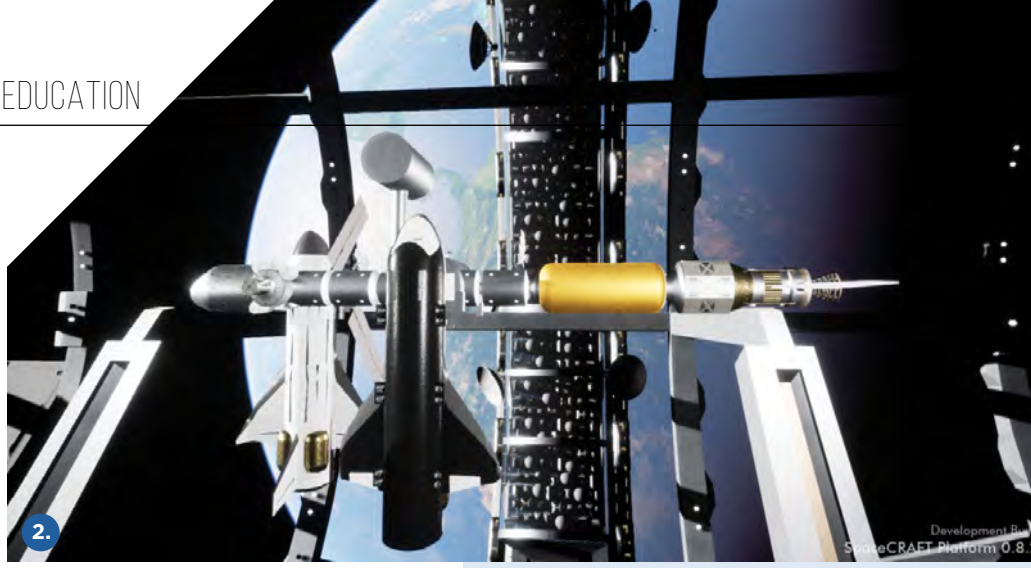
1. PLANETARY SCIENCE. Students were taught about our solar system and the planets within it, as well as other bodies such as asteroids and moons. Solar system formation and the interactions of planetary properties (mass, gravity, distance from the sun, temperature, pressure and composition) were discussed. The students were then asked to design and visit their own planet with SpaceCRAFT.

Australia's leading STEM provider

Build your knowledge and understanding of STEM and STEAM with our unique and exciting educational programs for all ages.

https://onegiantleapfoundation.com.au/

ONE GIANT Leap Australia Foundation



2. SPACECRAFT DESIGN AND ASSEMBLY. It is important to know about the systems needed to operate spacecraft in the vacuum of space, travel to distant planets, and maintain life support for the travellers. The students learned about the importance of design decisions, such as selecting the best propulsion system, choices for power generation, and minimising the mass while maximising resources, as they build their interplanetary spacecraft.

3. ORBITAL MECHANICS AND REMOTE SENSING. In order to travel in space, some knowledge of orbital mechanics, gravity and spaceship manoeuvres is required. That knowledge was applied as the students designed their trajectory from Earth to Vulcan, the rogue planet passing through our solar system. (SpaceCRAFT enables all of that to be done visually, without knowing the maths). Students were then taught about the tools and techniques used for scanning planetary surfaces from a distance using an orbital vehicle (remote sensing). By choosing their orbit properly, they were able to gather data on the properties of desirable resources and use that to select an optimal landing and habitat base location.

4. ATMOSPHERIC ENTRY AND LANDING. There is nothing like experiencing the complexity of the spacecraft landing process firsthand. Flying a spacecraft is different to flying an aircraft, and the landing procedure encompassed everything required for a safe descent from orbit. Each student honed their piloting skills using aerobraking to slow from orbital speeds to a smooth and safe landing.

5. HABITAT CONSTRUCTION. Once on the planet surface, students learned about the components that are crucial in the design of a habitable base. They learnt how to construct a base that would satisfy the requirements to support human life, and to conduct exploration and scientific experimentation on the planet's surface.

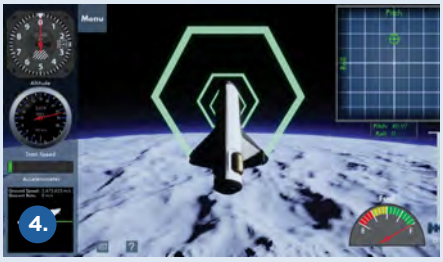
6. SURFACE EXPLORATION. The final element focused on the survival skills and methods for living on a planet other than our own. Spacesuit activities and robotic teleoperations were used for exploratory missions to locate resources needed for long-term survival on Vulcan. The final score used to distinguish winning teams came from the sustainability of their off-world habitats including resources they brought along for the mission and those they found in the vicinity of their habitat.

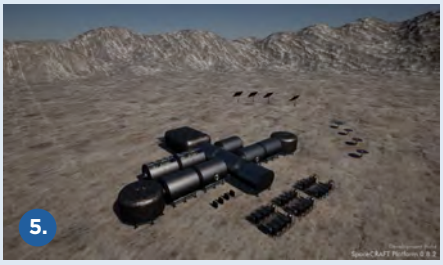
Volunteer mentors from Microsoft worked with the students to identify and overcome challenges and guide them as a team through the daily activities. While the students initially found the learning curve rather steep, they became quite relaxed as the course developed.

Following each activity, the students enjoyed an hour-long lecture and discussion with a space industry expert that included a real-time Q&A session. Students located across Australia were able to listen and interact with astronauts, a space-shuttle pilot, a Mars colony specialist, a NASA propulsion engineer and an Australian engineer working at NASA's JPL in California, specialising in robotics.

Reflecting on the course, an 11-year-old participant said: "I liked that I could design planets, ships, habitats, and see how they would turn out for real. Being in a virtual team was hard to start with, but by the end of the six days it was really easy for us to all work together. Not the best way to spend a week in school holidays, but it almost is."

Over the past decade around the world, the combination of the internet, technology, the adoption of citizen science, and open learning with a focus on STEM, has driven the youth of Australia to charge towards the innovation of gamification and simulation. They are now undertaking activities in homes and clubs, not waiting for their turn at academic studies.





The next Space Teams mission, the International SpaceCRAFT Exploration Challenge, will run from September 20-25 and is open to teams from around the world, see space-teams.com/space-camps.

• To watch a YouTube video about the challenge, scan the QR code.

PRESERVING RAAF FIGHTER HISTORY

THE WILLIAMTOWN AVIATION HERITAGE CENTRE, OPERATED ON BEHALF OF AIR FORCE BY FIGHTER WORLD INC, EXISTS THANKS TO A DETERMINED BUNCH OF VETERANS WHO SAW THE NEED FOR A FIGHTER-CENTRIC MUSEUM.

AT THE SOUTHERN END of the RAAF Base Williamtown runway sits a small collection of hangars huddled together with a large and somewhat fading radar head. An arched grey hangar, standing proud above its counterparts, has a distinguished name emblazoned across the roof – Fighter World.

Fighter World, the RAAF Williamtown Aviation Heritage Centre, is nurtured and run by a team of individuals dedicated to preserving RAAF Williamtown's fighter heritage and is a haven for local retired folk who like to tinker, engage in conversation and make old things look new again.

The enterprise began in 1984, when Squadron Leader Keith 'Sully' Sullivan of No.26 Citizen's Air Force Squadron approached his boss with a scheme for a fighter museum. Group Captain Doug Edwards, fighter pilot and CO Base Squadron, Williamtown from 1983-84, reminisced that, "a group of Williamtown veterans had conceived the idea for a fighter-centric museum and were trawling everywhere for artefacts to put on display. They'd even gone to local tech schools to seek out Air Force equipment that had been gifted for trainees to work on; only to shamelessly say, 'we'd like to have it all back, please'."

Sully and his veterans gathered a mountain of memorabilia – aeroplanes, engines, airborne radars, aircraft cannons, guns and missiles, but aside from convivial meetings in the Officers' Mess, the project planners didn't get far at first. "Money was the big 'dead-end' issue," explained Doug. "We needed a building. They cost."

Then the Federal Government threw a lifeline by rationalising the steel industry. Good news for the economy was bad news for Newcastle; the local steelworks would be shut down while Port Kembla and Whyalla would be upgraded. Spawned from the rationalisation, the Steel Regions

Assistance Program (SRAP) was conceived to provide $102 million in funding over five years to support local infrastructure renewal, expansion of training facilities and, most importantly, development of the tourism industry.

Sully's team put up a case for a fighter museum: "It'd galvanise tourism, pour money into the Port Stephens economy and hire a few people as well".

More good news was on the way. With the introduction of the F/A-18 Hornet, McDonnell Douglas Vice President visited the base and attended a social lunch in the officers' mess and who better to be seated next to him than Sully. By the end of the meal, Sully had managed to solicit some additional funds for the project.

The celebration fizzled when it was found that the SRAP funds were only available for existing projects. Undaunted, Sully had a solution. Dozens of World War II buildings were being cleared from the Williamtown RAAF Base. "How about that one?" Sully said pointing to the old theatrette. "We'll stick it out front near the main gate, fill it with gear and open it to the public." The demolition company jumped at the opportunity to make a little on the side and suggested the princely sum of $3,500 would cover the costs. Back to square one, no funds.

RAISING FUNDS

"Putting on an air show is surprisingly easy", according to Doug. "It's what Air Forces do, move aircraft to a place, have them do a bit of flying while there, then go home."

"No, you can't charge admission," was the beginning of an endless stream of no-can-do responses to Doug's enthusiasm. However, selling a program was okay.

The program booklet was a classy document with a map, two-page story on each unit, history and plenty of colour photos – a nice keepsake. The plan was to sell them for $1 each so 4,000 were printed, with the surplus to cover the cost of the print run. On the day of the show, bundles of booklets were lined up in a shed, ready to be handed out to the sellers who were all young enthusiasts from local organisations. What could possibly go wrong?

Fighter World main hangar floor.

ABOVE Gate guardians in front of original museum, 1988.

RIGHT Hangar frame.

FAR RIGHT From top: Sabre Aden 30mm cannon; Mirage ATAR 9C engine cutaway; Sabre A94-951 with Meteor in echelon left .

F-111 A8-148 with a Boeing Stearman above.

"Australian egalitarian decency, that's what went wrong," Doug recalled. The first bus driver stopped right at the air show entrance, nowhere near the shed with the programs. Bus number 2 stopped behind bus number 1 and so on down the line. At day's end, all the programs remained sitting in the shed, unsold. Even Sully was down. The air show, however, was a great success.

Where there's a will there's a way. The Base Equipment Officer was in charge of public funding in support of base activities and, more importantly, a handout that was given to the many visitors who toured the base each year. Doug organised a meeting to discuss the current handout and it didn't take him long to state the obvious, the existing booklet was in a sad way, no unit histories, out of date pictures and so on. Doug handed over a copy of the air show booklet and the EQUIPO agreed to buy all 4,000 copies at $1 each. The museum was underway.

In 1987, Commander Tactical Fighter Group (CDRTFG), Air Commodore Dennis Robertson, directed the establishment of a project team to create a Fighter Display Centre. His intention was to house the artefacts, the Avon Sabre, Gloster Meteor and a De Havilland Vampire at the Williamtown main gate, along with two restored Mirage aircraft stored in hangars on the base. The task was assigned to No.26 Squadron.

In February 1988, the RAAF Williamtown Fighter Display Centre Trust met for the first time under the leadership of base executives with CDRTFG as its chairman. The minutes of a trust meeting held in May 1988 record progress on lease arrangements for an "appropriate parcel of land deliberately selected to take advantage of the view of the airfield/runway at a 'peppercorn' rent of either 10c, $1 or $10 per year". With a SRAP grant of $500,000 on its way, the trust formed an Incorporated Association with the registered name Fighter World (FW).

In 1989, Prime Minister Bob Hawke accepted an invitation to be the patron of Fighter World and since then all successive prime ministers have served as patron.

On 16 February 1991, the FW display centre was opened by Senator Robert Ray, Minister for Defence. AIRCDRE Beej Weston, then Commander of Tactical Fighter Group, acknowledged

the support of Caltex, Westfield, the Newcastle Permanent Building Society, Boral and Valley Homes as significant contributors to the project.

In 1997, the mood changed. Responding to a perception in Canberra that serving Defence members could not be involved in active management of the museum, leadership roles were assigned to non-serving personnel. CDRTFG (now CDR Air Combat Group – CDRACG) remained an automatic honorary member of the management committee.

However, disassociation from Air Force was seen as a threat to sustainment of the museum. Deputy Chief of Air Force, AVM Leo Davies and current Fighter World President, AVM John Quaife (ret'd), outlined a plan for Air Force to resume its interest in the heritage of RAAF Base Williamtown and for Fighter World to be officially recognised as an Air Force Heritage Centre. A memorandum of understanding was signed on 21 July 2014 for the Fighter World Incorporated Association to continue to manage the RAAF Williamtown Heritage Centre and the Commonwealth-owned items on display.

TODAY'S FIGHTER WORLD

Today, the RAAF Williamtown Aviation Heritage Centre is part of a network of Air Force Heritage Centres at RAAF Bases Townsville, Amberley and Wagga Wagga with plans for a centre at Richmond and a heritage park at Woomera, South Australia.

This year it joined in the celebrations of the Air Force centenary and RAAF Base Williamtown's 80th birthday. For Air Force 2021, Fighter World has put some of its most popular and recognised machines on display, tracing the evolution of fighter aircraft from the dawn of air combat to the modern application of air power.

A Sopwith Camel replica, meticulously built by FW volunteers, now takes pride of place in the main hangar, immaculate in No.4 Squadron colours. The Sopwith Camel prototype first flew in December 1916 and it entered service in June 1917. It was armed with two .303 inch (7.7mm) Vickers machine guns mounted in front of the cockpit, firing forward through the propeller disc. A fairing surrounding the gun installation created a hump that inspired the name Camel. Unlike the preceding Pup and Triplane, the Camel was not considered pleasant to fly.

No.4 Squadron arrived in France on 18 December 1917 and, with a fleet of Sopwith Camels and Snipes, performed fighter sweeps, provided air support for the army, and raided German airstrips. No.4 Squadron claimed more "kills" than any other Australian Flying Corps unit: 199 enemy aircraft destroyed and 33 enemy balloons destroyed or forced to the ground.

New to Fighter World this year is the recently refurbished Spitfire Mk VIII replica. Many variants of the Spitfire were built, using several wing configurations, and it was produced in greater numbers than any other British aircraft.

Later models of the aircraft, including the Mk VIII, were adapted to the Air Interdiction role and the Australian Mk VIII used locally manufactured racks to carry general purpose bombs on the centreline and two wing stations. Squadron Leader Thomas Trimble, Wing Commander Lou Spence and Wing Commander Bobby Gibbes were instrumental in the development and use of the locally made bomb racks. The replica on display is painted in the colours of Wing Commander Lou Spence, Commanding Officer of No.452 Squadron.

As part of the Air Force 2021 celebrations, WWII Spitfire pilots Sid Handsaker and Clem Jones visited the museum and its Spitfire Mk VIII display before touring the Williamtown Base and being treated to a 100 Squadron Spitfire Mk VIII handling display. It was a nostalgic tour that highlighted their wartime experiences. They both turn 100 this year.

Two early jet fighters, a Vampire, A79-1 and Meteor F8, A77-875, join the aircraft display in the main hangar. On 5 March 1943, the Gloster Meteor became the Royal Air Force's (RAF) first operational jet aircraft and Meteor F.1s

From left: Mirage III; Hawker Hunter; "Raymond Terrace" Sabre.

LEFT Mirage IIIO single-seat fighter.

FAR LEFT From top: Mirage IIID *Daphne De Dual*; Sabre A94-951 with pilot mannequin; Vampire Nene engine.

BELOW A21-23 Worimi Hornet.

and F.3s were the only allied jet aircraft to see action in WWII. Meteors gained notoriety in the Korean War during which 44 Australian Meteors were lost to enemy action.

To replace the Meteor, the Commonwealth Aircraft Corporation (CAC) produced a modified version of the North American F-86 at Fishermans Bend, Melbourne. The prototype CA-26 (the only CA-26 built) Avon Sabre first flew on 3 August 1953. During a test flight of that aircraft at Avalon Airfield on 21 August 1953, the pilot, Flight Lieutenant Bill Scott, took the aircraft to a height of 42,000ft (12,800m), put it into a dive and at 36,000ft (11,000m) exceeding the speed of sound thus becoming the first aircraft in Australia to break the sound barrier. Sabre, A94-951, on display in the main hangar, was damaged on 29 July 1963 in a collision with another Sabre, A94-943. The aircraft was repaired by fitting the port mainplane off A94-943 which had been written off.

A pair of Mirage-IIIs, one single seat and the other dual, project the fighter evolution into the supersonic era and the ever-popular F-111C dominates the FW hangar by its sheer size. With a length of nearly 23m and weighing about 50 tonnes, it's the true heavyweight in the museum. A8-148 is famous as one of two F-111s that sank the drug running *Pong Su*, a 3,743-tonne North Korean freighter. The ship was intercepted off the coast of Port Stephens in April 2003 after a four-day chase. A8-148 delivered a 2,000lb laser-guided bomb, using the Pave Tack system, to scuttle the ship.

To complete the RAAF centenary, FW hopes by year's end to have A21-23, the Worimi Hornet on display. That famous aircraft will add another dimension to the heritage centre and will undoubtedly be one of the most popular aircraft in the collection. Keep an eye on the Fighter World Facebook page or the website for the latest updates.

• Fighter World is open 10am-4pm daily except Christmas Day (and during COVID-19 lockdowns). For admission fees and updates, see fighterworld.com.au.

MISTY

TO THE RESCUE

WORDS BY Dick Daub

F-100F Super Sabre.

IN THE WINTER EDITION OF *WINGS*, AVM AL REED RELAYED HIS EXPERIENCE FLYING PHANTOM RF-4C PHOTO RECONNAISSANCE AIRCRAFT WITH THE USAF IN VIETNAM. AL TOUCHED ON THE LOSS OF AN RF-4C AND A USAF GENERAL WITNESSED BY THE CREW OF A F-100 SUPER SABRE, FAST FAC 'MISTY' CREW. THIS ARTICLE RELATES THAT EVENT.

Sadly AVM Reed lost his battle for life in late July.

PROLOGUE: Dick Rutan is a famous aviator. In 1992, he became the first pilot to fly around the world un-refuelled in the now-famous *Voyager* aircraft designed and built by his brother Burt. Before he achieved aviation immortality, he was a regular-type F-100 pilot in Southeast Asia. It was early in his Vietnam tour that Rutan volunteered for 'Misty', a Temporary Duty Assignment with the original Fast Forward Air Control (FAC) unit at Phu Cat Air Base.

WITH DICK RUTAN FLYING from the back seat (a common practice to rest the usually very tired Misty front-seater during refuelling), the aircraft had just backed off the tanker when a Mayday call came through. An RF-4C, call sign Strobe 01, was exiting North Vietnam after taking a hit, and its rear cockpit was filling with smoke. Water Boy, a Ground Control Intercept site, confirmed the dire situation Strobe 01 was dealing with. They were losing hydraulic pressure and heading for feet wet (over water). Rutan, an old head with Misty, maintained aircraft control as they started to hustle towards the stricken Phantom. The front-seater, Don Harland, a new guy with Misty, hung on as they turned towards a point north of the demilitarised zone and Rutan urged their Super Sabre onward even faster. He called Water Boy, offering to make a visual check of the battle-damaged fighter. In response, Water Boy vectored the F-100F towards the RF-4C.

As the Misty joined with Strobe 01, Harland spotted a small hole in the forward belly area of the recce bird where flames flickered ominously inside the lower camera bay of the RF-4C. As they moved closer, they could see smoke coming from the seams in the belly area just aft of the camera bays. Moving to the right wing, they could see flames in the right camera bay too. Crossing back to the left side, they relayed the information to the Strobe crew. Strobe 01 confirmed their info and said they were heading out to sea for a possible ejection. The Misty crew relayed the situation to Water Boy and started the search and rescue (SAR) process. The nearest SAR package was located at Da Nang Air Base and could be there in short order. Rutan remembered thinking, "Good! These guys won't be in the water long".

As Misty cruised on their left wing, the crew aboard Strobe 01 began what should have been a picture-perfect controlled ejection: straight and level at 10,000 feet, ideal speed, under control, and a rescue package already en route Rutan recalls thinking it would be quite a sight, since he had never seen an ejection up close and had heard all about the F-4's notorious Martin Baker seat, known as the 'back breaker' for its complicated system.

They waited expectantly. Then things began to go awry. Two minutes went by and no ejection. Rutan later learned from Strobe 01's back-seater that the front-seater did not want to be automatically ejected but instead wanted each cockpit to command their individual ejections. (Many tandem seated tactical aircraft incorporate a 'command' ejection feature such that one ejection initiation would command the other.) And so, because the front-seater was the ranking crewmember, the decision was made: each pilot would eject individually.

As the Misty crew watched, the back-seater's ejection went perfectly: the rear canopy opened and separated cleanly, clearing the tail by a good 20ft (7m), the seat rose in its tracks, the rocket fired, the seat shot straight up, and was very stable. When the rocket burned out the drogue chute opened, tilting the seat back 90 degrees so the pilot was flat on his back as the seat cleared the tail. Looking back over his shoulder, Rutan watched the chute canopy deploy normally and the seat separate cleanly. As the back-seater swung serenely beneath the fully inflated canopy, Rutan and Harland turned their attention to the front-seater's ejection.

Rutan couldn't believe the horror they then beheld. The front cockpit was filled with smoke and fire, and the white dot of the pilot's helmet was barely visible through the smoke and flames. The pilot sat motionless, head erect, seemingly oblivious to what was happening. The flames seemed to be coming up from the front foot wells, through the cockpit and out the open rear cockpit. As the flames streamed over the back of the Phantom, a thick cloud of black smoke

F-100F Super Sabre refuelling.

obscured the tail. Still, the pilot sat there, motionless.

Rutan screamed over the radio, "Strobe 01, bail out! Bail out!". The Misty pilots watched in horror as the RF-4 entered a shallow dive. Rutan made several radio calls to the doomed fighter and moved in quite close, as if being closer would allow the pilot to hear him. Harland exclaimed, "Oh my God. Look at it burn." Rutan, quite close now, screamed again, "Strobe 01! Bail out! Bail out!" At one point the stricken Phantom began rolling into a right bank and, as Rutan pulled away quickly, the RF's wings rolled level, its descent steepened, headed directly for the beach.

The intense heat had charred the top of the canopy and the pilot was no longer visible. Paint began to blister all over the fuselage and small explosions rocked the plane as the oxygen system cooked off, sending panels flying and leaving the entire nose a charred mess. At about 500 feet the old Phantom gave one last gasp, pitching up slightly, and then dove straight into the beach, hitting about a hundred yards from the surf.

Rutan, still barking on the radio, had stayed glued to the wing until he heard Harland screaming, "Goddammit Dick! Pull up!". Today Rutan freely admits, had it not been for Harland's impassioned pleas he might've plowed right into the beach on Strobe's wing.

Dejectedly, the Misty turned back to find Strobe 01 Bravo (back-seater) and notified Waterboy of Strobe's fate. Asked if there was any chance of survival, Rutan replied, "Negative survival, negative survival".

They located Strobe 01 Bravo still descending in his chute at about 5,000 feet. To the west, however, a motorised sampan was heading straight for the helpless back-seater. Not knowing if it belonged to the good guys, they buzzed the boat in an attempt to turn it around. When the sampan continued on course, they put a burst of 20mm close across its bow, prompting the boat to come about and head back to the beach. Soon after the Jolly Green helicopter arrived and picked up Strobe 01 Bravo. Amazingly, Rutan and Harland returned to the North and continued their morning mission.

GIFTED PILOT AND ADVENTURER

Dick Rutan flew with Misty from January to August 1968. He was shot down on his 105th and final mission over North Vietnam, becoming one of only 12 to fly more than 100 Misty missions. Fittingly, he and Chuck Shaheen ejected 10 miles out to sea and were picked up by Jolly Green helicopters. In all, Rutan flew 325 combat missions.

After retiring from the Air Force, he went to work with his brother Burt at Rutan Aircraft Company, Mojave Airport, as chief test pilot and production manager until 1981 when he founded Voyager Aircraft Inc.

In 1986, Rutan, with co-pilot Jeana Yeager, made his record-setting flight around the world in *Voyager*, the first un-refuelled flight of such length. The flight took nine days.

Four days after that flight, President Ronald Reagan awarded Rutan the Presidential Citizens Medal of Honor. He was also a corecipient of the 1986 Collier Trophy for outstanding aviation achievement.

In a quote from his book, *Misty. First Person Stories of the F-100 Misty FACs in the Vietnam War*, Major General Don Shepperd said, "Dick is famous. He is an unusual man, a gifted pilot, an adventurer, a world record holder; but most of all, he is our Misty comrade and friend."

TOP Dick (front) and Burt Rutan (backseat).

ABOVE *Voyager.*

Da Nang Air Base during the Vietnam War.

USAF RF-4C Phantom IIs.

When they landed, they were met by a sea of bird colonels. It was then they learned that the front-seater was General Bob Worley. Rutan had recorded the mission, and they were dispatched to Saigon on a Scatback T-39 courier. Everyone wanted to hear the 'Misty tape'. Sadly, General Worley had been on his champagne flight. With his death, Tactical Air Command and all fighter pilots lost one of their strongest, most vocal advocates at Tan Son Nhut, which was chiefly populated with Strategic Air Command and Army folks running things. It was a sad day as well for the two Misty pilots. As Rutan looks back on it all these years later, he says that to this day he cannot explain what made him stay on the general's wing for so long. "Desperation," he says after thinking about it, "...the psychology of combat".

Originally published in The Intake, *journal of the Super Sabre Society.*

CARRYING THE SPIRIT FORWARD

THE AUSTRALIAN SPITFIRE ASSOCIATION IS CELEBRATING ITS 60TH ANNIVERSARY.

ABOVE Lysle Roberts' Spitfire painted by David Bryant to reflect the stormy conditions of Darwin and the RAAF's Pacific War.

OPPOSITE Spitfire aircraft at the Temora Air Force Centenary Showcase 2021, Temora Aerodrome. Photo: CPL Kylie Gibson.

IN THE CENTENARY year of the RAAF and 85 years since the first flight of the Supermarine Spitfire, the Australian Spitfire Association is marking its own milestone, celebrating 60 years since its formation by the pilots of No.457 Squadron.

Although fewer than a handful of pilots and support crews remain, the Spitfire Association carries on strongly, actively working to its motto, "Carry the Spirit Forward", for the founders of the association and all those involved in the success of the Spitfire.

Spitfire Association president Geoff Zuber is the son of a RAAF Spitfire pilot. He likens the flexibility and adaptability of the Spitfire to today's F-35A Joint Strike Fighter.

"The Spitfire is a remarkable aeroplane," he says. "As people think about the Spitfire, they think of it as a fighter, which of course it was; one of the greatest fighters ever made.

"My father typically flew them as a dive bomber, but no-one thinks about the Spitfire as a dive bomber. Yet, it was remarkably successful in that role, as well as its ability in ground attack and photo reconnaissance."

Just as the capability of the Spitfire evolved, so too has the aim of the Spitfire Association. In 2021, it is looking to the future and what it can do through the Spitfire Memorial Defence Fellowship (SMDF) and its other fund-raising efforts to help keep Australia resilient.

The SMDF was conceived by pilots of 457 Squadron, including the late AVM Lyndon Compton AO OBE, the late FLTLT Edward (Ted) Sly DFC, the late FLTLT Peter Watson DFC and the late Lifetime Vice President FLTLT Lysle Roberts,

a key committee member right through until his passing in 2019. Their vision for the fellowship was to create an ongoing living memorial rather than a traditional granite and bronze monument.

The SMDF is presented each year by the Governor General of Australia at Government House in Canberra. It demonstrates the importance of the close relationship between the Spitfire Association and the Australian Defence Force in funding innovative research across the domains of land, sea, air, space and cyber.

Fellowship of $35,000-$45,000 have been awarded to some of Australia's most distinguished academics and leaders in industry for innovative technologies that contribute to the defence of Australia (see two examples in the panel on the right).

ANNIVERSARY DINNER

The Australian Spitfire Association is celebrating its 60th anniversary with a dinner to be held in conjunction with the Temora Aviation Museum on Saturday 9 October.

The dinner will take place in the museum hangar with the Spitfires, and will feature stories and anecdotes from one of Australia's remaining Spitfire pilots and an announcement of this year's Spitfire Memorial Defence Fellow. The dinner will coincide with flying displays on Saturday and Sunday.

• Visit spitfireassociation.com for tickets, and to learn more about the association and the Spitfire Memorial Defence Fellowship.

SPITFIRE MEMORIAL DEFENCE FELLOWS

ROBERT DANE, OCIUS

In 2016, maritime research and development company OCIUS was awarded scholarships for several University of NSW students to work on the design and build of hardware for a Bluebottle prototype. Bluebottle is an uncrewed surface vessel (USV) that can conduct remote monitoring of Australia's maritime zones. In 2017, OCIUS CEO Robert Dane was awarded the Spitfire Fellowship for the development of the unique 'reel in the keel' winch for Bluebottles, enabling a small USV to carry sensors and deploy and retrieve them to depths of up to 140m.

PROFESSOR FRANK MARINO, CHARLES STURT UNIVERSITY

In 2016, Charles Sturt University scientist Frank Marino was awarded the fellowship to examine whether dehydration is of any consequence to Australian military personnel in the field. The research aims to provide local information to develop guidelines for hydration for Australian troops.

SPITFIRE ASSOCIATION 60TH ANNIVERSARY DINNER

The Spitfire Association commemorates its 60th Anniversary, with a celebratory dinner, on the 9th October 2021, at which David Bryant's original painting will be auctioned. (Bids prior to the dinner will be accepted and can be sent to lwaxmanspitfireassoc@outlook.com).

The dinner will take place at the Temora Aviation Museum, in the Museum hangar alongside the Spitfires. This follows VIP entry to the special airshow during the day.

Guests will include the Chief of Air Force, Air Marshal Mel Hupfeld, AO, DSC (Spitfire Memorial Defence Fellowship Patron), Air Vice- Marshal (Ret'd) Mark Skidmore, AM (Spitfire Association Patron) and the Air Commander Australia (ACAUST) Air Vice-Marshal Joe 'Vinny' Iervasi, AM, CSC.

- **DATE:** Saturday 9 October 2021
- **AIRSHOW COMMENCES:** 10am
- **DINNER COMMENCES:** 6pm with cocktails outside the hangar

- **COST:** $250 per person (significant discount for new members of the Spitfire Association. See below for website address).

- **DRESS:** neat casual (families may wear medals on right chest)
- **TICKET INCLUDES:** three course alternate fixed menu, with a selection of wine and beers included in the meal price.

CELEBRATING 60 YEARS OF CARRYING THE SPIRIT FORWARD

Secure your tickets at: www.spitfireassociation.com/dinner.php

SPITFIRE ASSOCIATION

GROUND CONTROLLED APPROACH

WORDS Jim Males

WITH NO ONBOARD INSTRUMENT LANDING SYSTEMS, EARLY MILITARY AVIATORS RELIED ON AN AIR TRAFFIC CONTROLLER GUIDING THEM DOWN TO A SAFE LANDING.

FLTLT Eric Trown (at the back), LEUT Grahame Higgs (RAN) and FLGOFF Ken Oprey at work in the CPN-4 operations cabin.

RECOVERING AIRCRAFT EFFICIENTLY and safely in inclement weather – low cloud and poor visibility – was a challenge around the world until the broad adoption of precise electronic glideslope and track guidance provided by instrument landing system (ILS) equipment and more recently GPS precision navigation.

Early military aircraft, particularly tactical aircraft, did not have the compartment or cockpit panel space to accommodate ILS components and displays. Military aviators consequently relied on an Air Traffic Controller providing glideslope and track guidance from a precision radar installation at each field. The equipment was called a precision-approach radar (PAR) and the pilot flew a ground-controlled approach (GCA).

GCA is now a part of RAAF history; phased out of service in 1990 following the arrival of aircraft equipped with ILS and the advent of GPS. But, when in service, GCA played an important role, especially for Sabre, Mirage and Macchi aircraft all-weather operations.

None of those aircraft had accurate navigation systems and the pilot relied mostly on dead reckoning – time, heading and speed, and a tactical air navigation system called TACAN that provided range and bearing from a fixed ground transmitter.

TACAN was notoriously unreliable, limited in range and subject to line-

of-sight reception and inherent errors. All aircraft had limited fuel capacity, particularly the Mirage, and efficient recovery in bad weather was essential.

RAAF GCA procedures were introduced in 1956, when an AN/CPN-4 PAR system was purchased and deployed to Essendon Airport for the Olympic Games. CPN-4s were subsequently installed at RAAF Bases Pearce, Williamtown and Amberley

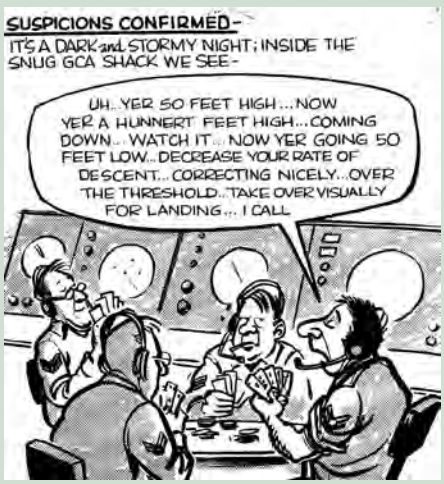
On other bases, the RAAF installed the smaller and less cumbersome AN/FPN-36 Quadradar, affectionately named to reflect its four radar functions: 360-degree azimuth search; precision approach; height finder; and taxi modes, plus the Indicator Group used by the controller. The Quadradar had 47 individual parameters that could be manually adjusted to refine radar performance. Throughout an approach, the controller continually adjusted radar reception gain – left side of console, while simultaneously working the elevation antenna azimuth servo left and right to keep it pointed at the aircraft – right side of console. One of the best controllers was Vic 'Wingy' Meyn, so called because he had only one arm, but still managed to operate the Quad effectively despite the console ergonomics.

The CPN-4 system, including the control station, was housed in two mobile cabins which were positioned in close proximity to the runway network and had to be moved and reorientated whenever there was a runway change. The working environment was very noisy, particularly with fighter type aircraft (Mirage) taking off nearby with full afterburner thrust.

There were three console positions in the operations cabin; the centre console usually manned by the Traffic Director with a Final Approach Controller in the other two bays. The radar equipment bays were behind the controllers. In wet weather, one of the controllers had to reach into the equipment bay to select circular polarisation to enable the x-band precision radar to "see" through the rain. Snakes were attracted to the warmth of the electronics and took up residence in the compartment. It was a brave controller who blindly put his arm into the equipment bay to wind in the polariser, although no-one was ever bitten.

The standard GCA traffic pattern normally comprised a 10-mile downwind leg during which the pilot was instructed to carry out landing checks. Downwind was followed by a 90-degree base leg, then a 30-degree intercept with the centreline. When close to centreline, the controller would adjust the angle of closure, finally making very small, two-degree adjustments to aircraft heading until established on the centreline. Further small adjustments would be made depending on the crosswind. At 6½ miles the pilot would be advised one mile to glidepath and to prepare for descent. At 6 miles to touchdown the GCA controller advised the tower controller of the GCA traffic on final approach. Near to 5½ miles the pilot would be instructed to commence descent to settle onto the glidepath. Small adjustments to centreline and glidepath were advised continuously to maintain the precision approach. At 3 miles to touchdown, the controller would again contact the tower to obtain a landing clearance or other instructions which would then be relayed to the pilot with a final wheels check.

At decision height (DH – 220ft) the pilot would be instructed to "look ahead and land visually". If the runway was not visible, in fog or heavy rain, the pilot would go around. Often with the Mirage a missed approach would be followed by a minimum fuel GCA,



TOP CPN-4 operations and systems cabins.

MIDDLE Quadradar display.

BOTTOM Cards were regularly played in the ops cabin during quiet times in the flying program.

a tight pattern at 1,000ft, a short and five-mile base leg and glidepath intercept at 3½ miles to touchdown. If the runway was still not visible at DH, the controller would continue centreline and glidepath guidance to touchdown if requested, alternatively the pilot would again go around or divert to a secondary airfield, fuel permitting.

Two other types of approach to cater for degraded radar or aircraft systems were practiced and occasionally employed. One, a surveillance radar approach, was used if the precision features of the PAR were degraded. In that situation, centreline tracking was derived from coarse surveillance radar returns and glidepath was the pilot's responsibility with the controller giving advisory heights each ½ mile based on 300ft/mile, for example "you're 3 miles to touchdown, you should be passing 900ft now". The other was a speechless approach practiced in case of facial injury or pilot microphone failure. In that case, the controller would give normal instructions and the pilot would answer by keying a carrier wave on the controlling radio frequency. One blip for "yes", two for "no" and three for "say again".

HMAS *Melbourne* had a ship-based version, SPN-35, and many old RAN controllers will fondly remember conducting a 'carrier-controlled approach' (CCA in lieu of GCA). The SPN-35 was similar to the FPN-36 but had a gyro stabilised antenna group because of ship motion. Talk down commenced as the ship was turning into wind, the final heading for aircraft recovery. It was not uncommon for naval aviators to be given large heading corrections with the ship turning up to 90 degrees to port or starboard; "commence descent and turn left 40 deg" etc. The philosophy was that we were training for war and aircraft were more expendable than the carrier so the ship spent minimal time vulnerable while tracking into wind.

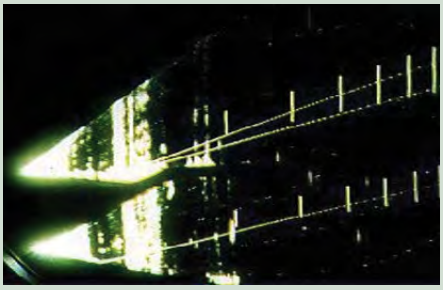
In training for electronic warfare procedures, communication, radar and navigation aids would be turned off deliberately by the ship to avoid detection. In those scenarios, aircraft returning in instrument meteorological conditions (IMC) would initially descend on a signal from a sonobuoy submarine detection beacon located in one of the gun sponsons, until acquired by the SPN-35 final approach radar.

In Butterworth, the STC (Standard Telephones and Cables Limited) SLA3-C PAR had separate screens for centreline and glideslope display and the console was only a couple of metres from the controller's crew room and dart board. Many a game was played by GCA controllers waiting for their next "customer".

Qualification as a GCA controller at Williamtown and Butterworth was a rewarding and challenging responsibility, as Mirages often recovered in bad weather with minimum fuel. To illustrate the precision possible, the controller would position one-third of the Mirage radar return (blip) above the glideslope to account for the high angle of incidence of the delta wing Mirage on final approach. Such was the accuracy, the controller could continue guidance beyond DH right to touchdown. It was an intrepid pilot who said "keep talking to touchdown", as the alternative of wasting the aircraft and banging out (ejecting) was not a cherished option. Many a Mirage pilot bought the GCA controller a few beers after using the service to get the wheels back on the runway.

At East Sale, the GCA procedure was also demanding of both controller and pilot, especially for the HS748 "draggies" that would often return from six-hour navexes (navigation

ABOVE SLA3-C console.



ABOVE Mirage high angle of incidence on approach and landing.

MIDDLE CPN-4 PAR display.

BOTTOM FPN-36 Quadradar antenna group.

exercises) when thick fog had set in. Often the fog bank top was only 300ft above ground level, so the aircraft would only enter very low visibility conditions just prior to DH and all would hope like hell that the pilot could see the high-intensity approach lights to orientate for landing on the prepared surface. It was therefore critical for the controller to have the aircraft "in the slot" positioned perfectly on glideslope and centreline at ½ mile to touchdown.

The School of Air Traffic Control and C Flight at Central Flying School (CFS), RAAF Base East Sale trained hundreds of controllers on the FPN-36. On graduation, controllers would undertake conversion training on the equipment installed at their home base.

Operating the FPN-36 required the controller to manually refine the radar beam orientation and sensitivity and most controllers carried a small screwdriver in their pocket as many of the 47 controls were 'tweeked' that way. The centreline cursor was orientated between two reflectors, one each side of the runway threshold, while the glideslope cursor was electronically set to 3 degrees, to give a descent rate of 300ft/mile.

The FPN-36 had search and elevation antennas. In search mode, the horizontal surveillance antenna scanned at 15rpm and was initially used to position the aircraft close to centreline. The controller would than select precision mode and the search antenna would scan 15 degrees left and right of centreline and the elevation antenna would scan vertically from -1 to +6 degrees.

The elevation antenna had a very narrow beam width and the controller had to constantly adjust the antenna left and right to keep the aircraft within the vertical beam.

In 1980, the CPN-4s were phased out and replaced with a much improved Raytheon FPN-802 and the tactical version, TPN-803. Those systems featured a computer-controlled tracking capability to maintained a radar lock on the approaching aircraft for centreline and glidepath guidance. The Raytheon equipment and the Quad radars remained in RAAF service until 1990 when PAR was progressively phased out.

• SQNLDR (Ret'd) Jim Males AM carried out more than 2,000 GCAs at Williamtown. Butterworth, East Sale and Richmond during his 22-year career in the RAAF. Jim was proficient on all PAR systems and instructed GCA Controllers at C Flight, CFS. A highlight of his career, Jim qualified on the FPN-802 in 1980 after training at Tinker Air Force Base, Oklahoma, USA.

TOP Macchi flyover on the occasion of the final CPN-4 talkdown.

MIDDLE FPN-802 antenna group.

BOTTOM FPN-802 display.

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Perfect gift for the technology buff and that aspiring young astronaut

AIR FORCE ASSOCIATION

SCAM PANDEMIC

LAST YEAR AUSTRALIANS LOST MORE THAN $850 MILLION TO SCAMMERS.

FOR MANY OF US, 2020 was a tough year, but it was pretty lucrative for scammers. With an increase in the number of people not working or working from home and increased online activity, the COVID-19 environment provided a target-rich hunting ground for scammers. Scamwatch reports that last year Australians lost more than $850 million to scams.

Scammers target people of all ages, backgrounds and income levels. No one group is more likely to fall victim to a scam. However, some groups appear to be more susceptible to certain types of scams. For example, men reported higher losses to investment scams, while women were more likely to fall for a romance scam. People aged 25-34 years reported the highest number of losses to scams, however those over 65 reported higher dollar losses.

Last year, for the first time, Victorians experienced the highest losses of all states and territories, most likely because they spent more time in lockdown than anyone else.

Here's how some of 2020's more popular scams worked.

PUPPY SCAMS

With people spending a lot more time at home, the demand for puppies, and puppy prices, increased significantly. Scammers used fake websites and classified or social media ads to pretend to sell popular breeds of dogs. Scammers relied on state border closures, travel bans and social distancing measures to stop buyers seeing the animal in person. The situation also allowed them to scam people twice, once for the cost of the puppy and again for transport costs.

ADVICE: The safest way to protect yourself is to only buy or adopt a pet you can see in person.

VEHICLE SALE SCAMS

Scammers also used COVID-19 restrictions to facilitate vehicle sale scams, particularly car, caravan and campervan sales. Scammers used legitimate websites such as Facebook marketplace, Gumtree, Car Sales and Autotrader to pose as both buyers and sellers.

When posing as a seller, scammers sometimes pretended to be serving in the military in a remote location, using a fake military email address (for example, @royalairforce-gov.com), which most members of the public would not recognise as fake. They would offer to use military transport to get the vehicle to the seller and suggest using a third-party escrow service to hold the funds until the vehicle arrived with the buyer. In reality, there was no third party, the money went directly to the scammer.

ADVICE: Just because an ad is on a legitimate website, doesn't mean it's not fake. Don't pay for expensive goods you haven't physically inspected.

PHISHING SCAMS

Phishing scams are aimed at stealing your money or personal information. Victims receive an email or text message impersonating a well-known company or government agency, which looks legitimate. It claims there is an issue and advises victims to click on a link to fix it. The link takes the victim to a fake website where they are asked to provide personal information such as date of birth, bank details, tax file number, which the scammer then uses to obtain money in the victim's name. Some of the more popular ruses in 2020 purported to be from:

- **THE AUSTRALIAN TAX OFFICE** – particularly in relation to the early release of super annuation under temporary COVID-19 access measures.
- **AMAZON** – claiming a fraudulent purchase had been made on their Amazon account, or their Amazon Prime free trial was running out. This typically then became a remote-access scam.
- **FINANCIAL INSTITUTIONS AND TRANSACTION SERVICES (PAYPAL)** – scammers impersonated banks and payment houses in order to obtain account and personal details.
- **NETFLIX** – claiming subscription payment details had been declined, or were about to expire, and needed updating.

INVESTMENT SCAMS

Last year reports of losses to investment scams totalled $328 million, as scammers took advantage of social media to make first contact with victims, often involving the purchase of Bitcoin or other cryptocurrencies. Scammers also used methods such as:

- Cold calling victims claiming to be a stockbroker or portfolio manager
- Offering hot tips and share promotions via email or message forums
- Promoting investment seminars promising access to experts
- Posing as financial advisers offering early access to super.

The Australian Securities and Investments Commission is also concerned about the growing number of online influencers offering financial product advice, without being licensed to do so.

PROTECT YOURSELF

Unfortunately, we live in an era where it pays to be sceptical. Here are some tips to help keep you safe.

- Educate yourself on popular scams by visiting the Scamwatch website (scamwatch.gov.au).
- Do not give out personal details unless you made first contact with the organisation.
- Always consider that unsolicited approaches via email, text message, social media or any other format could be a scam.
- Do not open suspicious texts or pop-ups, or click on attachments. If you think it could be legitimate, contact the organisation using details you have searched for yourself.
- Don't give someone remote access to your computer unless you have made first contact and you can verify who you are talking to.
- Keep personal details secure by locking your mailbox, shredding important documents you no longer need, keeping passwords and PINs in a safe place and being careful about the personal information you share on social media.
- Review your privacy and security settings on social media sites.
- Be wary of requests for personal details or payments.
- Be careful when shopping online and think twice before using virtual currencies such as Bitcoin.

Air Commodore Robert M C Brown AM FCA, Chair, ADF Financial Services Consumer Centre

POPULAR SCAM TACTICS

Compared to 2019, 2020 saw significant increases in losses to:

- Online shopping scams – up more than 52%
- Remote access scams – up more than 74%
- Classified scams – up more than 96%
- Threat-based scams – up more than 178%
- Health and medical scams – up by 2,080%

BUILDING **THE HOUSE OF** AUSTRALIA

TRUE NATIONAL SUCCESS REQUIRES A NATURAL, JUST AND NURTURING CULTURE, WRITES ***PETER RING.*** HE BELIEVES THAT OUR LEADERSHIP ECOSYSTEM NEEDS URGENT REPAIR AND OUR YOUTH MUST BE NURTURED TO LEAD THAT CHALLENGE.

SAM OPENS HIS SCHOOL LUNCH with great hunger and finds a peanut butter sandwich is on the menu, again. Everyone else in the group has a wrap, salad or other yummy thing. Sam as normal lets forth with a sigh of disappointment. Sam's friend Ella says, "Ask your mum to change what she gives you for lunch". Sam replies with a look of disappointment, "I make it myself".

Do we sufficiently address the sort of sandwich we make for ourselves, our community and Australia?

People have their own will, their own mind and their own way of thinking. They need to be inspired to grab the reins of life so that opportunities are not only promoted but grasped in order to best 'do' life. But people today could be forgiven for wanting to sink into a coma. Many workplaces focus on robot-like work and subliminally decay job satisfaction and original thinking. Governments attempt to structure our society through ever-increasing rules and regulations. There is a lack of moral courage to speak the truth when necessary and mould the rules to best 'do life'. Efforts to improve safety practices happen through regulation not rational thought and conscious awareness. Our lives are beset by scams. CEOs receive unreasonably huge salaries, often simply based on the profits they can drive upwards by any means they deem fit. Large companies lose connection with their customers by adopting almost forceful use of digital relationships and/or outsourced third-party engagement. Focus is on material profits rather than on service-produced profits. Sensationalism in our news services is to the detriment of the quality, integrity and broad coverage of newsworthy events. Reality TV shows nurture our shallow instincts and dumb us down. Drug companies focus on human vanity to convince us to use their drugs. Advertisements focus on ridiculous connections between the product and your material welfare. Political parties focus on winning the next election not on managing and nurturing the nation's capabilities – running the country. In many facets of our lives, is a coma preferable?

Life today seems to have morphed into rigid structures run by money rules, egotistical greed, and power or submission to fringe groups making heaps of emotional noise about fringe matters. We desperately need an effective thrust promoting an Australian culture that inspires and engenders ownership of, and commitment to, underlying goals for our House of Australia and a fun but value-driven societal fabric.

I have not made any effort to prove the above statements, they are observations made by many.

Throughout Australia, everyone seems to know a good family, maybe the "House of the Aussie Family". Mum and Dad are good role models. Grandparents are seen to be of a similar nature. The kids reflect that culture. Mum and Dad promote involvement in the community. The kids are into organised sport. The family genuinely cares about others including all their adult friends and the kids' friends. People generally are attracted by this family.

The cycle of a tree has similarities, as expressed by Mark Jones Jr in "Getting our Hands Dirty" (*Flight Test Safety Fact*, 21.07).

We prepare the soil, getting our hands dirty and working up a sweat. We might grunt aloud or skin knuckles. We plant the seed and begin to nurture it. A transformation takes place under the soil. We water, weed and feed. As the sapling shoots up, we continue to labour but only with a small sphere of influence because we cannot control the wind, rain, sun or shade. It does require hard work and the level of exertion ebbs and flows but we do not control the growth or the fruit. There is a symbiosis that takes place between the tree and the other members of the ecosystem. So too in life…

Were we to raise our Australian youth in a value-driven leadership-nurtured school environment we would subsequently have political leaders we could trust and admire, businesses we would like to deal with, collaborative public services, a continuing spirited, honourable military, great community police and, in fact, a society that is a model for the world. True national success requires a natural, just and nurturing culture underlying it. We would have an excellent 'House of Australia'.

Our leadership ecosystem is in need of urgent repair.

The pressures on youth to spiritually survive and then to emotionally and physically achieve are enormous. Society puts a very high focus on material success and the physical manifestations of life. Totally insufficient attention is paid to sustaining higher order needs such as feeling valued, being listened to, feeling

your contribution is important, being accepted for who you are, having fun and achieving.

Our culture is not skilled in addressing higher order needs. We know that they are highly significant, but we have created too few pragmatic opportunities to learn to be conscious and deliberate about creating and sustaining goals for life, or life's values.

We need to influence people in their maturing to not only address aspects such as planning, organising, directing and controlling but to also address the enabling conditions through a strong Australian culture to lead the most enriched and enriching lives they can.

Two things are evident in life: we all want something to do and we all want it to be connected to emotionally rich rewards. But the world tends to lead us along a path of accruing qualifications, getting the task done and pursuing material reward. We often end up having to look hard for our intrinsic culture, but the tasks always keep on coming.

I am not suggesting that all of life needs to be a continuum of internal reflection. I'm suggesting that a sound underlying national culture would smooth out the ups and downs and deliver a measure of consistency to 'do life'.

Imagine sitting in a circle of 20 people, close enough to pass a tennis ball to the person sitting beside you or to throw it across the circle. The tennis ball is the pulse of Australian culture. It must continue beating strongly and that is symbolised by the ball not being allowed to stop its movement from person to person.

Then someone introduces another item and you pass it around or across the circle because that is the rule. Then another and another and another item enters the circle to be passed. Habit and busyness set in as you pass anything that comes into your hands just to stay in the game. But the items' relevance is not being evaluated anymore – no time for that. You get so busy catching and throwing you lose sight of and even forget which item is the pulse of our culture.

Each day, and the living of it, has to be a conscious and deliberate creation in which self-discipline and order are mixed with play and pure foolishness.

GROWING YOUR PULSE

Australia hosts our life: we need Australia. What can we do to energise our cultural pulse while leading a typical Australian life?

A framework for understanding and strengthening our pulse needs to start at school. We need to explicitly expose students to a new way of thinking. To provide an experience that allows them to challenge ideas and behaviours in an environment that has no judgement and encourages growth and the pursuit of excellence through exploration.

We need to encourage students to impose their own disciplines. If we make the goals exciting enough, they will want disciplines that help them to their goals.

> "Be the change you wish to see in the world."

Through such an environment, students would discover their innate spirit, confidently make and carry out decisions and become clever responsible communicators. They would identify and experience, from life at school, best practice to mould and nurture their spirit and to become best equipped to shape the direction of their lives.

Mahatma Gandhi said: "Be the change you wish to see in the world". In order to make effective change in the world, we must first adopt behaviours that support that change. If we wait for others to take action on our behalf, we'll be waiting a lifetime.

School could help students to organise discussions about the culture we want in Australia. Discussions would need to take place through semi structured small group exposure to controversial subjects. Organise some skits around a controversial topic. Do some whole group work on topics such as what does listening really mean and why is music important. Invite some guest speakers to a once a fortnight lunch time gathering. Do some role plays on bad behaviour. Tackle, in small groups, some community projects.

All those hands-on activities would stimulate innovation, debate, the sharing of ideas and drawing parallels to the real world.

Topics for discussion that are pertinent to helping us all along a leadership road could be: what is expected of me, how do I handle put-downs, what do values and ethics really mean? Other topics that do not have one answer are how do I survive peer pressure and how can I get over being too self-conscious? You could debate over coffee "should I believe that I have a duty to contribute to the betterment of our Australian culture?"

Then continue with the following. How do I manage my anger? What role does guilt play in my life? Why am I fearful of being judged? Why is there so much prejudice? How should I react to difference – race, looks, colour, intelligence, expectations? And the most important of all, how do I get to feel I can have a say where people will listen to me? Even, do I need to have my say?

Many people in adulthood are still asking themselves those questions.

Whatever is wanted – give it freely: respect, enthusiasm, compassion, empathy, cooperation, recognition. Decide to be a role model. Work out for yourself what that means for you.

The House of Australia needs youth having a place of importance. Let us continue to fly our flag with a lot more respect and continue to sing our anthem more frequently – all reminders of the importance of our House of Australia.

Peter Ring,
Principal, Lingk

NSW GROUP CEREMONIAL PARADE

ABOVE Cadets of Marrickville Squadron march off from Hyde Park. ABOVE RIGHT Sergeant Adam Glowacki and Junior Cadet Jazmine Tickner make a presentation to the NSW Governor.

ON SUNDAY 30 MAY, cadets and officers of the NSW Group of the Australian Air League (AAL) participated in the group's annual ceremonial parade, marching through the streets of Sydney from Hyde Park to Government House.

The parade has been regular fixture on the Air League's calendar since 1936 when the then Minister for Defence Sir Robert Parkhill handed over the League's flag at Government House.

On arrival at the grounds of Government House, the squadrons formed up for inspection by the Group Patron, NSW Governor the Honourable Margaret Beazley AC QC, who was the Reviewing Officer for the parade.

Speaking to the cadets, Her Excellency reminded them of a quote attributed to aviation pioneer Amelia Earhart, who was setting flying records and was the first person to fly solo from Hawaii to the US mainland during the era when the AAL was formed: "There's more to life than being a passenger".

Her Excellency strongly encouraged the cadets to take the opportunities afforded to them, to take charge of and be responsible for their lives and to be brave in taking their lives forward.

Following the inspiring address, awards and trophies were presented to members and squadrons for competitions on the march and activities held throughout the year. A number of young officers were also promoted.

At the conclusion of presentations, the NSW Group Cadets of the Year, Sergeant Adam Glowacki and Junior Cadet Jazmine Tickner, made a presentation to Her Excellency on behalf of the NSW Group. The parade was then handed back to the Parade OC for the march off, with the Reviewing Officer, Her Excellency, taking the salute as the squadrons matched past and all officer affording a Royal salute.

THE AUSTRALIAN AIR LEAGUE is for boys and girls aged eight years and older with an interest in aviation as a career or a hobby. In the Air League they learn about aviation in all its forms through classes in theory of flight, navigation, aircraft engines and more. airleague.com.au

COMPETITION WINNERS

In July, AFA NSW ran a Facebook competition inviting our younger audience to describe, in less than 25 words, why they had a passion for aviation. Two sets of *Wings* magazines were offered as prizes. Here are the two winners.

Australian Air League Sutherland Shire Squadron Junior Cadet Ben Spratt, nine, has taken a strong leadership role in his squadron since joining last year and is running for NSW Cadet of the Year. Ben wrote: "I draw planes all the time. I spot planes and watch the flight radar. I also attend the Australian Air league where my love of aviation can be shared among other kids like me".

Leading Cadet Alexander Finnegan, 11, has attained a lengthy rap sheet of achievements and badges since joining Edmonson Park Squadron last year. He aspires to be a RAAF pilot and an AAL flying instructor. Alexander wrote: "I am interested in planes and the magazines would teach me more about planes and, as it interests me, I read more which helps with my dyslexia".

WORDS Flying Officer (AAFC) Paul A Rosenzweig OAM

RETURN TO FLYING OPERATIONS

GLIDER TRAINING SCHOOL

With the easing of COVID-19 restrictions and with appropriate safety measures in place, the units of the Gliding Training School (GTS) have returned to flying operations.

The GTS is a subordinate unit of the Australian Air Force Cadets (AAFC) Aviation Operations Wing. Through its three centres of excellence, GTS delivers flying pathways to Cadets through gliding experiences and training using the AAFC's fleet of DG1000S gliders.

The three GTS flights conducted pilot experience (PEX) flights to give Cadets the feel of flying a DG1000S glider, and selected Cadets attended formal training courses with the intention of achieving solo status.

Warwick Glider Training Flight ran Gliding Training Course 1/21 out of Warwick Airfield in April for Cadets drawn from across No.2 Wing. Two Cadets achieved their first solo, and three post-solo students achieved their first AAFC solo in the DG1000S aircraft.

Bathurst Glider Training Flight, based at Bathurst Airport, ran a Gliding Training Course out of the Air Chief Marshal Mark Binskin Aviation Centre for Cadets from across No.3 Wing. The trainees were visited by the incoming Director-General Cadets – Air Force, Air Commodore Craig Heap CSC. Bathurst Flight's newest junior instructor, Civilian Instructor Thomas Jamieson, had the privilege of briefing AIRCDRE Heap prior to his first experience of flying a AAFC glider.

In South Australia, **Balaklava Glider Training Flight** ran two PEX weekends for cadets from No.6 Wing. Some of the Cadets who flew were new members in their first year of training; others had completed formal aviation theory training and were able to start making entries in their pilot's log book.

One of the Aviation Theory Training Course graduates who flew his first flights was Cadet Sergeant Kshitij Sapdhare, who received the Bronze Award of the Duke of Edinburgh's International Awards earlier this year. CSGT Sapdhare is continuing with the Silver Award, and his efforts to improve his skills in aviation have been contributing to the skills section of the award. Cadet Corporal Jesse Isaac and Cadet Diandra Paiva, who also flew on the day, are also recipients of the Bronze Award of the Duke of Edinburgh's International Awards, and current Silver Award participants.

The Duke of Edinburgh's International Award is an enriching program in which young people participate in a number of activities and non-formal education to qualify for Bronze, Silver and Gold awards. Open to 14 to 24 year olds, it operates in more than 130 countries. For more information see aafc.org.au/what-we-do/duke-of-edinburgh-award.

BELOW Civilian Instructor Thomas Jamieson briefs DGCADETS-AF AIRCDRE Craig Heap AM CSC prior to his first experience flying a AAFC glider.

ABOVE CUO Nicole Wilson (No.203 SQN) flew her first solo flight in a DG1000S glider operated by Warwick Glider Training Flight.

LEFT Preparing for a Pilot Experience flight at Balaklava Airfield, from left, Cadet Rayaan Hashwani, Cadet Corporal Jesse Isaac and Cadet Diandra Paiva.

ABOVE RIGHT From left, LCDT Liam Miranda, CDT Luca Saw and CDT Jack Ruan with their pilot, FLTLT James Francis of the Elementary Flying Training School. Photo: Richmond Flight, EFTS.

ELEMENTARY FLYING TRAINING SCHOOL

The Elementary Flying Training School (EFTS) is also returning to flying operations.

A subordinate unit of the AAFC's Aviation Operations Wing, EFTS delivers flying pathways to Cadets through powered flying experiences and training managed through its three flights at Amberley, Richmond and Point Cook.

Flight Lieutenant Kate Hobson is Flight Commander of Richmond Flight, based at RAAF Richmond.

EFTS Flight Richmond ran the first in a series of Cadet Air Experience flights for Cadets from No.3 Wing (NSW) in the Diamond DA40NG, operating from RAAF Richmond from 12 to 14 April.

Richmond Flight Instructor FLTLT Hobson said, "We flew 61 cadets and eight staff over three days during an Easter holiday camp at RAAF Richmond".

Leading Cadet Liam Miranda from No.324 (City of Randwick) Squadron, Cadet Luca Saw from No.323 (City of Blue Mountains) Squadron in Glenbrook and Cadet Jack Ruan from No.302 Squadron (Rockdale) were the first to fly.

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Wings is a product of the Air Force Association a charitable, ex-service organisation supporting military Veterans.

AIR FORCE ASSOCIATION

GROUP CAPTAIN BRUCE GEORGE GRAYSON AFC

1 October 1939 - 18 May 2021

BRUCE ENLISTED IN the RAAF on 20 January 1958 as a Cadet in the RAAF College, Point Cook on No.11 Course.

Completing the pilots' course at the end of 1961, Bruce graduated with the award of the Sword of Honour, the Flying Trophy and the Queen's Medal, having already gained his Colours for tennis, hockey, basketball and cricket.

Posted to No.2 (Fighter) Operational Conversion Unit on 15 January 1962, Bruce underwent training on Sabre aircraft. In 1964, he had two tours with No.79 Squadron at Ubon, Thailand.

He returned to No.2 (Fighter) Operational Conversion Unit on 18 January 1966 for conversion onto the Mirage. He later qualified as a Fighter Combat Instructor and was posted to RAAF Washington in October 1967.

Back to Australia in 1970, Bruce was posted to No.77 Squadron, where he was leader of the Deltas aerobatic team, flying the No.1 position. The wingmen who flew with him commented on the smoothness of his flying, noting his ability to engender trust, clear instructions, consistency, reliability, accuracy and finesse. A high tribute.

After a posting to Headquarters Integrated Air Defence System for two years, Bruce returned to Australia to undergo Staff College training in 1974 and spent a period as a staff officer in Air Force Headquarters.

He was appointed Commanding Officer No.3 Squadron, Butterworth in 1977, followed by a posting to the F/A-18 Project Team in 1980 where he conducted flight tests and comparisons of the Mirage 2000, F-16 and F/A-18 for RAAF consideration.

In 1983, he returned to Australia with a posting to Headquarters Operational Command. He retired from the Air Force in October 1985.

Bruce was awarded the Air Force Cross for distinguished service.

On leaving the Service he was Flight Safety Manager for Cathay Pacific in Hong Kong for many years, followed by time with Emirates Airlines, before settling on the Gold Coast.

A well-respected friend and comrade.

WARRANT OFFICER HARALD ANDREAS ANDRESEN

8 January 1950 - 25 June 2021

HARALD (ANDY) WAS BORN IN Neumunster, Germany and moved to Australia, where he later married Sandra, the start of a 49-year partnership.

He enlisted in RAAF on 25 August 1969, graduated as an Airframe Mechanic from No.1 Recruit Training Unit in November and was posted to No.481 Squadron, Williamtown in July 1970 to undergo a Mirage course. He returned to Wagga in January 1971 on No.90 Airframe Fitter course and then went back to Williamtown to No.76 Squadron on 27 April 1971. A posting to No.75 Squadron in Butterworth in November 1973 followed.

Returning to Australia in May 1976, Andy was posted to Edinburgh where he spent three postings working on Orion, Dakota and Mirage aircraft, specialising in Maintenance Control Section with the Computer Aided Maintenance Management (CAMM) system.

Subsequent postings included: RAAF Wagga Wagga in July 1984 to complete a CAMM system course, becoming an instructor on the system; No.2 Flying Training School in Pearce on Macchi aircraft and Maintenance Control Section; and to Canberra as a CAMM auditor.

In 1993 he returned to No.492 Squadron.

Having achieved the rank of Warrant Officer, Andy left the Air Force on 21 June 2001 after a 32-year career, moving to Canberra to work in the Public Service on the CAMM2 Project.

He worked on at least eight aircraft types, had 21 postings, 18 attachments and completed no less than 33 courses. Along with his service medals, Andy was awarded the Australia Day Medallion, a prestigious award for efficiency.

In civilian life, Andy had a leadership role in the Canberra Tuggeranong Seniors Club, was a committee member with the Isabella Plains Scout Group, and a board member of the Beachmere RSL Sub-branch, Queensland.

FLIGHT SERGEANT GRAHAME LESLIE TANNER

29 January 1955 - 14 April 2021

BORN IN MAITLAND NSW, Grahame enlisted in the RAAF in March 1972 as a 17-year-old Cat 2B trainee. He completed recruit training at Edinburgh on No.1156 course, earning the nickname Spanner, and was posted to the RAAF School of Technical Training (RAAFSTT) at Wagga.

Commencing technical training on No.204 Trainee Mechanics course on 6 June 1972, Spanner elected specialisation as a Motor Transport Fitter. However, he was subsequently remustered to General Hand and posted to RAAF Base Fairbairn, Canberra.

After 18 months, he returned to RAAFSTT to commence training as an Aircraft Metal Worker on No.5 AMWKR Course. This time he was successful.

Posted to No.2 Aircraft Depot (2AD) at RAAF Richmond in 1976, he worked on Hercules and Orion aircraft.

In April 1978, Spanner was posted to

No.75 Squadron, Butterworth, maintaining Mirage aircraft and was promoted to Corporal and NCOIC Metalworking Section. Off-duty he displayed excellent skills playing Rugby League and Rugby Union for the "Boatie Tigers".

He returned to RAAFSTT in April 1980 as an instructor. After five years at RAAFSTT and promotion to Sergeant, he was posted to No.38 Squadron, Richmond as SNCOIC Metalworking Section where again he demonstrated strong leadership and was an effective mentor for his troops. At Richmond, he played touch football, representing the RAAF at inter-service level.

Promoted to Flight Sergeant and posted back to 2AD in 1991, Spanner was an excellent leader, promoting high morale within the section.

After 23 years in the RAAF, he elected discharge and settled in Perth.

Spanner worked for Air Flight for 15 years, then moved to Port Headland in 2011 to manage a concrete railway sleeper manufacturing plant before returning to Perth in 2015.

Wazza Urquhart

JAMES ANDREW GABLE OAM

19 September 1944 - 1 May 2021

JIM SPENT HIS VERY EARLY years in Sydney before moving to Melbourne where he attended East Hills Boys School. He was apprenticed as a draughtsman and played Aussie Rules football for St Kilda.

Before joining the RAAF on 9 October 1968, Jim completed two periods of service in the Citizens Military Forces, serving with No.3 Battalion and then No.4 Battalion, Royal New South Wales Regiment. He was posted directly from the 4th Battalion to No.1 Recruit Training Unit at RAAF Base Edinburgh and then to No.3 Aircraft Depot at RAAF Base Amberley.

Jim was subsequently posted to No.1 Operational Support Unit, Vung Tau, South Vietnam on 4 June 1969 before being attached to No.9 Squadron for a six-month tour as a door gunner on Iroquois (Huey) helicopters. During his tour, the helicopter he was crewing crashed and he received back injuries. He completed his tour in Vietnam with No.1 Operational Support Unit.

After a posting to Base Squadron Amberley from June 1970 until October 1971, Jim returned to South Vietnam, posted to No.9 Squadron and then No.1 Operational Support Unit.

On return to Australia in February 1972, he served at Base Squadron Amberley, electing discharge on medical grounds on 15 August 1973.

Jim was a staunch member of the Airfield Defence Association of Australia and served as secretary, treasurer and editor of the association's magazine, *Blue Beret*, for many years. Promulgated in the Queen's Birthday honours list in 2019, Jim was awarded the OAM for his service to veterans and their families. He died in May suffering myelofibrosis.

WING COMMANDER RONALD LEITH BIDDELL AFC

1 December 1939 – 25 June 2021

BORN IN ADELAIDE, Ron attended Norwood Primary and High Schools. As a youth he represented South Australia playing baseball and was selected for the Australian side – he was even considered by the New York Yankees. He subsequently represented three states at the highest level. Only one of two believed to have accomplished that feat.

Aged 21, while undergoing Army National Service Training, Ron elected to join the RAAF and completed No.44 Pilot Course in 1962. He was presented with his Wings at RAAF Pearce by the Duke of Edinburgh.

He served at RAAF Amberley before completing two postings to Malaysia flying Canberra aircraft with No.2 Squadron Detachment at Butterworth. Returning to Australia in 1966, he was posted to No.2 Squadron, Vietnam, from April 1967 to October 1967 on the first Canberra Bomber rotation.

Returning to RAAF Amberley, Ron completed a Sabre Conversion Course at RAAF Williamtown before completing an F-111 Conversion Course in the US. He returned to Australia in 1968 and flew Canberra aircraft for 18 months.

Selected for flying instructor duties, Ron completed No.46 Flying Instructors Course in 1970 followed by a posting to RAAF Point Cook. A two-year exchange with the RNZAF at Ohakea flying Harvard aircraft, during which time he led the RNZAF aerobatic team, was followed by a posting to Central Flying School from 1976-78 and appointment as leader of the Roulette aerobatic team. He was responsible for designing the famous 'R' logo that has been used on the Roulette aircraft for over 40 years.

After a tour in Canberra, Ron returned to CFS as the Commanding Officer from 1980 until 1981. He was awarded the Air Force Cross in the 1978 Queen's Birthday Awards for outstanding professionalism and service for flying instruction.

Without exception, those who knew Ron spoke very highly of him citing his sense of humour, ease of company in any circumstance, an inspirational pilot and officer, and a loving father.

After 20 years of service, Ron retired from the RAAF in 1981 to settle on the Gold Coast, followed with a move to Adelaide in the early 2000s.

Ron joined the AFA (Mitcham Branch) in 2010. An active member, he was President of the Branch Golf Club from 2017 until this year when ill health forced him to retire. He was recently awarded a Distinguished Service Award for his work with the Mitcham Branch.

Ron is survived by his three sons – Scott (a serving RAAF member), Leith (a former RAAF Officer) and Brett.

REVIEW BY Bob Treloar

AIRCRAFT OF THE ROYAL AUSTRALIAN AIR FORCE

By **RAAF HISTORY AND HERITAGE BRANCH**
Big Sky Publishing, RRP $43.75

PUBLISHED TO COMMEMORATE the centenary of the RAAF, *Aircraft of the Royal Australian Air Force* describes the acquisition, operation and service record of the multitude of aircraft types flown by the RAAF. Endorsing the book, Chief of Air Force, Air Marshal Mel Hupfeld notes that the evolution of air and space technology in a relatively short time has shaped both the nature of the battlespace and the skills demanded by those who sustain, control and fly the aircraft.

The book presents a history of force evolution, charting Australia's response to changing strategic circumstances through the harnessing of technology. Each aircraft type features a narrative that is informative, interesting and easy to read and is supported by a table of technical data. There are some wonderful photographs and an excellent index.

Commemorating the 100th anniversary of the RAAF, it is an excellent research and reference source, presented as a beautiful coffee-table book. It also has some interesting asides. For instance, the pilot of one of four crashed D.H.9as, on Flemington racecourse in 1924 challenged jeering onlookers to a fight – a tribute to service loyalty. Then there was the Lancaster bomber that flew under Sydney Harbour Bridge…

Aircraft of the Royal Australian Air Force will appeal to those who have a keen interest in the history of military aviation and the evolving capability of the RAAF. It will be of particular interest to those have served in the Air Force and to those who wish to gain an appreciation of the RAAF in its centenary year.

REVIEW BY Bob Treloar

PATHFINDER, 'KRIEGIE' AND GUMBOOT GOVERNOR: The Adventurous Life of Sir James Rowland AC, KBE, DFC, AFC

By **AIR MARSHAL SIR JAMES ROWLAND & DR PETER YULE**
Big Sky Publishing, RRP $27.75

A RAAF BOMBER pilot and a prisoner of war in World War II, James Rowland went on to become a test pilot, head engineer for the Mirage aircraft procurement project, head of the RAAF engineering branch, Chief of the Air Staff and Governor of New South Wales.

First published by the RAAF History and Heritage Branch in 2018, *Pathfinder* was republished for the RAAF centenary. In part, it is Rowland's autobiography and, when his note-taking decreased, his story is taken up by historian and author Dr Peter Yule.

Selected for operations in the Pathfinder Force, Rowland served with distinction on Lancasters until his 34th mission ended with a mid-air collision over Germany in 1945. His resilience was called upon during his interrogation by the Gestapo and his imprisonment.

Completing his aeronautical engineering degree, he re-enlisted in the RAAF in 1947 and trained as a test pilot. His service had a lasting impact on the development of the modern RAAF and his leadership during the procurement of the Mirage was outstanding. Promoted to Chief of the Air Staff, he remains the only engineer to have led the RAAF.

On retirement, he was appointed Governor of New South Wales and then Chancellor of the University of Sydney.

Well written and referenced, the book is recommended to those with an interest in aviation, the RAAF and a most distinguished Australian.
Note: Germans to referred to Allied prisoners of war as kriegies.

REVIEW BY Bob Treloar

KNIGHT OF GERMANY: Oswald Boelcke – German Ace

By **JOHANNES WERNER; TRANSLATED BY CLAUD W. SYKES**
Casemate Publishers, RRP $21.99

KNIGHT OF GERMANY is a biography of one of Germany's true heroes, Oswald Boelcke. In World War I, Boelcke was the top-scoring scout pilot in the German air forces at the time of his death, with 40 victories. His true genius was his ability to foresee the value of the scout force beyond defending Germany's army from attack by enemy aircraft. At the time, Germany's air service was limited to artillery observation in support of its army.

Written in German by Professor Johannes Werner and first published in English in 1933, *Knight of Germany* has been reprinted several times, most recently in January 2020. The substance of the book is taken from letters from Boelcke to his parents.

Boelcke grasped the significant impact air power would make on and over the battlefield well before most others. His success was due to his aggressiveness in the air, seeking out enemy aircraft. The principles of air combat he developed became a compendium for all fighter tactics well into the 20th century.

On 26 October 1916, Boelcke achieved his 40th victory. On a sortie later that day, while avoiding an enemy aircraft he was attacking, he collided with a colleague's aircraft and crashed.

One of his students was Manfred von Richthofen, who went on to become the most well-known and successful scout pilot in WWI.

Knight of Germany captures the essence of aerial combat, its dangers and rewards. It traces the early development of air warfare the principles of which influenced air combat in WWII.

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