

WINGS

WINTER 2023
VOLUME 75 NO. 2

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FROM THE X-15 TO AN AUSSIE SCRAMJET

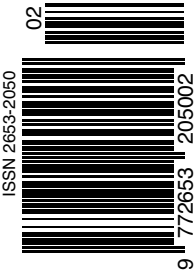
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MANAGING EDITOR'S MESSAGE



IN THIS EDITION, we present a couple of personal accounts of the development effort and events associated with introducing advanced technology aircraft to service. As you can imagine, platforms designed to operate at the edge of practical boundaries expose those involved to a range of unknowns.

The X-Planes feature deals with the X-15, probably the most popular and well-known aircraft of the experimental series. We introduce readers to an innovative Australian company, Hypersonix, advancing toward launching satellites into low earth orbit using a reusable hypersonic vehicle powered by the company-developed scramjet engine; inspiring home-grown technology.

We have noticed a typographical error in the 'Home-made wings' story in the autumn edition; the Jet era table on page 49 indicated 7,110 Vampires had been built for the RAAF. The correct number was 110 trainer variants and a total of 184 including fighter and fighter-bomber versions.

We hope you enjoy the winter 2023 edition of *Wings*.

Ron Haack,
Wings managing editor

WINGS EDITORIAL DEADLINES 2023

Wings welcomes editorial submissions and letters to the editor. Please note the following deadlines for submissions.

EDITION DEADLINE

Spring (September) 17 July
Summer (December) 16 October

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



AIR FORCE ASSOCIATION



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PRESIDENT'S DESK

AIR FORCE ASSOCIATION

LTD'S BOARD sought to add new company directors to the National Board following implementation of the company's replacement Constitution. Air Marshal (Retd) Mel Hupfeld AO, DSC, Air Commodore (Retd) Doug Chipman and Greg Hood AO were nominated and appointed to the Board at the AFA Ltd AGM held on 26 May. I congratulate them on their appointment and look forward to working with them.



legislation remains unchanged. Consequently, nothing changes for those ADF members who have served in wars and conflicts, in recognition of the specific effects, risks and privations associated with service on operations. Medallion recognition, in almost all cases, tells the veteran's operational history and, therefore, there seems no cogent argument to preserve the term to identify or give recognition to war veterans only.

Recently the Federal Government responded to the Royal Commission into Defence and Veteran Suicide's first recommendation contained in its interim report by proposing to make the *Military Rehabilitation and Compensation Act 2004* (MRCA) the single ongoing act. Existing claims under the *Safety, Rehabilitation and Compensation (Defence-related) Claims Act 1988* (DRCA) and the *Veteran's Entitlements Act*, would remain under grandfathering provisions of those two acts.

The Association also holds the view that injury in service, regardless of the nature of service, should have equal compensation/health support. That view was recommended by the 2019 Productivity Commission review into the efficacy of the veteran support system. There is no loss to entitlement, only gain by those who suffered in non-war like circumstances.

MRCA is the more contemporary legislation and the simplest to comprehend. While not a new replacement act, the optimum desire of most ESOs and veterans, MRCA is the more beneficial act. The Association applauds the government initiative.

Open Arms started life as the Vietnam Veterans' Counselling Service to help deal with trauma and other health-related issues suffered by Vietnam veterans. Its remit broadened over the years and more recently morphed into Open Arms. Certain elements within the veteran community are lobbying to have the service limited to war veterans due to the 'specialised nature of injury' from war service. Further, there are suggestions the service has been diluted due to its widening clientele. All veterans or their family members seeking assistance from Open Arms are triaged and assigned to support staff. I am a client of Open Arms and have been for 18 months. I cannot speak more loudly in support of the level of assistance provided.

The meaning and use of the term 'veteran' remains a robust topic of conversation within the veteran community. Also, there are challenges to the Open Arms' client base, which includes all veterans and families, emphasising the use of the wider term, veteran.

We need to show empathy and support for our brothers and sisters in arms regardless of their service and generation. We are all family.

The Association's official position on the term veteran is: a person who is serving, or has, served in the Australian Defence Force, a definition agreed by all state and territory ministers attending the November 2017 Veterans' Affairs Ministers Roundtable. That broad term has no impact on access to entitlements, and its use within veterans' support

Carl Schiller
National President

To join the Air Force Association visit raafa.org.au and follow the JOIN US link. For assistance, contact the Association, see page 12 for contact details.



ON THE COVER

Royal Air Force Eurofighter Typhoon at the Royal International Air Tattoo. Photo: Nir Ben-Yosef/Alamy.

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EDITED BY Bob Treloar

WEDGETAILS JOIN THE USAF

THE US AIR FORCE (USAF) will buy up to 26 E-7A Wedgetail aircraft from Boeing to replace its fleet of ageing E-3 Sentry airborne warning and control aircraft (AWACS).

The E-3 Sentry has been in service for nearly 50 years and its primary sensor, a Northrop Grumman rotating radar antenna, takes 10 seconds to refresh its view of the battlespace. The E-7As Multirole Electronically Scanned Array can deliver a near-constant, high-fidelity image and track objects of interest while maintaining a wide area search function.

The E-7A is also more manpower efficient; AWACS requires a flight crew of four, plus a mission crew complement of 13-19 specialists. New technology enables the Wedgetail to operate with a pilot and co-pilot, and a variable number of mission operators for the 10 onboard control stations.

The RAAF operates 6 E-7A Wedgetails from RAAF Base Williamtown, NSW.

Source: *Defence News*



ABOVE A RAAF E-7A Wedgetail receives fuel from a USAF KC-135 Stratotanker over Iraq in 2020. Photo: Staff Sgt. Daniel Snider/USAF.

RAAF replaces lost Growler

IN EARLY 2018, the RAAF lost an EA-18G Growler during take-off from Nellis Air Force Base, Nevada, due to a catastrophic failure of a fan disk in the left GE Aerospace F414 engine. No personnel were injured, but the aircraft was a write-off.

In February, the RAAF took delivery of a single Boeing EA-18G Growler, at an estimated cost of \$125 million, restoring Australia's Growler fleet to 12 aircraft.

Apart from the US Navy, the RAAF is the only operator of the EA-18G, an electronic warfare variant of the F/A-18F Super Hornet.

Source: *Flight Global*



ABOVE RAAF EA-18G Growler. Photo: Defence.

JDAM-ER FOR THE UKRAINE

JOINT DIRECT ATTACK MUNITION-EXTENDED RANGE (JDAM-ER) is a winged variant of the JDAM precision guidance kit produced by Boeing. Jointly developed with the Australian Defence Science and Technology Organisation, it incorporates a low-cost wing set that enables the weapon to glide more than 70km, triple the stand-off range of an unwinged JDAM. The JDAM-ER was introduced into the RAAF inventory in 2015.

During a test program that involved the release of over 450 JDAM-ER weapons at Woomera, Australia in 2006 and 2008, the munition recorded a system reliability of 95 percent and achieved a Circular Error of Probability of just 9.6m.

Bloomberg reported in February 2023 that the US is providing JDAM-ER weapon systems to Ukraine, as part of its \$US1.85 billion of additional military aid announced in December 2022.

Source: *Air Force Technology*



BELOW JDAM-ER is a high-precision glide bomb with a stand-off range of more than 70km.



Deployable air traffic management

THE RAAF HAS TAKEN delivery of three Indra Australia Defence Deployable Air Traffic Management and Control Systems (DDATMCS) that will strengthen the ADF's capacity to provide airspace management at deployed locations.

The DDATMCS will provide approach and enroute air traffic management. Two of the systems are intended for rapid deployment by air, land or sea for short duration operations, for example Defence assistance to humanitarian aid and disaster relief operations. The third system will include an integrated Area Control Centre (ACC), with up to six operator positions, to support more permanent RAAF deployments. The two rapid deployment systems consist of a transportable medium-range 3D surveillance radar fully integrated into a mobile ACC complemented by secondary surveillance radar with Mode 5 Identification Friend or Foe (IFF) and Automatic Dependent Surveillance-Broadcast (ADS-B) signal reception and processing system. Those features enable early detection of both cooperative and non-cooperative targets.

Source: Defence Connect



TAIPAN TROUBLES

IN MARCH, a MRH-90 Taipan helicopter ditched into shallow water at Jervis Bay, NSW during a routine counter-terrorism training exercise. The 10 ADF personnel onboard were rescued; two soldiers sustained minor injuries. Taipan operations have resumed with unspecified "risk mitigations" in place.

Purchased for \$3.7 billion in 2005-06 to replace ageing Black Hawk and Sea King fleets, the locally assembled Taipan has not been a success, with statistics showing just 46 percent of MRH-90 aircraft allocated to flying units were available to fly in 2021. The problems led to Defence replacing the fleet with 12 MH-60R Seahawks for the Navy and 40 UH-60M Black Hawks for the Army.

Source: Australian Aviation



MRH -90 Taipans operated by the 5th Aviation Regiment. Photo: Defence.



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If you enjoyed our latest issue please consider a donation to help cover the cost of production and contribute to our work with military Veterans. Follow the Donate link at wingsmagazine.org

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



AIR FORCE ASSOCIATION



A RAAF C-17A Globemaster III touchesdown at Hobart International Airport.
Photo: Corporal Lisa Sherman.

Cool lift

FOR ICE CORES

A RAAF C-17A GLOBEMASTER from No.36 Squadron transported the first ice cores of the Australian Antarctic Division's (AAD) Million Year Ice Core project to Tasmania in March.

The ice cores were transported in special powered cold boxes from Casey Station, Antarctica, to AAD Headquarters in Hobart. The RAAF also air dropped approximately 12 tonnes of cargo to a remote field between Casey and Davis stations, allowing preparation for a scientific excursion next season.

The flight reflects a strong relationship between the ADF and AAD with the provision of air transport support since the establishment of Operation Southern Discovery in 2017. Operation Southern Discovery occurs annually, primarily between November and March.

Source: Contact



ABOVE LEFT Australian Antarctic Division cargo being unloaded from a C-17A Globemaster III at Hobart International Airport, Tasmania.
Photo: Corporal Lisa Sherman.

SMALL DRONES TO PROVIDE BIG CAPABILITY

USING SMALL DRONES that look like radio-controlled hobby aircraft, the US Air Force Research Laboratory (AFRL) is flight-testing various algorithms, behaviours, components and concepts to inform the development of future weapons and air-combat capabilities. A prominent focus is the use of drones to demonstrate networked, autonomous and collaborative weapons concepts.
Source: *The Drive*



RIGHT One of the drones used by the AFRL's Networked Weapons Laboratory.
Photo: AFRL.





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NT flood

RELIEF

IN MARCH, Defence helped the Northern Territory's emergency services evacuate up to 600 people from isolated flood-affected communities in the Kalkarindji, Pigeon Hole and Daguragu areas on the Victoria River. Air evacuation was the only viable option to get the residents to safety.

Two C-130J Hercules and one C-27J Spartan aircraft from Nos. 37 and 35 Squadrons were deployed to RAAF Base Tindal to execute the evacuation, requiring multiple sorties. No.17 Squadron's Air Movements section provided ground support and received the evacuees.

Source: Defence



ABOVE Air Force evacuates residents from the Kalkarindji area.



RAAF BIRTHDAY CELEBRATIONS

ON FRIDAY MARCH 31, members of the Air Force across the nation stopped to reflect on the 102 years since formation of the RAAF. In addition to local base commemorations, the raising of the RAAF ensign and a commemorative service at the RAAF Memorial on Anzac Parade, a Last Post ceremony at the Australian War Memorial and the Air Force Proficiency and Leadership Awards ceremony were conducted in Canberra.

Heritage aircraft from No.100 Squadron conducted a flypast over the RAAF Memorial at Anzac Parade and over RAAF Base Williams, Point Cook.

Chief of Air Force, Air Marshal Rob Chipman said the foundation of Air Force's achievements had always been the aviators.

"We'll be challenged by advancing technologies and accelerating strategic uncertainty, but we're up for that challenge," he said. "I'm confident our aviators, current and future, will uphold and strengthen our wonderful heritage. So, to all aviators who have served in the Royal Australian Air Force and still do, thank you."

Source: Defence



ABOVE The RAAF 102 years ago. Photo: The Ram.

Air Force

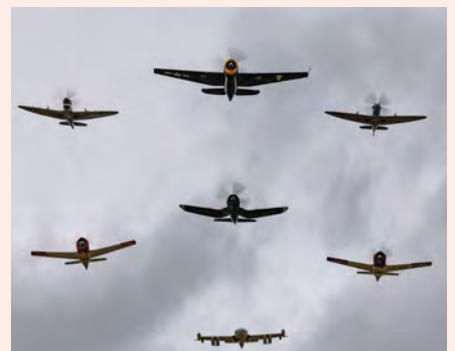
HERITAGE ON DISPLAY

IN MARCH, almost 20,000 aviation enthusiasts converged on the Hunter Valley Airshow at Cessnock Airport, NSW to witness modern and historic aircraft flying displays.

The event showcased flying displays from an E-7A Wedgetail aircraft, an MH-60R helicopter, and No.100 Squadron historical aircraft.

Air Force was part of a broader ADF presence at the air show, with Navy and Army providing a range of aerial and static displays.

Members of the public were able to get up close to the Air Force Balloon, enjoy performances by the Air Force Band, experience the Naval Aviation Prospects Scheme simulator, and take a trip down memory lane with the historical aircraft static display from No.100 Squadron.



ABOVE Historic aircraft from No.100 Squadron fly in formation over crowds at the Hunter Valley Airshow. Photo: Sergeant Glen McCarthy.

SOUTHERN CROSS RESTORATION PROGRAM

THE HISTORICAL AIRCRAFT RESTORATION SOCIETY (HARS) at Shell Harbour, NSW, is restoring a full-size replica of Sir Charles Kingsford Smith's Fokker F.VIIb tri-motor *Southern Cross* to flying condition. The three Jacobs motors were fired up in early April, an important step on the path to seeing the *Southern Cross* fly.

June 10 is the 95th anniversary of the original Southern Cross landing in Sydney, just a day after Kingsford Smith and crew flew it from Oakland, California, to Brisbane, Australia. The 11,585km, 83 hours and 38 minute journey included stops in Hawaii and Fiji.

Source: *Simple Flying*



Southern Cross replica. Photo: Howard Mitchel.

Poseidon to replace Canada's CP-140

THE CANADIAN GOVERNMENT has selected the Boeing P-8A Poseidon to replace the Royal Canadian Air Force's (RCAF) ageing fleet of Lockheed CP-140 Aurora maritime patrol aircraft. The Aurora has been in service since 1980 and is due to retire in 2030.

The P-8A is operated by several of Canada's defence partners including all its 'Five Eyes' allies: the United States, United Kingdom, Australia and New Zealand. Other P-8A operators include Norway and South Korea, and it was recently selected by Germany. In addition, the similar P-8I is in service with the Indian Navy.

Canada has submitted a Letter of Request for up to 16 P-8As, including associated equipment and initial servicing

under the Foreign Military Sales program but has yet to formalise the decision.

Source: *Australia Defence Magazine*



BELOW Artist impression of a P-8A in RCAF livery.



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AIRFORCE BIRTHDAY

ON 31 MARCH 2023, Air Force Association (SA) co-hosted with RAAF Edinburgh the Formation of the RAAF Commemorative Service at the Air Force Memorial, Torrens Parade Ground, to acknowledge the 102nd birthday of the RAAF and the aviators who have served our nation.

More than 120 attendees included Her Excellency, the Governor of South Australia, veterans young and old, and representatives from across the political, industry, heritage and Indigenous communities.

A Welcome to Country and Smoking Ceremony were performed by local Traditional Kurna Custodian Clifford Wilson. AIRCDRE Adrian Maso delivered the keynote address, relating the story of WWII South Australian Indigenous veteran George Tongerie.

The commemoration remembered the men and women who have served in the Australian Flying Corps and the RAAF, leaving a legacy that is proudly embraced by today's Air Force. In particular, those who have fallen in the service of their nation in war and peace over the past 102 years were remembered. Key 2023 anniversaries such as the 50th Anniversary of the end of Vietnam War and the 70th anniversary of the Korean War ceasefire were acknowledged. WWII aviators Ray Merrill DFC and Don Looker,

RAAF veterans of the Vietnam War and the families of RAAF Korean War veterans attended the service.

Her Excellency the Honourable Frances Adamson AC, Governor of South Australia, attend in her Honorary Air Commodore uniform and later engaged with the service participants and veterans.

Australian Air Force Cadets provided a Guard and RAAF Edinburgh Aviators provided the Catafalque Party.

After the service, the Acting President AFA-SA, Lawrence Ng, presented two Vimy Flags, one to RAAF Edinburgh and the other to the South Australian Aviation Museum (SAAM) in recognition of their contributions to the Epic Flight Centenary and their ongoing collaboration with AFA-SA to promote and preserve Air Force's heritage in South Australia.

The Vimy Flags were produced in 1919 for the epic and record-breaking flight from England to Australia by the four brave aviators, Sir Ross Macpherson Smith, Sir Keith Macpherson Smith, Jim Bennett and Wally Shiers, who made the journey in the famous Vickers Vimy G-EAOU.

Gary Lloyd, second cousin twice removed of Sir Ross Macpherson Smith, who worked closely with AFA-SA, RAAF Edinburgh, SAAM and other organisations in planning and conducting the Epic Flight



Centenary celebrations in Adelaide in 2019 attended the commemorative service.

The flags, signed by each of the famous aviators, are important heritage items. The AFA also provided Adelaide Airport with a signed Vimy flag for inclusion in the Vickers Vimy Exhibition unveiled in late 2022.

The intent is for the Vimy flag presented to RAAF Edinburgh to be placed on prominent display at the base to share the inspirational and remarkable story of the Vickers Vimy flight and its courageous aviators with young RAAF aviators and inspire them to serve, achieve and be brave in their own service of the nation. Likewise, it is hoped the Vimy flag will become a key part of SAAM's aviation heritage collection and serve to inspire future generations of South Australians to achieve just as the Vickers Vimy aviators did more than 100 years ago.

AFA-SA is proud to promote and preserve Air Force heritage in South Australia ensuring the stories and deeds of those who have served are not forgotten.



ABOVE Gary Lloyd with the Vimy Flag, signed by his famous relative in 1919, presented to AIRCDRE Maso for display at RAAF Edinburgh.



LEFT WWII veterans Don Looker and Ray Merrill DFC with Her Excellency the Honourable Frances Adamson AC, AIRCDRE Adrian Maso, Senior RAAF Representative South Australia and Commander Air Warfare Centre, and members of the Catafalque Party from RAAF Edinburgh at the service.



Addressing VETERAN homelessness

RAAFA WESTERN AUSTRALIA

managers represented the Air Force Association at the inaugural Homeless Veteran Forum hosted earlier this year by RSL Victoria, in partnership with RSL Care SA.

Chief Operations Officer, Tonia Zeeman, and Head of Clear Skies, Ian Craig, took part in the forum which focused on tackling one of the most significant challenges facing the veteran community – homelessness.

According to recent data from the Australian Housing and Urban Research Institute, veterans are at higher risk of homelessness, more likely to be homeless for longer, less likely to access mainstream services and also face a multitude of factors placing them at risk of homelessness.

“It was an incredibly valuable forum, particularly to be able to confer with experts around Australia who are involved in helping to tackle this issue,” said Ian.

“There is a big difference in talking to people about homelessness, and those who are experts in veteran homelessness



ABOVE From left, Ian Craig, Sir Peter Cosgrove and Tonia Zeeman at the Homeless Veteran Forum.

and have experience, skills and insight that are so valuable to RAAFA as we continue to work on our Andrew Russell Veteran’s Living Program in WA.”

As guest speakers shared what they have learned from supporting veterans who have experienced homelessness, several common themes emerged, including the need for partnerships, prevention and treating the root cause of homelessness.

“One of the biggest takeaways was the need for just one clear, coherent voice in talking to government and politicians to bring about better collaborations and better outcomes,” said Ian. “We very much feel that together we can share our expertise and provide a united front to represent veterans across Australia.”

A second Homeless Veteran Forum is planned for later in the year, where more collaboration and work will be shared.

Retirement living awards finalists

RAAFA’S CIRRUS APARTMENTS

and RAAFA Club at Air Force Memorial Estate (AFME), Bull Creek, WA are finalists in the Best Luxury Retirement Living Development category of the 2023 National Retirement Living awards.

The awards celebrate high achievement across all elements of the retirement living sector and contain nine categories and one special award, recognising people and companies doing great work to ensure senior Australians have an enjoyable retirement.

AFME Estate Manager, Penny John, says RAAFA strives for excellence in every area of its operations and the organisation was delighted to have been nominated for the award.

“We’ve always been focused on responding to the individual needs and choices of our residents, and this seems to have been recognised as a result of us making the finals in this award category,” she said.

Penny John and Tonia Zeeman plan to travel to the Gold Coast for the award ceremony on 22 June.

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EDITED BY John Kindler

\$506 million GUIDED-MISSILES DEAL

THE US STATE DEPARTMENT has approved the sale of 63 extended-range, advanced anti-radiation guided missiles (AARGM) to Australia in a deal worth an estimated \$506 million. The sale includes 20 AGM-88G AARGM-ER captive air training missiles, containers, components, support equipment, software, and engineering and other logistic support. Northrop Grumman Information Systems has been selected as the main contractor.

The US has also approved the possible sale of 600 Javelin missiles, worth \$125.13 million, to the United Kingdom, and an additional \$619 million sale of F-16 munitions to the Taipei Economic and Cultural Representative Office (TECRO).

The TECRO in the US had asked to buy 100 AGM-88B high-speed anti-radiation missiles, 23 HARM training missiles, 200 AIM-120C-8 advanced medium-range air-to-air missiles, four AIM-120C-8 AMRAAM guidance sections and 26 LAU-129 multi-purpose launchers.

Source: Defence Connect



A US Navy F/A-18F launches an AGM-88G.

Honeywell signs F-35 & Hawk deals

HONEYWELL HAS APPOINTED

Rosebank Engineering as the maintenance, repair and overhaul authorised service centre for the F-35 Joint Strike Fighter Wheels and Brakes program in the Asia-Pacific region. It is the first of several F-35 sustainment assignments to be awarded to Rosebank Engineering and activated.

In a separate agreement, BAE Systems Australia commissioned Honeywell to supply aircraft parts and component repair services for 33 RAAF Hawk 127 aircraft. An upgrade program was announced for the Hawk 127 fleet in 2022, as it is expected to continue operations in the lead-in fighter training role until 2031.

Source: Australian Defence Magazine



No.76 Squadron Hawk 127.

RAAF Triton squadron revealed

A MOCK-UP OF NORTHROP

GRUMMAN'S MQ-4C Triton high-altitude long-range endurance unmanned aerial system was on show at the 2023 Avalon Airshow sporting the markings of No.9 Squadron RAAF.

Australia is set to receive the first of at least three Tritons on order under Project Air 7000 Phase 1B in 2024. An announcement on further aircraft – the RAAF has a requirement for six, possibly seven – is expected to be informed by the Defence Strategic Review (DSR).

No.9 Squadron, which flew the Sikorsky S-70A-9 Black Hawk helicopter, was deactivated in 1989 when the RAAF's rotary-wing fleet was transferred to the Army. The squadron's last

commanding officer, Sir Angus Houston was as one of the architects of the DSR.

The reformed 9SQN will join the RAAF's existing maritime Intelligence Surveillance and Reconnaissance units, No.10 and No.11 Squadrons, which fly the Boeing P-8A Poseidon maritime patrol aircraft and the Lockheed AP-3C(EW) Orion electronic intelligence aircraft respectively. No.10 Squadron is due to relinquish its AP-3Cs in favour of the new Gulfstream MC-55A Peregrine aircraft after conversion to the Intelligence, Surveillance, Reconnaissance and Electronic Warfare role.

No.9 Squadron has a strong maritime tradition: formed in January 1939 as a Fleet Cooperation squadron flying Supermarine Seagull aircraft from the

Royal Australian Navy's capital warships to provide a surveillance and anti-submarine warfare capability.

Source: Australian Defence Magazine



ABOVE An MQ-4C Triton mock-up with 9SQN markings at Avalon. Photo: Nigel Pittaway.



AH-64E Apache.



Locals join

APACHE SUPPLY CHAIN

Censored Defence Innovation Review

RELEASED

A HEAVILY REDACTED DEFENCE INNOVATION REVIEW has been released online. The review was originally announced as a comprehensive review of Defence innovation, science and technology by the Morrison Government on 13 September 2021.

Former Rio Tinto Australia managing director David Peever was selected to lead the review to establish how more effectively homegrown, innovative capabilities could be delivered to the ADF. It was expected to provide recommendations regarding improving links between academia and industry, solving Defence capability challenges, simplifying contracts, and effective commercialised strategy for Defence-funded research and innovation.

The final product was released on 14 March, the same day as the AUKUS defence agreement, and features entire pages of redacted information including the removal of all key recommendations for Defence, project management tools, reports, and interviews.

Source: Defence Connect

IN A FIRST FOR THE AUSTRALIAN AVIATION INDUSTRY, local companies will supply components for new-build AH-64E Apache attack helicopters, including the 29 aircraft Australia is buying to replace its smaller fleet of Airbus Tiger helicopters.

Under a deal signed between Boeing and the Australia government, Australian advanced manufacturer Thomas Global Systems will design and manufacture cockpit avionics for the global fleet of Apaches. Australian firm Cablex will manufacture cabling for all new Apaches.

Four companies, Cablex, Ferra, Axiom

Precision Manufacturing and Mincham, will supply wiring harnesses, electrical panels, the vertical spar box, machined parts, fairings and composites for the Apaches to be acquired by Australia.

Boeing has also announced that its supplier base for the new MQ-28 Ghost Bat has grown by 60 percent and now includes 55 companies. Boeing said aircraft development was progressing, with a robust flight test program under way and the aircraft's operational capabilities in an all-digital environment was being validated to refine mission sets.

Source: Australian Defence Magazine



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Fleetwide retrofit FOR F-35 ENGINE

THE F-35 JOINT PROGRAM OFFICE (JPO) has recommended all Pratt & Whitney F135 engines powering the global fleet of Lockheed Martin F-35s be retrofitted, within 90 days, with a fix for a vibration problem that caused an aircraft to crash last December.

No technical details about the retrofit were released but the JPO says it can be performed “at the operational level and completed in four to eight hours.”

Pratt & Whitney developed the retrofit procedure to mitigate harmonic resonance that was cited as the likely cause of the December mishap, which involved an F-35B during a predelivery check flight at the company’s Fort Worth production site.

Described by the engine-maker as an extremely rare phenomenon, the vibration problem is potentially common to the F135 variant powering the F-35B short-take-off-and-vertical-landing model as well as the versions powering the conventional-take-off-and-landing F-35A and F-35C models.

While only a small number of aircraft

were affected by the harmonic resonance, the plan is to retrofit the entire fleet, because the modification is inexpensive, nonintrusive and supports the JPO’s desire to maintain and manage a single configuration across the entire fleet.

The JPO said it had cleared Pratt & Whitney to resume delivering engines, but Lockheed Martin is yet to resume deliveries of new F-35s. More than 850 F-35s have so far been delivered globally.

Source: Aviation Week



ABOVE Pratt & Whitney F135 engine in a maintenance stand.

AIM opens directed energy facility

AFTER THREE YEARS of development, AIM Defence has opened its directed energy facility.

Sponsored by RAAF Project Jericho, the 2,000sqm facility houses high-power-laser research and development labs, as well as the largest directed-energy test range in the southern hemisphere.

It is equipped with a range of sensors capable of operating and analysing high-power lasers, advanced fabrication equipment, and both an additive and subtractive manufacturing centre. Those services provide a unique ability to prototype, build, and test high-power laser systems in both simulated and real environments.

By building rapid prototyping and test capabilities, AIM wants to increase the pace at which cutting-edge Australian research can be translated into capability and delivered into service.

The facility has already accelerated the production of several Australian high-power laser capabilities, including AIM’s Fractl:1, an ultra-compact counter-UAS system.

Source: Australian Defence Magazine

Aussie ‘spaceplane’ picked

FOR US DEFENCE TESTING



BRISBANE-BASED HYPERSONIX LAUNCH SYSTEMS was selected ahead of 63 entrants by the US Defense Innovation Unit (DIU) for a program to test aircraft that can fly faster than five times the speed of sound.

Hypersonix believes its DART AE aircraft can fly at seven times the speed

of sound, and founder Professor Michael Smart has suggested his long-term aim is to fly customers to space “like you fly with Qantas”.

The DIU is tasked with accelerating the development of commercial technology so it can be used by the military. Its Hypersonic and High-Cadence Airborne

Testing Capabilities program sought an aircraft capable of high-cadence long-endurance test and validation of hypersonic platforms and embedded components such as detection and tracking sensor, and communications, navigation, guidance and control systems.

DIU requires vehicles capable of operating in a “representative environment,” maintaining speeds up to Mach 5 with a manoeuvrable and non-ballistic flight profile, and flying for at least a three-minute duration with near-constant flight conditions, repeatable at short intervals.

The DART AE, slated for its first test launch next year, has a range of up to 1,000km, translating to about 400 seconds of flight time, with a modular payload bay of up to 20lbs.

Source: Space Connect

See page 34 for more on Hypersonix



ABOVE Hypersonix Dart AE drone.

Collaboration on high-energy laser system

DEFENCE HAS AWARDED a \$12.9 million contract to QinetiQ Australia to co-develop and manufacture a high-energy defensive laser system prototype capable of deployment in a wide range of operational environments.

QinetiQ, an Australian-based specialist in high-power laser research and technology, will work in collaboration with the Defence Science and Technology Group (DSTG) to establish a high-energy laser manufacturing capability in South Australia. According to a Defence announcement, the laser manufacturing capability will enable the development and delivery of laser sources suitable for directed energy applications.

Chief Defence Scientist, Professor Tanya Monro, said the collaboration demonstrated how DSTG is facilitating the rapid transition of science and technology into Defence capability. "DSTG is partnering with industry to build advanced and competitive Australian sovereign capabilities for our Defence Force in critical technology areas," she said.

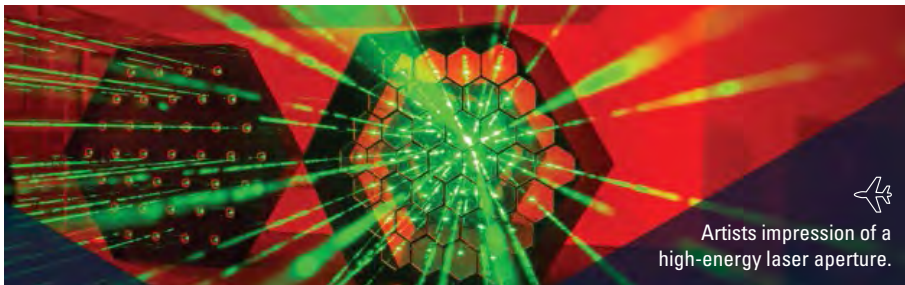
Source: Australian Defence Magazine



Northrop Grumman Brisbane maintenance centre

THE NORTHROP GRUMMAN Australia Brisbane Maintenance and Modification Centre has been officially opened.

The facility conducts continuous through life support to key RAAF fleets and will engage an ongoing Northrop Grumman Australia workforce of about 100 employees. The new infrastructure capacity at the centre now allows for significant expansion.



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Joint Terminal Attack Controller TRAINING

AUSTRALIA'S CAPABILITY GAP in Joint Terminal Attack Controller (JTAC) training could be met with SiNAB's new Phoenix JTAC Training Solution.

The Phoenix JTAC sensor pod incorporates an electro-optical infra-red camera sensor, gimbal mounted in the nose, a GPS antenna and a range of in-service voice and data communication capabilities including Link 16. It was developed under a Defence Innovation Hub project to provide a JTAC training capability without requiring an expensive and lengthy process to integrate the capability into specific aircraft.

The RAAF could employ training aircraft such as the Hawk 127 in the JTAC training role by installing Phoenix on a wing station and emulating the close air support capability of other RAAF aircraft such as the F/A-18F Super Hornet.

Phoenix has already been tested in Australia on a Learjet 35 aircraft and in the US using ex-RAAF Pilatus PC-9/A aircraft operated by Blue Air Training. Tests have demonstrated its ability to satisfy all JTAC training requirements, including firing of the installed laser designator.

Phoenix is controlled through a tablet-based interface connected to the pod via wi-fi. It can also be controlled from a ground station with a communication range of up to 80km, enabling a ground-based JTAC instructor to control the pod's mission equipment.

Source: *Australian Defence Magazine*



ABOVE Phoenix JTS fitted to a Cessna 0-2A observation aircraft.



MORE APPRENTICES FOR BAE

BAE SYSTEMS AUSTRALIA has welcomed its largest group of aerospace apprentices and first cohort of aircraft engineers as it expands its sustainment operations for RAAF's growing F-35 fleet and the Hawk 127 Lead-In Fighter training aircraft.

The 2023 intake has increased threefold to include 18 apprentices and seven aircraft engineers, to be deployed across the company's Williamstown and Pearce sites, taking its total number of apprentices to 30.

Employees at Williamstown deliver a comprehensive maintenance and sustainment program for the RAAF and its Hawk 127 Fighter and F-35 programs.

US Navy jammer pod contract

THE ADF IS SET TO receive four next generation jammer pods, under a \$972.2 million US Navy contract awarded to Raytheon Technologies.

A total of 15 next generation jammer (NGJ), mid-band low-rate initial ship sets, associated spares, support equipment, engineering, and associated data will be supplied by Raytheon.

The NGJ system is expected to replace current ALQ-99 Tactical Jamming System pods initially developed and fielded in the 1970s.

Under a separate contract, Raytheon was awarded a \$55 million revision to a previously awarded Royal Australian Navy contract for

Evolved SeaSparrow Missile Block 2 assemblies, shipping containers, and spare parts. Forty-two percent of the work will be completed in Arizona, seven percent at Edinburgh, South Australia, and more than 14 percent in Norway and other locations.

Source: *Defence Connect*



BELOW Artists impression of the NGJ pod fitted to an F/A-18F Super Hornet.



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LOCKHEED MARTIN

BAE SYSTEMS

BAE SYSTEMS' AN/ASQ-239 next-generation electronic warfare (EW) system includes long-range threat warning, self-protection and targeting support with 360-degree, full-spectrum situational awareness and rapid-response capabilities.

The British multinational defence and aerospace company has delivered 1,200 EW systems for the F-35 Lightning II fighter aircraft to date. It has now been contracted in a \$491 million deal with Lockheed Martin to produce improved Block 4 EW systems for future Lot 17 F-35 aircraft.

The Block 4 EW system will offer greater situational awareness, enhanced survivability, and increased capabilities to counter modern threats, and is upgradable to address evolving threats.

Source: Defence Connect



LEFT Promotional illustration of proposed EW enhancements. Image: BAE.

BOEING BEEFS UP APACHE PRODUCTION



BOEING HAS CONFIRMED it will build 184 AH-64E Apache helicopters for the US Army and international customers, including the first Apaches for Australia as part of a US\$1.9 billion acquisition contract. As part of the deal, the US Army will receive 115 remanufactured Apaches, with an additional 15 new-build Apaches to be procured as options.

Under the first multi-year contract, signed in 2017, Boeing delivered 244 remanufactured Apaches to the US Army and 24 new-build aircraft to an international customer. The AH-64E, built at the Boeing site in Mesa, Arizona, is the most advanced multirole combat helicopter in the world. There are more than 1,275 Apaches currently in operation around the world.

Source: Defence Connect



LEFT AH-64E Apache attack helicopter.



Italian C-27J

FLEET UPGRADE

LEONARDO AND ARMAEREO, the Italian Defence Ministry's Air Force Armament and Airworthiness Directorate, has signed a contract to upgrade the Italian Air Force's (ITAF) C-27J Spartan fleet.

The contract provides for development, qualification and certification of a significant upgrade of the C-27J avionics suite through new features integrated in the mission computer, the flight management system, head-up and head-down displays, radio and satellite communication systems and the self-protection system. Other upgrades aim to improve the aircraft's flexibility and operational effectiveness.

The training system will also be updated on the basis of the new systems, aligning both training devices (flight simulators) and courseware (teaching materials) along with relevant technical publications.

Australia signed an agreement with Leonardo to upgrade the existing radio suite of its C-27J fleet late last year. At the time, the RAAF Avionics Upgrade was scheduled to begin in September 2023 at RAAF Base Amberley and was due to be completed in 2026.

Source: Australian Defence Magazine

Milskil joins Future Air Mission Training bid



MILSKIL, an operational training services provider has joined the CAE-led Team AUStringer's bid for the Future Air Mission Training System (FAMTS), valued by Defence at \$500 million.

Under the agreement, Milskil is expected to provide training development and training delivery to support CAE Australia. It will be joining Leidos and Nova Systems in the bid.

FAMTS is designed to support the training of future RAAF aviators. According to CAE, that cohort includes electronic warfare officers, maritime patrol and response officers, air battle managers, air traffic controllers and other specialists.

Source: Defence Connect



ABOVE Milskil executives at the announcement.

Enhancing P-8

TRAINING SOLUTIONS



BOEING AND CAE have signed teaming agreements to expand multi-mission platform training collaboration for the P-8 Poseidon programs in Canada, Norway and Germany. The partnership will capitalise on strengths to better manage training in a cost-effective manner.

The P-8's primary roles are anti-submarine and anti-surface warfare, maritime surveillance and search and rescue operations. With a maximum cruise altitude of 41,000 feet and maximum cruise speed of 491 knots, the aircraft can be employed in a variety of situations. The model has flown over 500,000 flight-hours in countries across the world, and 155 P-8 aircraft are currently in service.

Source: Avionics International



LEFT US Navy P-8 Poseidon.



GROWING THE TYPHOON



BRITISH TEST PILOT KEITH HARTLEY WAS HEAVILY INVOLVED IN THE DEVELOPMENT OF THE EUROFIGHTER (TYPHOON) AND SHARES A PERSONAL VIEW OF HIS EXPERIENCE.

TYPHOON (OR EUROFIGHTER as it was initially called) is, like the Tornado before it, a multinational program shared between the UK, Germany, Italy and Spain. France was initially involved but its naval requirements for a fighter that could operate from the small French carriers, which defined a maximum size and weight limit, were not compatible with the other nations' requirements, so it dropped out and went its own way to produce the Dassault Rafale.

THE FORERUNNER

It was decided to build and fly a technology demonstrator called, unimaginatively, the Experimental Aircraft Programme (EAP). EAP was designed to demonstrate the design, build and performance of three main technologies: that required for creating a largely carbon-fibre structure; an advanced fly-by-wire flight control system (FCS) capable of providing good handling qualities in a highly unstable aircraft; and an advanced integrated cockpit using multi-function displays and highly integrated digital systems.

EAP was a research aircraft, never designed to go into service. The program was remarkably successful and efficient, but, because it didn't need developing for long-term in service use, if something didn't work well it would only get fixed if it affected one of the technology demonstration objectives. That meant it had some unusual characteristics, one of the quaintest being its wings.

The left wing was built by BAE Systems and the right by Alenia in Italy. The wings were structurally matched, of course, but some problem with the Italian wing's clearance processes meant that the right wing was deemed less strong than the left. So, the FCS was programmed with an unusual G limit profile that significantly varied achievable G with speed (G – normal pitch acceleration [Nz]).

On my first flight in the aeroplane, the EAP project test pilot, Pete Orme, arguably BAE's best technical test pilot and a guru on the EAP, got me to set the aircraft in a turn at 400 knots, set idle power and then pull and hold full back stick. The G limit at that speed was about 3G and, because the wing aerodynamics were so good, the aircraft only decelerated very slowly. As the speed decreased, the G limit, controlled by the FCS, increased, so drag increased and the aircraft slowed some more. At about 230 knots, the FCS defined G limit was 7.2 G. The effect of that G-limit profile, to the pilot, was that the turn started very gently, then gradually tightened until, suddenly, the aircraft seemed to pitch up strongly. Even though I sort of knew what to expect, the pitch rate caught me out and I immediately pushed full forward stick to catch what I thought was going to be a departure from controlled flight. "No," Pete said. "Do it again and stick with it this time." Of course, he was right.

EAP superficially looked a lot like the Eurofighter Typhoon but was actually very different. In particular, it was bigger and a couple of tonnes heavier than the Typhoon, with less thrust (EAP used Tornado RB199 engines, not Typhoon's EJ 200s). However, it was extremely manoeuvrable, a simple, easy aircraft to fly and it really whetted the appetite for Typhoon.

EARLY PROGRAM

In the 1970s and early 1980s, some parts of European industry were still engineering oriented. Pilots were only required to fly, their opinion on engineering stuff was considered of little value, so went the established thinking. Other parts of industry were coming to realise that listening to the test pilot (and the test pilot's job is to be the translator between the fighter pilot and the design engineer, who speak completely different languages) could save them time, money and a lot of angst should their design



ABOVE EAP. Photo: BAE.



RIGHT Ken Hartley in the cockpit of DA2.

make it into a prototype and then not prove to be acceptable in some way. Fortunately for me, the customer was well aware he was looking for a fighter considerably more capable than a Tornado or an F-16/F-18, with systems churning out far more data than ever before, but all in a single-seat cockpit.

For the first time in a European program, it was necessary for the cockpit (man-machine interface – MMI – if you want the buzz words) to be a certified system in its own right, like the FCS or the fuel and hydraulic systems. Since the cockpit was one of BAE's responsibilities under work share, it was necessary to create a dedicated cockpit design group of which I was a key part and given a commensurate amount of responsibility. What a gift! To be a fighter pilot and test pilot given the keys to designing the next generation of fighter cockpit. I really did have one of the best test pilot jobs in the world.



Long before the first Typhoon prototype flew, we had completed a huge amount of detailed cockpit design involving me in lots of detailed work with the designers of every system. Endorsed designs then went into the avionic systems simulator in which I spent hundreds of hours assessing, adjusting and refining those designs. As we developed the design in incredible detail, the “real” avionic system design and interface documents were updated to ensure the eventual flying system replicated our efforts and worked as expected.

THE JET

No matter how good all your preparatory design work is, the only real proof is getting the beast airborne and trying it. Initial testing was focused on performance and handling qualities, because the major systems like the radar and electronic-warfare (EW) were still in bench development. Unlike older programs, the fundamental test method with Typhoon was gathering data to validate the model. Thanks to modern computing, it was possible to use wind-tunnel data and mathematical modelling to create a high-quality aerodynamic model before first flight. We'd get airborne, exercise lots of test conditions gathering data, all recorded for subsequent playback and detailed analysis and comparison with model response to the same pilot inputs. If there was a difference, we'd try to understand why and then adapt the model to conform to the reality. There were several handling qualities simulators across Europe, so all the pilots flew many hours before getting to the real aircraft, some of which involved us trying our hardest to beat the FCS with the most gross handling inputs we could imagine, to make sure the FCS control laws were suitably robust.

From day one, the handling qualities were good, apart from needing some improvements in the high angle of attack roll rate. The aircraft was incredibly easy to fly and yes, it had lots and lots of thrust. It was the first aircraft I'd flown where I didn't quickly think I'd like more power.

A good mate of mine was the RAF's last Lightning display pilot before that aircraft went out of service and, like all air force pilots, he was sceptical about the promises being made for Typhoon, suspecting they were more company PR than reality. Well, the Lightning was known for getting from brakes release to 36,000 feet, 0.9 Mach in 1 minute 58 seconds. I told him the Typhoon would do it in about 1 minute 45 seconds.



“Okay,” he said, somewhat disappointed. “Better but not that much better.”

“Yes, but that’s not using reheat, just max dry power,” I pointed out. “It’s an awful lot quicker if you use the burner.”

The single-seat prototype didn’t have all the weapons systems in it but did have more than a tonne of flight test instrumentation, so it was pretty close to production weight. It also had early development engines with less than production thrust, but I’d regularly do a dry power take off, climb to 40,000 feet and level off at 0.9 Mach within 12 nautical miles of brake release: that’s quick. I never lost the exhilaration of take off in the jet.

In the UK, we had two of the seven Typhoon prototypes, a single seater (DA2) that was primarily assigned to handling and performance qualification and a two seater (DA4) which was the primary radar and weapons system development machine. DA2 always had the latest standard of flight-control software and clearances, necessary for expanding the flight envelope as quickly as possible. DA4 didn’t need the latest flight envelope to carry out radar testing, so sat fairly well back in the cycle of system updates, only getting updated when systems testing paused for a suitable period.

My first flight in the jet was entertaining. DA4 hadn’t yet flown, so my initial flying was in DA2, which was still at an early avionic systems standard, with a fairly crude standard of cockpit software and, as prototypes tend to be, not that reliable. It wasn’t that the kit failed, it was just that there were a lot of different components and they’d occasionally stop talking to each other and the cockpit displays. The FCS standard was also still low, so there was no back-up primary cockpit instruments such as speed, attitude, heading, etc. as they were fed by the FCS for good technical reasons, but not at that early standard.

I briefed up for my first flight, a mix of familiarisation and some handling test points (never waste the chance to gather data). Start-up was easy, in cockpit terms, even then it was a simple aeroplane, and off I went. Take off was easy, but what struck me immediately was how familiar the aircraft felt: it was like a Lightning. It sat in the air like a Lightning. It buffeted like a Lightning. When I moved my left hand and changed power, I could hear and feel it because the intakes were under my feet, just like a Lightning. I’ve never flown a new aeroplane for the first time and immediately



felt so much at home: love at first flight.

However, some time later in the sortie, the cockpit went dark. I was on a telemetry link talking to the boffins in the control room and while the boxes underneath me weren’t talking to the cockpit, they were still sending data down the telemetry, so it was no big deal. I could ask a boffin for a number if I needed one. But coming back to land it wasn’t necessary. I set it up like a Lightning: 2.5 degree approach path with the touchdown point at the bottom of the windscreen and it came in on rails. The boffins confirmed I was within 1 knot of the nominal approach speed and on angle of attack (AOA). Magic! Out of my first six flights, I came back with a dark cockpit on four and I can’t say it gave me any concern.

Early in DA4’s flying life, I think it was flight six, I was tasked to take it from the company airfield to RAF Leeming, an air defence base flying Tornado F3s. It was going to go into a hardened aircraft shelter (HAS) – of which there were many on base – to do a load of ground running to assess compatibility with the HAS systems. Now, you can’t just tiptoe quietly into a fighter base with an example of the next generation fighter. Well, I can’t and no-one would expect me to. Trouble is, DA4 had a small flight envelope at that stage with low AOA and G limits so my ability to impress would be limited. So, rather than do the usual fighter pilot run and break, I arrived slowly and did a few turns and wingovers, all while staying within the AOA limit. I also

couldn’t use reheat because at the low AOA limit there was nowhere near enough drag and reheat would have had me accelerating madly and the low G limit would have then had me turning huge circles; not very impressive! The net result was, even at those low limits, a brief demonstration of tight turning all within the airfield boundary, something novel to the assembled Tornado force. The Station Commander, with whom I’d been on a Lightning squadron a few years before, met me after landing. “I’m glad you’re a civilian now Hartley,” he said and gave me a beer.

As the systems improved, we had other opportunities to let the RAF see their new toy. I took DA2 to RAF Leuchars on the east coast of Scotland, another fighter base operating Tornado F3. We detached there for two weeks so we could do some flight envelope expansion above 1.6 Mach. Our company base on the west coast of England didn’t have sufficient open airspace for that. It was a great opportunity to sit side-by-side with squadron crews and let them compare the differences.

For a normal Tornado F3 sortie, crews would walk to the jet a minimum of 45 minutes before take-off to allow time to get the systems up and running; not always straightforward. The Tornado was designed in the engineering era when every system included Built In Test Equipment (BITE) and air force procedures required the crew to initiate BITE every start up, particularly for the FCS. Trouble is, the BITE wasn’t



ABOVE & ABOVE RIGHT Typhoon DA2.

well configured and was oversensitive, so it often failed, required a repeat, and may or may not pass the next cycle. All time-consuming and not germane to the operational task, so the test pilot team was adamant the Typhoon would not require pilot-operated BITE on any system – and we won that one. That, coupled with detailed cockpit design and good automation, meant all it took from the pilot being outside the cockpit to Typhoon taxiing ready for take-off were six actions.

So I'm sitting in 43 (Fighter) Squadron's crew room (the Fighting Cocks, if you want the squadron nickname, you can make up your own jokes on that). The squadron guys know I've planned a 1400 take off and it's already well past 1315. What am I still doing there? After a pleasant bit of banter, I stroll casually to the jet a bare 15 minutes before take-off, watched by a cynical bunch of guys just waiting for me to fail. But no, I took off on time.

The take-off would have been special for the base, too. RAF runways of that vintage had a wide apron on the left side of the runway threshold where fighters on two-minute readiness would sit ready for immediate take-off. An air-traffic control (ATC) caravan was parked at the end of the apron with a chappie with binoculars and a radio, whose task was to closely check jets on take-off and look for leaks or bits



falling off. A Tornado usually lifted off about 3,000 feet down the runway, so the caravan chappie had time to check things.

I lined up on the westerly runway. ATC cleared me for take-off and a left or right turn out as required. One of my most enduring memories is the look on the caravan operator's face as I passed him, airborne with the gear retracting. And, just because I could, I didn't turn left or right, I half looped and zipped off to the east.

AIR DISPLAYS

One of the great privileges as a company pilot is to be approved to display the aircraft at major air shows. I displayed at Farnborough and Berlin for which we used one of the German prototypes (DA1) and shared the flying with one of the German industry test pilots. A good arrangement which minimised the hassles of a pilot going sick and the German team (from Bavaria, of course) was a delight to work and play with.

Even during displays, the flight test team was gathering data. They had a portable telemetry station that monitored and recorded everything. I was going round a tight level turn at the Berlin show, where it was a 30°C summer's day, when I went through an unusually big thermal bump. I'd like to think it was actually my own wake after flying a particularly accurate turn, but I probably wouldn't get away with that. Apart from the bump itself, the striking thing was seeing out of the corner of my eye the canards (foreplanes, which do much of the pitch control in that part of the envelope) cycle what seemed fully up and down, to control the aircraft motion.

I called it to the telemetry team and got them to specially mark the data traces for analysis and we discussed it for a bit while I whiffed around, because it was a useful bit of data. The Typhoon is highly

unstable in pitch – one of the reasons its turning and supersonic performance is so good. But if the FCS should fail (it's quadruplex, so an extremely unlikely risk), the aeroplane will fly backwards in about two seconds. Except it won't get to go backwards because the wings would be ripped off before that at any reasonable speed. One of the challenges was trying to create conditions where you could test such things. So a Berlin summer gave us some great free data.

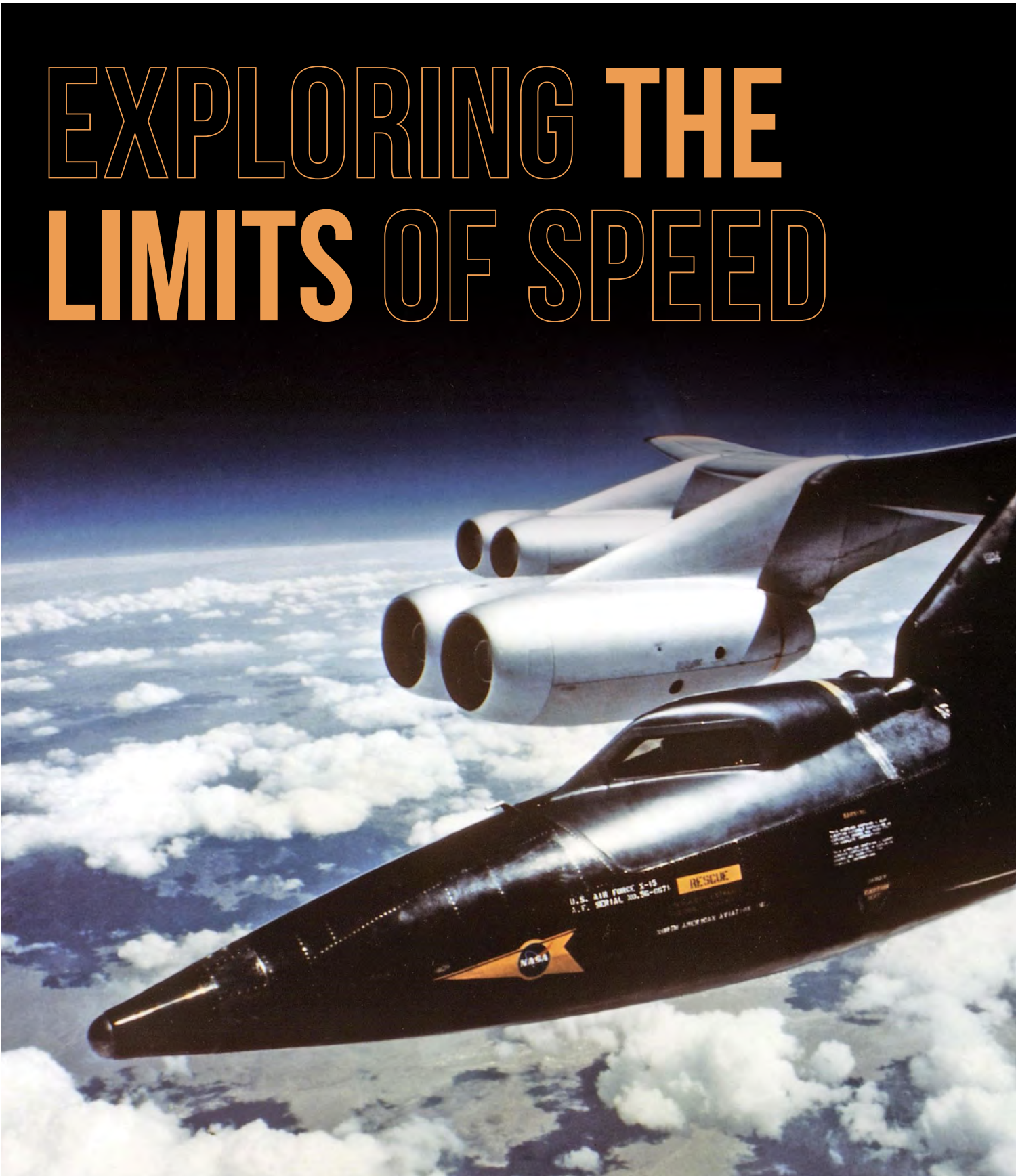
I've done a fair number of air displays in a variety of different aeroplanes of very differing performance, but none as satisfying and downright exhilarating as the Typhoon. It has plenty of lift and lots of thrust. Indeed, for my first Berlin show, the FCS AOA limit was still relatively low so it was necessary to keep the manoeuvres slow to generate enough drag to balance the thrust – at more than about 200 knots the jet will accelerate even at full back stick. Looping on take-off is easy with so much thrust and the freedom from angle of attack and G limits means the pilot can manoeuvre with aggression and confidence.

You will detect that I love the jet and you're right: you probably won't get an objective analysis of it from me. Some aeroplanes just fit the soul and the Typhoon's the best for me. I've been privileged to contribute to the design of something special. I've had the privilege of working with some talented people and even more privileged to fly the machine to parts of the envelope the customer has not seen. [W](#)



Scan the QR code to view a video of a Typhoon demonstration at the Farnborough airshow.

EXPLORING THE LIMITS OF SPEED





X-15 attached to the wing pylon of a B-52.



BELOW RIGHT Half of the X-15's eventual 12 pilots, as at December 1965. From left, Joe Engle, Bob Rushworth, John MacKay, Pete Knight, Milt Thompson and Bill Dana. Photo: NASA.

IN PART FOUR OF OUR SERIES ON X-PLANES, WE TAKE A LOOK AT THE HYPERSONIC NORTH AMERICAN X-15.

WORDS Michael Nelmes

THE X-7 TO X-12 SERIES of X-planes were, in fact, missiles. As our series focuses on aircraft, we will skip those, as well as the X-13 and X-14 vertical take-off aircraft which were covered in *Wings'* Skunk Works series. Next in line is the X-15, arguably the most important and best-known of all X-planes.

In 1952, the aerodynamics section of the National Advisory Committee for Aeronautics (NACA, forerunner of NASA) began to build on the pioneering work of Bell Aircraft Corporation's Robert Woods who had co-designed the X-1, X-2 and X-5. NACA resolved to "increase its program dealing with the problems of unmanned and manned flight in the upper stratosphere at altitudes between 12 and 50 miles [20 and 80km], and at Mach numbers between 4 and 10 [5,000 and 12,000kph]."

A preliminary proposal for a hypersonic aircraft came from a colleague of Woods at Bell. Walter Dornberger was a former engineer on Nazi Germany's design

program for the V-2 rocket bomb of World War II – the only air vehicle to have reached Mach 5 and able to withstand the high atmospheric forces and frictional temperatures associated with high-speed flight, albeit briefly.

Woods developed the idea into a detailed proposal that would become the X-15, though North American Aviation, not Bell, would produce the vehicle.

In conducting its mission to explore the limits of speed and even venture above the atmosphere to the edge of space, the X-15 program would provide valuable data for use in solving the problems to be encountered in space flight, especially atmospheric re-entry. NACA's work on the design began in 1954. At that time thermodynamics, the study of heat and energy, in relation to frictional heating at high Mach numbers was an unknown quantity. As it turned out, heating effects on the aircraft were somewhat overestimated, but the aircraft did require heat-resistant titanium alloy to be used in much of its structure.



Another unknown was stability of an aircraft at such speeds. Directional instability had previously been encountered by the X-1 and X-2 in particular. The surprising solution to the tail design was conceived by C.H. McLellan, who abandoned the usual thin supersonic airfoil section and instead introduced a 10-degree wedge shape with a flat trailing edge. Despite the high drag the wedge imposed at low speeds, it proved to be many times more effective for stability at high speed, and a great improvement over the earlier X-planes.

The wings were trapezoid-shaped, with an extremely thin thickness-to-chord ratio of 5 percent (though not as thin as the Lockheed F-104's 3.6 percent) and equally extreme aspect (span to mean chord) ratio of just 2.5, similar to that of the F-104.

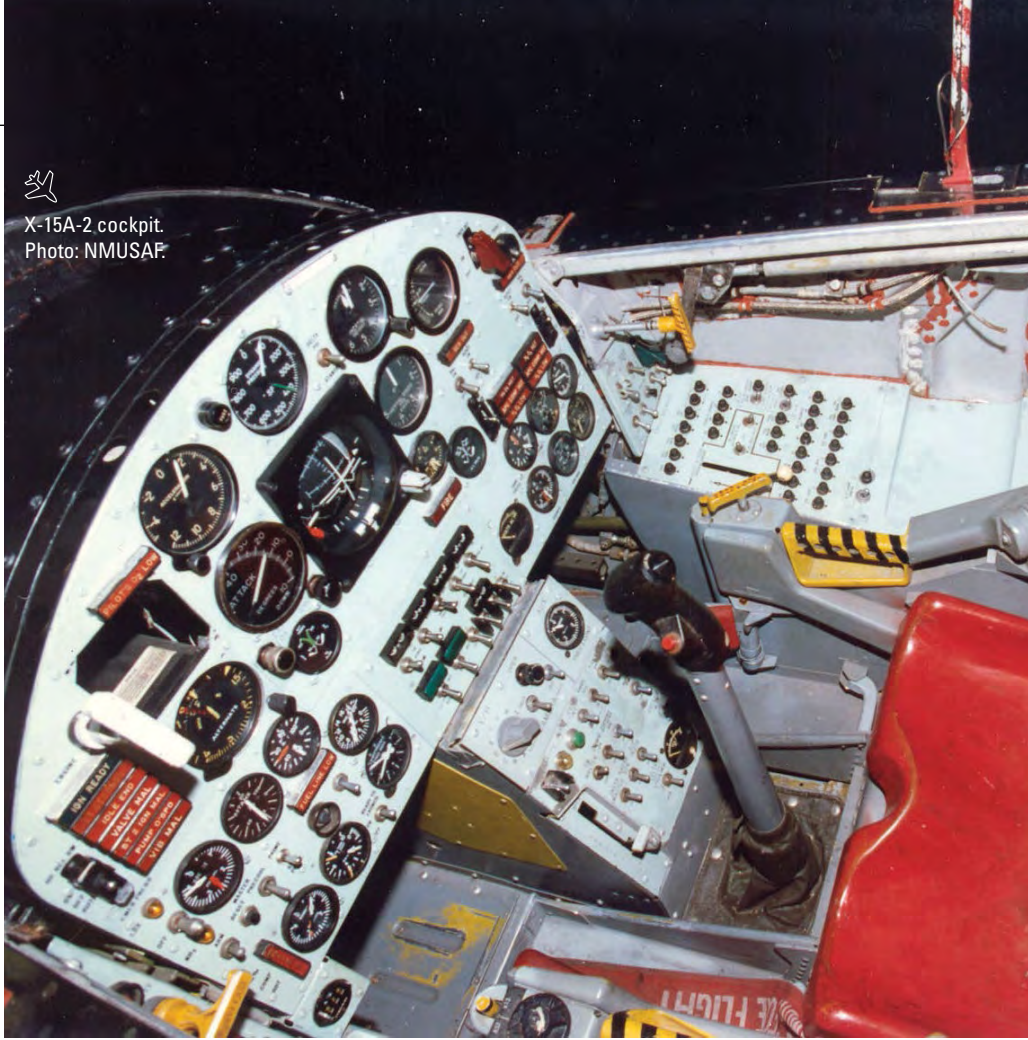
A counterintuitive feature was the positioning of the horizontal tailplanes. Instead of being located high above or below the wing plane to avoid interaction with the wings' shock waves, they were mounted in the wing plane. That placed them between regions of high downwash from the wings depending on speed.

The X-15 flight test program between 1959 and 1968 was begun at Edwards Air Force Base, California, by Scott Crossfield and continued by a dozen US Air Force, NASA, US Navy and North American Aviation pilots, of whom the most notable was Neil Armstrong. Like the X-1 and X-2, the X-15 had to be air-launched, but now from a wing pylon beneath a B-52 Stratofortress (the B-58 Hustler was initially favoured but replaced by the B-52) instead of the bomb bay of a B-29 or B-50 Superfortress.

Three X-15s were built. The first two survived the test program, but the third was destroyed in 1967 when it came apart at Mach 5, killing its pilot, Major Michael Adams. Some 200 flights were made, with the modified second aircraft (X-15A-2) attaining a maximum altitude of 354,200 feet (piloted by Joe Walker on 22 August 1963) and speed of 7,274kph or Mach 6.7 (William Knight on 10 March 1967) which were unofficial world absolute records for a winged aircraft. That altitude qualifies as a space flight according to the Fédération Aéronautique Internationale, which defines space as beginning at a height of 100km (330,000 feet). In fact, by the USAF's definition of space, all flights over 80km (264,000

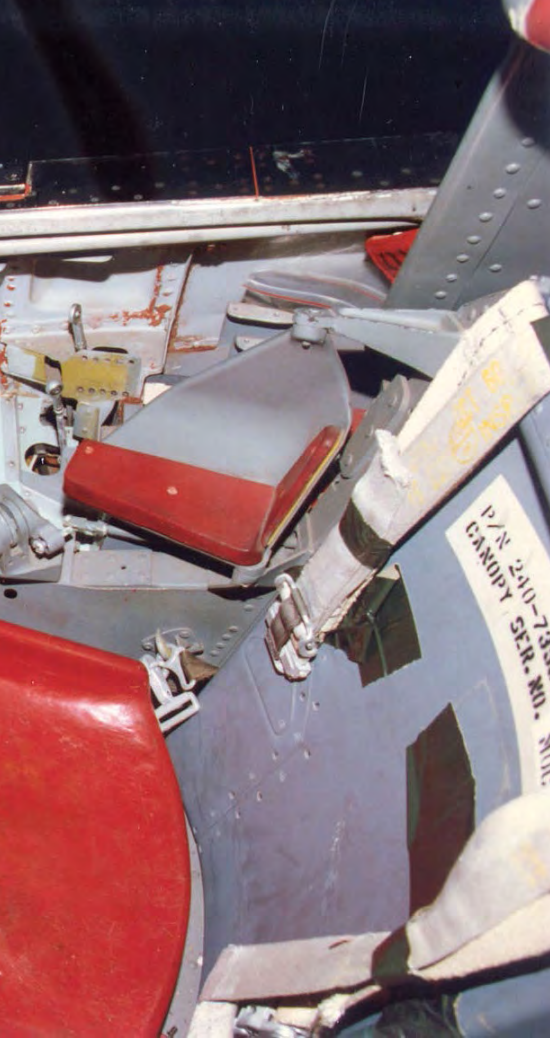


X-15A-2 cockpit.
Photo: NMUSAF.



The third and final X-15 after release from its B-52 mothership.





SPECIFICATIONS (X-15 NO.1)

LENGTH: 15.47m

WINGSPAN: 6.81m

WING AREA: 19sqm

EMPTY WEIGHT: 6,622kg

GROSS WEIGHT: 15,422kg

POWERPLANT: Thiokol Reactional Motors XLR99 rocket engine of 313kN thrust. (XLR11 engines were fitted for the first 24 powered flights)

FUEL (XLR11 ENGINE): Ethyl alcohol-water and liquid oxygen

FUEL (XLR99 ENGINE): Anhydrous ammonia and liquid oxygen


FUEL ENDURANCE: 87 seconds at maximum thrust (70 percent longer with the second X-15's jettisonable fuel tanks)

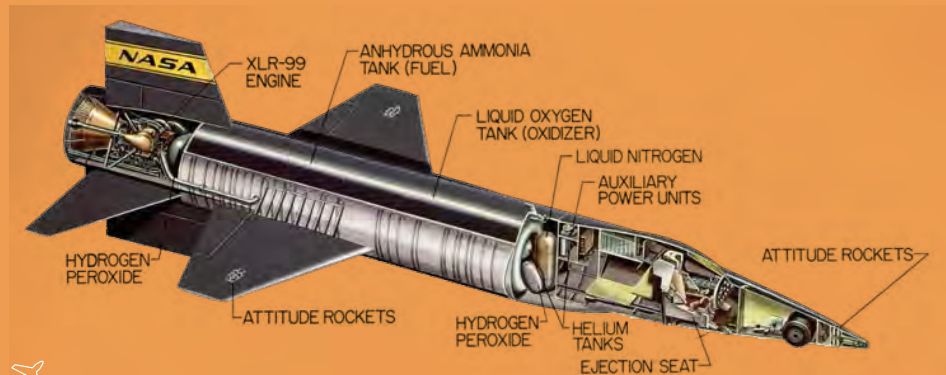
MAX ALTITUDE ATTAINED: 354,200ft

MAX SPEED ATTAINED: 7,274kph (Mach 6.7)

feet) earned the pilot 'astronaut wings'. For comparison, in 1963 a rocket-assisted F-104 Starfighter operated by NASA (the NF-104A) reached an altitude of some 120,000 feet on a ballistic trajectory – a record for a jet, set by Chuck Yeager.

The pilot's controls for the X-15 were unusual. The central stick controlled pitch and roll in the atmosphere, but was later removed as it was made redundant by a hydraulically boosted joystick on the pilot's right. A lefthand joystick operated the peroxide thrusters in the nose and wingtips for control in space flight. Cockpit heating and pressurisation was provided by vapour from a liquid-nitrogen system, as was the pilot's full pressure suit.

X-15s achieved more than just high and fast flight. Taking advantage of the lack of atmosphere, the program carried out ramjet propulsion experiments, aerial photography, ultraviolet photography of stars, observations of the Earth's horizon at different wavelengths as a reference for planned spacecraft stabilisation systems, atmospheric density measurements, micrometeoroid collection, and measurements of the intensity, polarisation and spectral distortion of light. Considering all its findings, the US\$300 million X-15 program was considered a bargain. 



Much of the aircraft's interior was taken up with propellant and oxidiser tanks. Photo: NASA.



 ABOVE The power end of the first X-15 on display in the National Air & Space Museum, Washington, DC. Photo: Michael Nelmes.



 ABOVE The second of three X-15s built, now displayed at the National Museum of the US Air Force. Photo: NASA.

S P E E D I N G I N T O

SPACE

WORDS
Christopher Rees



AUSTRALIAN
INNOVATION IN
SUSTAINABLE
FLIGHT SYSTEMS
PROMISES TO
REVOLUTIONISE
HOW WE FLY
TO SPACE AND
POSSIBLY AROUND
THE WORLD.



HYPERSONIX LAUNCH SYSTEMS' motto is Fly to Space, but that's not its only vision. The Australian aerospace company focuses on developing cost-effective launch systems to place satellites in low earth orbit (LEO). However, joint-founder and head of research and development, Michael Smart believes the technology currently being developed will have long-term implications for air travel as it could be used on commercial aircraft. In future, flying from Sydney to New York in two to three hours could be possible with an airliner flying at hypersonic speeds.

At the core of Hypersonix's activities is the SPARTAN scramjet (supersonic combustion ramjet), which requires a minimum speed of Mach 5 to operate and can thrust a vehicle to Mach 12.

Smart's 30 years of experience in

scramjet technology through extensive test and evaluation has provided specialist knowledge of the dynamics involved in producing a successful scramjet. The limitations of materials used in engines and on external flight surfaces to operate at the elevated temperatures of hypersonic (above Mach 5) speeds has led to the development of special alloys and composites. In addition, manufacturing technology has introduced new processes, improving the product's quality and efficiency.

The use of 3D printing or additive engineering, as it's known, to manufacture the fixed internal geometry of a scramjet has reduced costs and has the added advantage that design changes to the engine geometry can be achieved quickly.

Before scramjets, ramjets were used predominately to propel surface-to-air

missiles to supersonic speeds and first came to prominence in the 1950s and 1960s. An early example was the Bristol Bloodhound which used four solid-fuel expendable rockets and two Bristol Thor ramjets. Air-breathing ramjets have no moving parts and work by compressing supersonic air to a subsonic high-pressure state to achieve combustion and thrust.

A scramjet has many features of a ramjet but can operate hypersonically. The engine accepts supersonic airflow and produces shock waves, via a shock train in the engine inlet, that promotes efficient combustion and delivers progressively increasing thrust. Scramjet operation is optimised at a high Mach number and makes the engine an ideal match for Hypersonix's Fly to Space objectives.

EARLY SCRAMJETS

The development of scramjets goes back to 1987 with the T4 free piston shock tunnel at the University of Queensland pioneered by Professor Ray Stalker. The Stalker tube, as it was known, performed more than 10,000 ground shot tests and provided a springboard for more in-depth exploratory projects.

Follow-on programs, such as the University of Queensland's 2002 HiShot program and a more extensive project, HIFIRE 2007, were carried out with the assistance of a rocket that carried the scramjet to the required speed and altitude test conditions.

The NASA X-43A project was the first scramjet-powered vehicle to fly independently, reaching Mach 6.8 for 11 seconds in 2004. A later test achieved a speed of Mach 9.8, which remains the record for an independent scramjet-powered vehicle.

SUSTAINABILITY

Launching satellites into LEO is currently an expensive business requiring large volumes of fuel and high thrust, delivered by multiple rocket stages that are discarded after stage burn-out. The actual satellite payload typically amounts to just two percent of the total launch mass. Rocket propulsion has been the standard launch technique since the 1960s and apart from cost and inefficiency has some significant adverse environmental effects.

Hypersonix is committed to flying to space using scramjet power rather than conventional multistage rocket thrust to satisfy the launch to LEO objective.

Scramjet engines are fuelled by hydrogen which emits only water vapour when burned. Initially high-pressure hydrogen gas will be used, but further developments will introduce liquid hydrogen. Ultimately, hydrogen produced using renewable energy for electrolysis to generate H₂ from seawater will be used. The company places an emphasis on environmentally sustainable techniques in all facets of its business and launch-platform reuse is central to its development objective.

Over many years, a significant mass of debris has been left in space, mostly in low orbit and Hypersonix is determined its vehicles will not add to the problem. "We return 98 percent of what we send into the atmosphere and beyond," says Smart.

THE SPARTAN

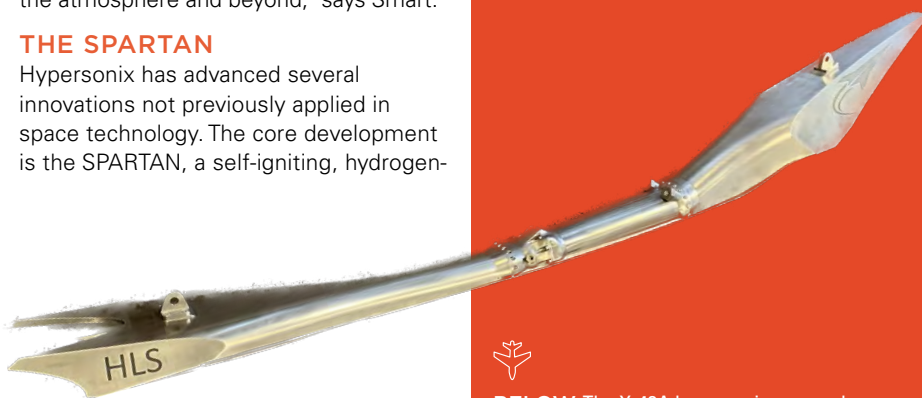
Hypersonix has advanced several innovations not previously applied in space technology. The core development is the SPARTAN, a self-igniting, hydrogen-



LEFT DV Orbiter separation near space.



BELOW SPARTAN engine.



BELOW The X-43A hypersonic research vehicle and its modified Pegasus booster rocket mounted to NASA's NB-52B carrier aircraft at the Dryden Flight Research Center, Edwards, California. Photo: NASA.





fuelled scramjet and the world's first 3D-printed engine using high-temperature metal alloy. SPARTAN achieves a high strength-to-weight ratio objective and the ability to perform at the elevated temperatures of hypersonic flight. The engine has been mated to a three-metre-long flight vehicle, DART AE, also constructed from a high-temperature alloy.

Against stiff competition, Hypersonix won a significant order from the US Defence Innovation Unit (DIU) for a hypersonic vehicle to explore the characteristics of the hypersonic environment. The DIU will take delivery of DART AE demonstrator vehicles in 2024 to satisfy the requirements of the US High-Cadence Airborne Testing Capabilities (HyCAT) program. The DART AE provides the ideal platform to present a non-ballistic, hypersonic flight profile at speeds up to Mach 7 and for up to 400 seconds. DIU will test sensors, communication systems, navigation and guidance components repeating flights at short intervals.

Hypersonix Head of Product, Andy Mulholland says: "I believe we have a common road map with DIU, and our innovation in hypersonic technology together with our flight test program aligns closely with their requirements."

LAUNCH SYSTEMS

Velos Intelligence Surveillance Reconnaissance (VISR) is a larger sustainable flight demonstrator at

5.5m long with a wingspan of 2m. It's powered by four SPARTAN fifth-generation hydrogen-fuelled scramjets, enabling acceleration from Mach 5 to Mach 12. The vehicle has a delta planform, performs like a plane, and can be returned to a conventional runway. As a non-ballistic, manoeuvrable vehicle, VISR can turn into and deliver a 50kg payload to any required LEO station.

The Delta Velos Orbiter, a 12m long, 3.5m wingspan delta-shaped aircraft and a larger version of VISR is designed to launch small satellites of up to 150kg. The orbiter can be scaled up to accommodate satellites up to 300kg. The Delta Velos Orbiter benefits from a plug-and-play approach allowing access to any orbit from any launch site, thus reducing launch costs and timescales.

Hypersonix has developed a three-stage launch system identified as Wirraway. Wirraway uses a small, conventional first-stage rocket incorporating a few proprietary Hypersonix modifications, dubbed Boomerang, to boost the Delta Velos Orbiter to the first-stage velocity of Mach 5, at which point Boomerang is jettisoned, enabling it to glide back to Earth for reuse. The SPARTAN-scramjet-powered orbiter then accelerates to the desired launch speed up to Mach 12 before deploying a small kick-stage rocket to insert the satellite into orbit. The Delta Velos Orbiter then returns to Earth on a pre-determined path.



ABOVE Michael Smart.

FUTURE DEVELOPMENTS

Hypersonix is in collaboration with like-minded partners to further develop composite materials that will enable reliable scramjet operation at higher speeds and temperatures, and has opened an office in Munich, Germany. "We were already in discussion with several German companies involved in composite materials, and it made sense for us to be at the heart of this technology with our own office," Smart says.

A key company objective is to pursue a small slice of the expanding multi-billion-dollar launch to LEO market. The first demonstrator order from DIU indicates the potential within the worldwide defence industry and will help establish a solid base for future growth. **W**

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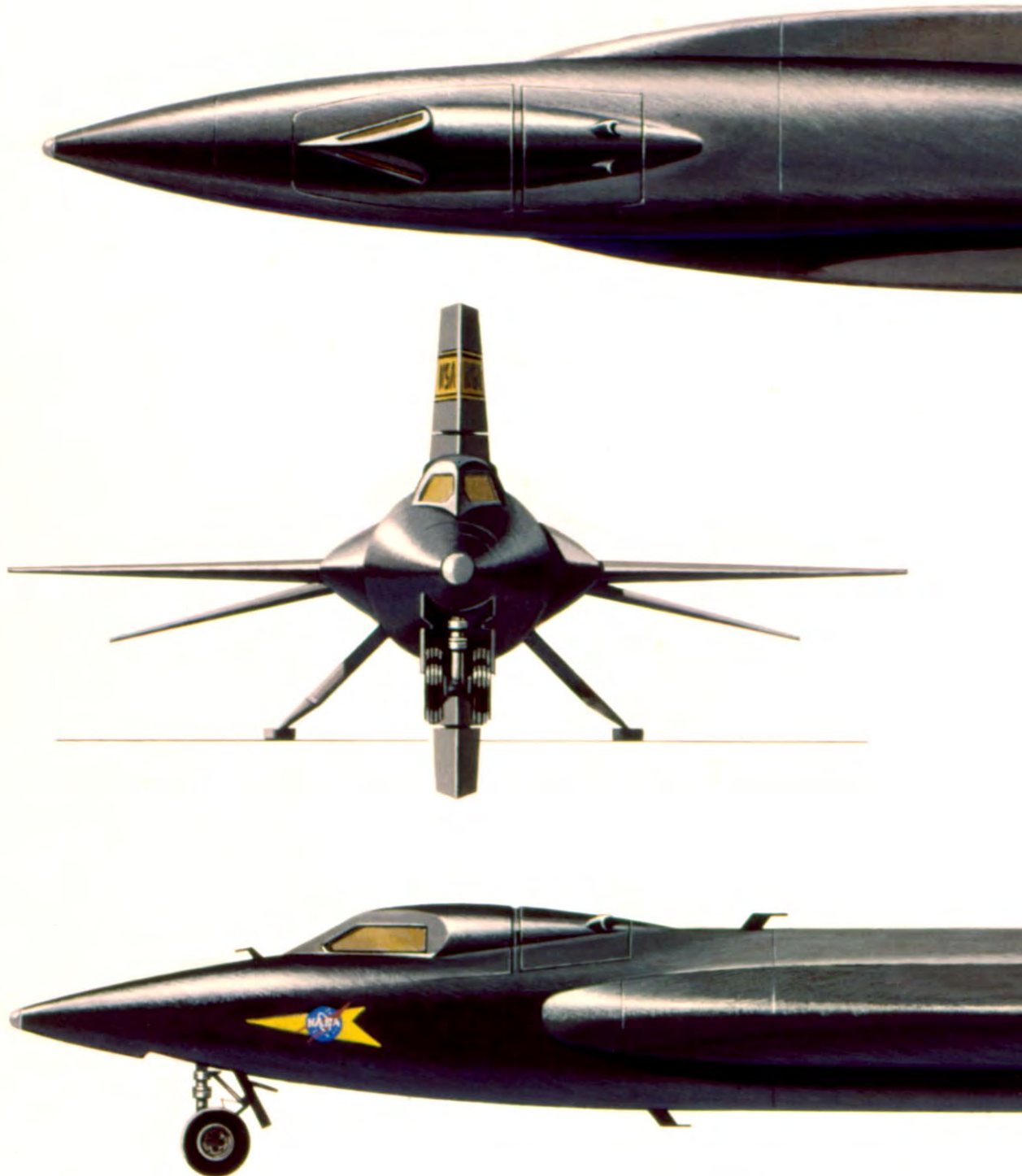
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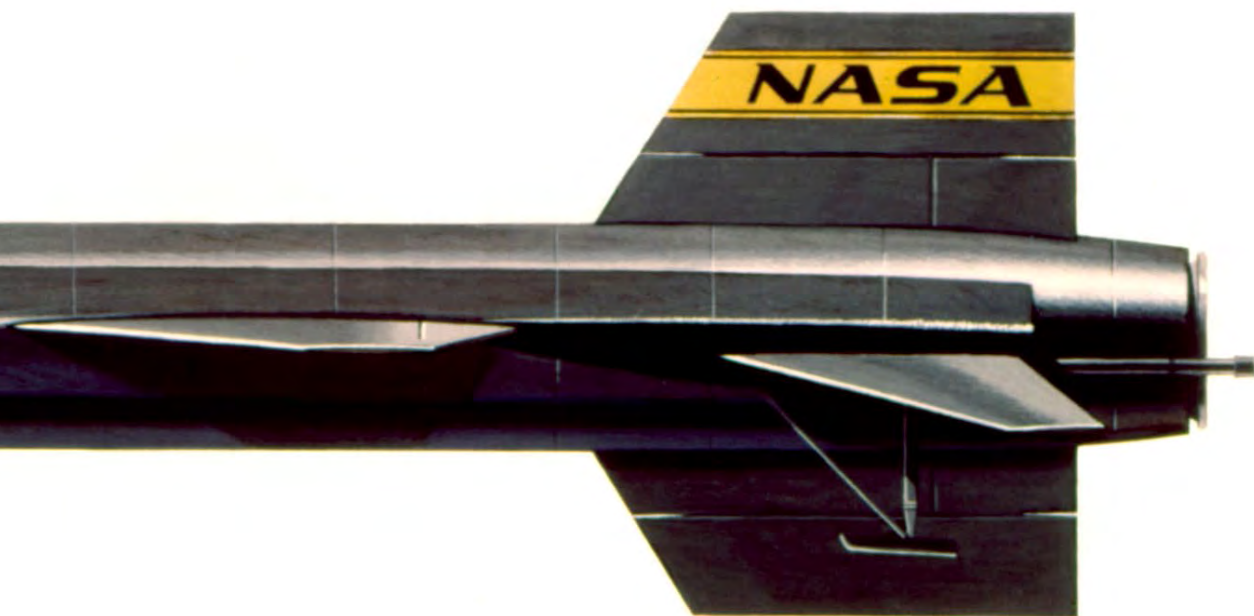
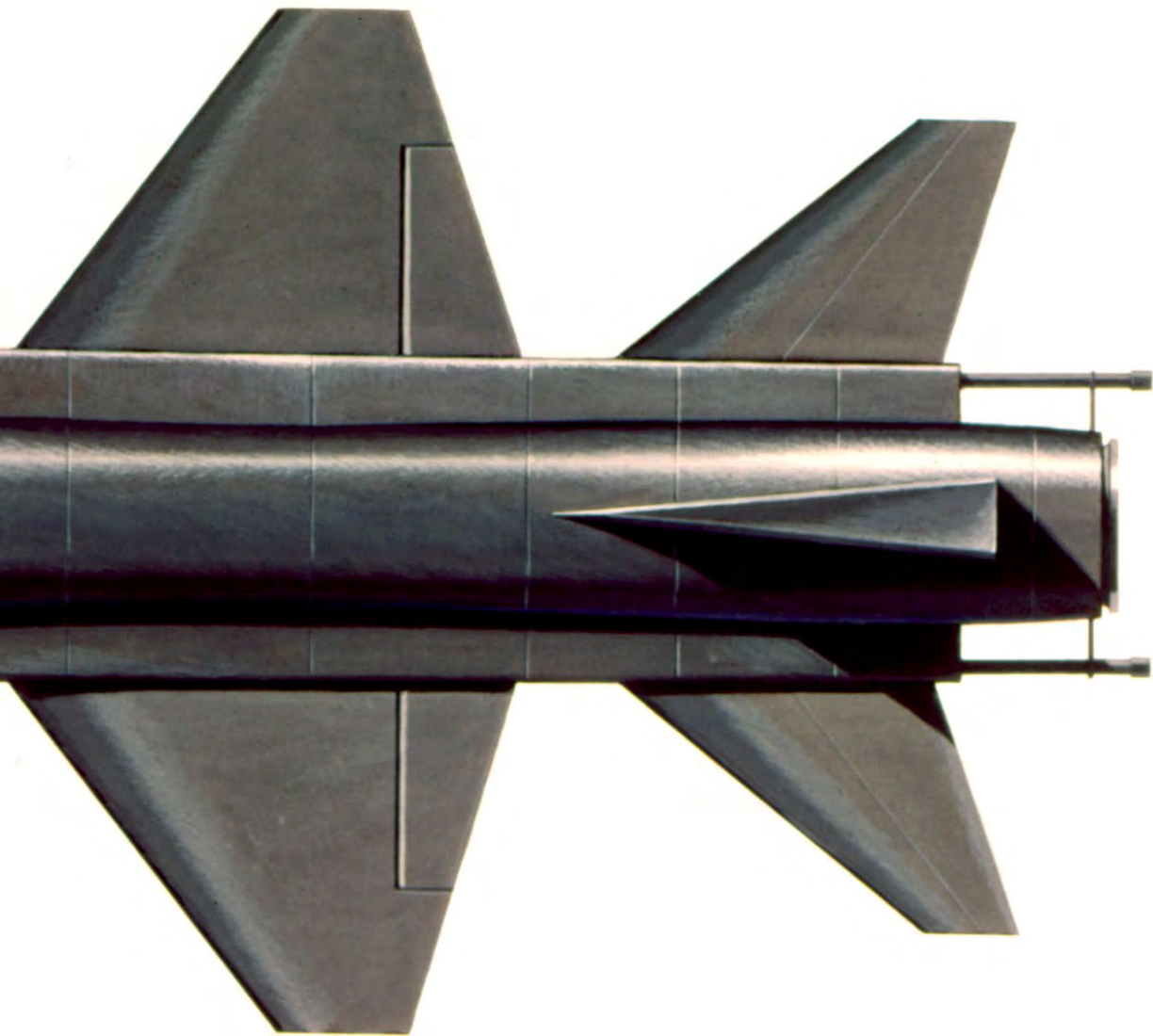
VOCUS

X-15

WINGS VOLUME 75 NO.2



North American X-15 three-view art.
Image: NASA



R&D PARTNERS IN

THE UNIVERSITY OF ADELAIDE'S DEFENCE AND SECURITY INSTITUTE HAS MORE THAN \$65 MILLION WORTH OF DEFENCE-FUNDED RESEARCH IN PROGRESS.

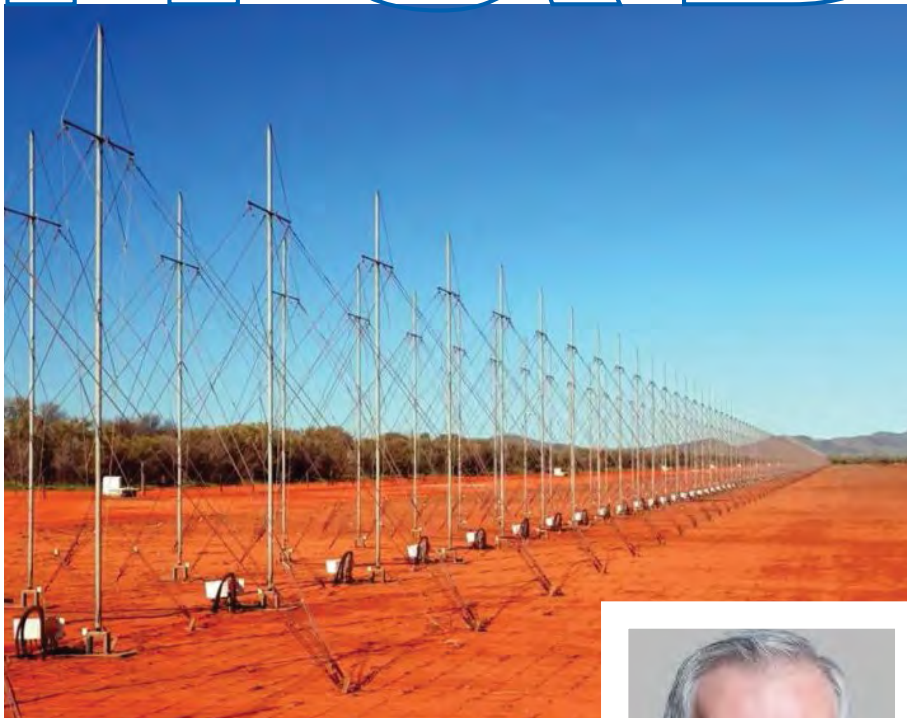
THE DEPARTMENT OF DEFENCE'S SCIENCE AND TECHNOLOGY 2030 STRATEGY, titled *More, together*, is explicit: the 2,200-strong Defence Science and Technology Group (DSTG) simply doesn't have the capacity or resources to tackle every technology challenge the Australian Defence Force faces.

DSTG needs trusted partners that can bring rigour and integrity to research and development (R&D) and who can then help translate that effort quickly into warfighter capability. The University of Adelaide's Defence and Security Institute (DSI) is an important one of those partners with more than \$65 million worth of Defence-funded research work in progress.

While many University of Adelaide defence-related R&D projects were once established on a one-to-one, transactional basis, academic researcher to DSTG researcher, DSI now integrates R&D activities across the university's three faculties and deliberately seeks to build scale around key priority areas.

Through the university's recently awarded \$250 million Defence Trailblazer program, Concept to Sovereign Capability, DSI, in partnership with the University of NSW and 52 partner companies, aims to use collective R&D skills to provide the asymmetry the ADF needs in the current deteriorating geopolitical circumstances and deliver impact at scale. The concept also aims to accelerate the transition from R&D into capability and help create a robust, resilient industry sector to underpin Defence and act as a pillar for a stronger national economy.

One of the *More, together* strategy innovations is the STaR Shots (Science,



ABOVE Research capabilities will enhance the Jindalee Operational Radar Network. Photo: Department of Defence.



RIGHT Professor Michael Webb (University of Adelaide).

Technology and Research) missions. STaR Shots don't describe stand-alone technology challenges: they are problem statements requiring a combination of technologies. One STaR Shot mission is Information Warfare, which aims to develop capabilities integrated across human, information and physical dimensions to allow the ADF to fight in and through contested information environments.

Science and technology areas that contribute to that STaR Shot include international security and political science, law, psychology, advanced cyber, artificial intelligence, communications, data fusion, encryption, advanced sensors (RF and Quantum) and semiconductor design and manufacture. University of Adelaide researchers have been working in all those areas for years and DSI is pulling their efforts together in an integrated response.

The DSI recently showcased about 22 defence R&D programs from across the university. Critically, almost all those programs have embedded DSTG researchers. What was showcased and celebrated was precisely what *More, together* looks like in practice. Projects range from University of Adelaide spinoff QuantX's Cryoclock Sapphire oscillator which, under a scheduled upgrade, will dramatically enhance the performance of the Jindalee Operational Radar Network (JORN), to the development of ultra-short and short pulsed lasers that can be configured to protect aircraft against incoming missiles by disabling the missile seeker head.

The showcase was the first time most of the university's defence researchers came together and demonstrated the scale of the scientific

community engagement with Defence. It also demonstrated that the research-commercialisation continuum is virtually complete. Thanks to the Defence Trailblazer, yesterday's research now has a clear pathway to operational capability.

One of the most important things DSI does is maintain a pipeline of trained researchers. Undergraduate courses and Masters and PhD programs instil the rigour and capacity for lateral thinking that Defence needs, but DSI looks beyond the traditional hand-to-mouth funding that blights much Australian R&D. It aims to train and develop researchers and keep them within the Defence innovation eco-system.

For example, DSI partners with DSTG to run its Cyber Internship Program, a 12-week program held annually for up to 16 students. Internship supervisors are senior DSTG staff, the university provides a secure environment and pastoral care, and all students get a Defence security clearance. In fact, Adelaide is the first and only Australian university able to sponsor its own Defence security clearances, up to NV2 level. Currently DSI has more than 150 security cleared people. Programs like that are not money-earners but they go to a fundamental, shared need: to develop the next generation of cyber-qualified researchers.

The DSI is proud to be a trusted partner of DSTG. In these uncertain times, it is committed to working with DSTG, bringing particular research strengths to the defence of the nation while helping DSTG deliver more quickly those technologies that make the difference so essential to our national security and well-being. **W**

Professor Michael Webb, Director of the Defence and Security Institute, University of Adelaide.

ACCELERATING DEFENCE INNOVATION

The Australian Government plans to invest \$3.4 billion over the next decade to establish the Advanced Strategic Capabilities Accelerator (ASCA). It will replace the Defence Innovation Hub and Next Generation Technologies Fund, which the Defence Strategic Review (DSR) identified as no longer fit for purpose.

The DSR concluded Australia needs more effective support for innovation, faster acquisition and better links between Defence and industry to deliver the capabilities the ADF needs.

Priorities for the ASCA will be hypersonics, directed energy, trusted autonomy, quantum technology, information warfare and long-range fires. It will focus on defined missions, solving the most relevant technical issues, and taking a more flexible and agile approach to procurement.

ASCA will be guided by the Vice Chief of the Defence Force, the Chief Defence Scientist and the Deputy Secretary, Capability Acquisition and Sustainment Group. It will be up and running by 1 July 2023, with a phased start up over the first 18 months to develop, test and refine the operating model.

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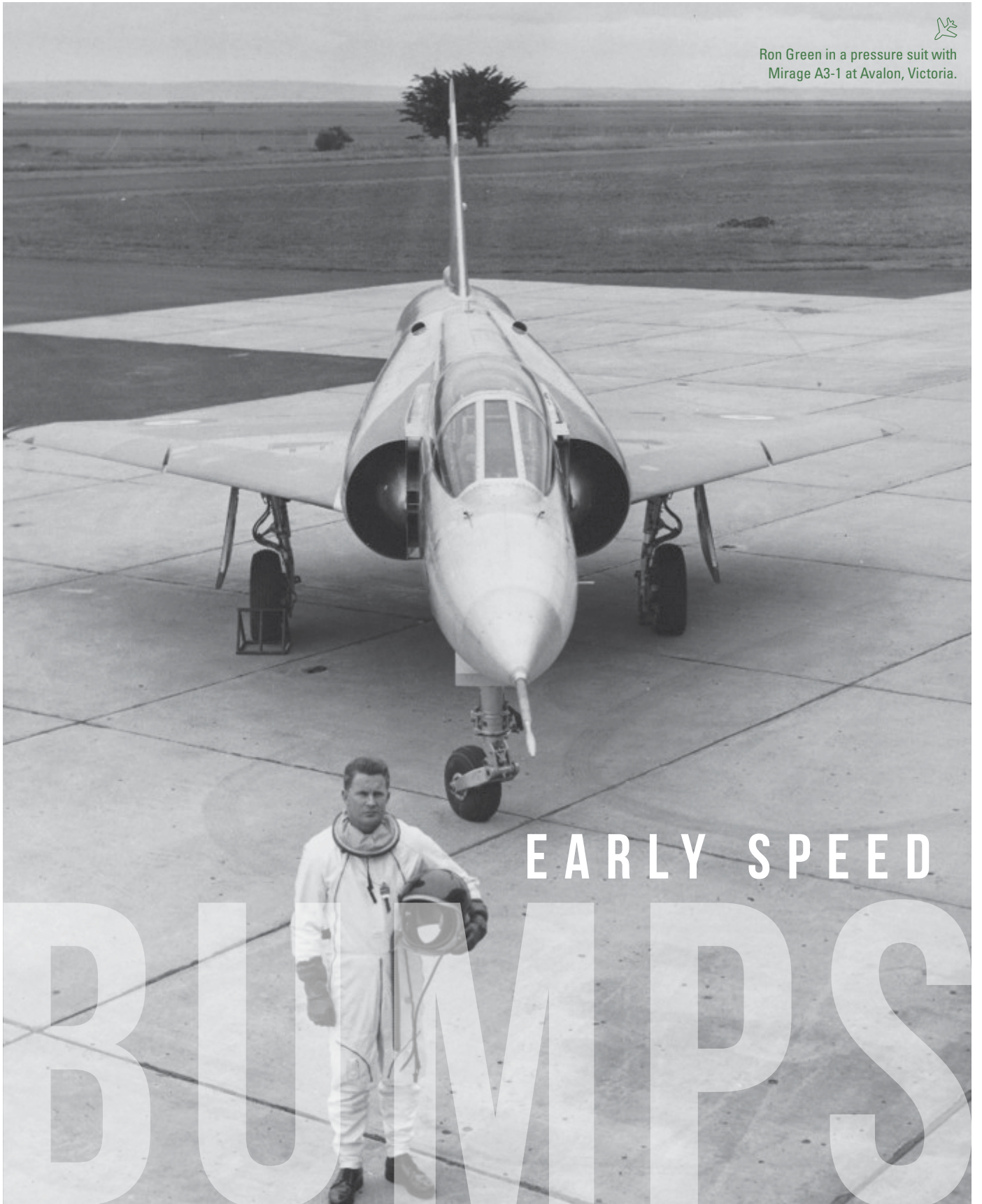
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Ron Green in a pressure suit with
Mirage A3-1 at Avalon, Victoria.



EARLY SPEED

BUMPS

A GRADUATE OF THE EMPIRE TEST PILOT SCHOOL, **GPCAPT RON GREEN** HAD THE OPPORTUNITY TO INTRODUCE TWO ADVANCED COMBAT AIRCRAFT, THE MIRAGE III AND THE F-111, INTO RAAF SERVICE. IN THIS EDITION RON RECALLS TWO SIGNIFICANT EVENTS IN THE EARLY DAYS OF MIRAGE ACCEPTANCE. HIS EXPERIENCE WITH THE F-111 WILL BE PUBLISHED IN A LATER EDITION. SADLY, RON PASSED AWAY IN MARCH. SEE LAST FLIGHT, PAGE 72.



ABOVE Mirage A3-1 near Avalon, 16 September 1964. Photo: Defence

WHEN THE MIRAGE IIIIO was acquired by Australia in 1963, it represented a great leap forward in fighter technology, giving the RAAF a sustained supersonic capability in its fighter force. At the same time there were major advances in onboard systems and, of course, propulsion.

The Mirage IIIIO for Australia and the IIIIE for the French Air Force came off the production line at Bordeaux, France at the same time; the O variant beating the E by a few days. While the airframe/engine combination was the same for both, the onboard systems were very different, and the E would be limited to the European environment while the O was planned for the tropics. Those differences necessitated independent flight test programs. When that was agreed, Mirage IIIIO #1 was fitted,

during production, with instrumentation tailored to measure performance, while IIIIO #2 was fitted with a simpler system aimed at evaluating the operation and performance of the RAAF Nav/Attack systems.

Both aircraft were test flown extensively in France while numbers 3 and 4 came off the production line. They were then broken down for transit to Australia via RAAF C-130A. On arrival at Avalon, Victoria, the aircraft were reassembled by Government Aircraft Factories and test flown prior to RAAF acceptance.

The first to arrive, A3-1 was launched into a test program aimed at determining performance in a tropical atmosphere, engine surge boundaries, including gun fire induced surge, shock cone operation and other aspects that could not be achieved in France. Geoff Talbot and Bill Collings flew most of that program.

LOSS OF MIRAGE A3-1

On 7 December 1964, A3-1 was engaged in investigating the high-altitude effects of angle of attack (alpha) on the surge behaviour of the ATAR 9C engine, specifically the combination of alpha plus rate of change of alpha (alpha dot). The aircraft, flown by RAF exchange test pilot Flt Lt Tony Svensson, was operating at 35-45,000 feet in hazy conditions, with a poorly defined horizon and little visual reference to ground features.

Six of the planned eight test points had been achieved, and the aircraft commenced a wind-up turn (a pitch manoeuvre designed to maintain speed at a specified normal acceleration (g) and angle of attack) for the seventh test condition. The aircraft apparently departed from controlled flight shortly after turn entry, and the pilot reported to the test control room: "I'm spinning"

'A Gathering of Eagles'

BATTLE OF BRITAIN COMMEMORATION HOBART, TASMANIA

• 15-17 SEPTEMBER 2023 •

The RAAF Association, Tasmania Division, extends to all Air Force members, past and present, and their partners and guests an invitation to attend 'A Gathering of Eagles' to be held in Hobart over the period Friday 15th – Sunday 17th September 2023.

There will be a number of events over the weekend, including a Dinner, to commemorate the 83rd Anniversary of the Battle of Britain.

For more information visit the website: raafatas.com or email: events@raafatas.org.au

To book go to: <https://events.humanitix.com/battle-of-britain-commemoration-2023>

At that stage, little was known of either the spin characteristics or the recovery procedures for the Mirage III. Moreover, the concept of inertia coupling was largely limited to academic discussion. It was only much later that we were able to document the Mirage's extremely oscillatory roll/yaw characteristics, and its major pitch angle excursions, pitching from +20° to -110°.

The pilot was advised from the 'Mushroom', the Aircraft Research and Development Unit (ARDU) flight test monitoring facility at Avalon, to maintain positive spin recovery control: control column held neutral in pitch and with full in-spin roll control applied. He acknowledged that instruction, and reported the oscillatory behaviour was becoming more violent. If he did not have recovery by 10,000 feet he intended to eject.

One further, unintelligible transmission was followed by the explosive sound of a high-speed impact. The aircraft had crashed close to the airfield.

The pilot was badly injured, with both legs broken and numerous dislocations. It was concluded that he had ejected in an 80° dive below 10,000 feet, and at higher than transonic speed. (Later, sections of the photo-trace recorder roll recovered from the wreck showed the final impact speed was more than 800 knots.)

The subsequent inquiry concluded the aircraft had probably recovered from the spin condition during a nose down pitch change and had begun to accelerate rapidly, while full roll control was being maintained and with the pilot lacking visual clues – initially due to poor visibility and then due to the extreme effects of severe roll/pitch inertia coupling (noting that at high diving speeds application of full roll control at 15,000 feet will result in a roll rate of 330 degrees/second).

After lengthy periods in hospital, Tony Svensson recovered and returned to RAF flying duties in the UK.

MIRAGE A3-2

The loss of A3-1 left the RAAF without a Mirage instrumented for the extensive program to document aircraft performance under Australian operating conditions. It was decided to carry out a major upgrade of the instrumentation in A3-2. That took several months and included a comprehensive suite of sensors and flight recorders capable of capturing data over a wide range of variables. A second aircraft, A3-76, was later allocated to be instrumented with a

then novel digital tape recorder for airframe fatigue data capture and analysis.

I took over the major flight test activities on A3-2, and we embarked on flight clearance programs for a wide variety of weapons, with and without external fuel tanks. That program proceeded without major problems until February 1966 when the aircraft became due for a major service which had to be done at RAAF Williamtown.

When we were advised that A3-2 was ready for return, I was dropped off at Williamtown on 13 April for the acceptance test flights and transit to Avalon on the following day.

Two test flights were required following a major servicing. The first was a functional flight to prove all systems were working satisfactorily, and the second was a maximum performance check, involving an acceleration from M 0.9 to M 2.0 at 36,000 feet, the notional tropopause. A few small problems from the first flight were rectified within a couple of hours after engine shutdown. On the second flight, the supersonic acceleration time



TOP Painting of Ron Green with A3-2 by Norm Clifford.

ABOVE A3-2 carrying the Glide Test Vehicle store, a prototype design adapted for the JDAM-ER (see page 6). Note camera nose cone and wing-tip pod.



LEFT Mirage A3-2 over Glenelg, SA.



was in tolerance although the aircraft developed considerable yaw due to a binding slide on the engine nozzle actuator, but that was considered acceptable for the ferry back to Avalon.

After an uneventful return to Avalon, A3-2 was placed on jacks ready for the instrumentation reinstallation. Reconnection, reactivation and testing of the instrumentation required three working days and the aircraft was scheduled to continue the test program on 20 April.

The first task was to establish baseline performance of the clean aircraft and check operation of the instrumentation. That required measurement of climb performance using both dry and full afterburner thrust, a selection of speed/power points, and an instrumented acceleration from M 0.9 to M 2.0.

The first flight made the climb with full dry power. It was normal flight test practice to call flight and engine parameters, together with fuel remaining, every 5,000 feet back to the Mushroom where all transmissions were recorded. That meant

an active series of transmissions during a dry power climb. During a climb with full afterburner, the transmission became a rapid-fire continuous monologue. That not only provided backup information in the event of instrumentation failure, but also kept flight test engineering staff fully in the picture.

A series of speed/power test points were flown as the aircraft proceeded along the Victorian coastline toward Cape Otway. Shortly after passing Geelong the speed reached M 2.0, power was reduced to dry and the aircraft placed in a limit turn (with full up elevon) to starboard to minimise the possibility of dropping a sonic boom on Melbourne's bayside suburbs. Power was reduced to idle during the turn which was continued until the nose was pointed at Avalon. Recovery was uneventful.

The instrumentation engineers were ecstatic. Their black boxes had all worked, and A3-2 was serviced for the next flight.





The next flight plan called for a full afterburner climb to ceiling followed by a series of speed/power test conditions

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during a slow descent to Avalon. Departure to the south was routine and the aircraft flown at 300 Kt/500 ft across the Bellarine Peninsular before turning southwest. The start altitude for the climb was 1,000 feet and the climb schedule was maximum power at 400Kt/M0.9. Consequently, the workload was high prior to that start point. The engine had to be brought up from cruise power to maximum dry stabilised, the afterburner lit, stabilised and advanced to maximum, all before the aircraft reached 400kt and 1,000 feet. That achieved, I started the climb with a pitch angle of 28-30° nose up and began the busy monologue of data transmissions.

The climb was smooth to 25,000 feet. I had just started to call the engine parameters when there was a muffled whoomph and everything went quiet with the engine revs running down and airspeed falling off. That was at about 26-27,000 feet. My reaction was compressor stall and I turned back toward Avalon, closed the throttle and dived to keep airflow up to the engine.

At 450kt or so the engine was continuing to unwind so the aircraft was recovered to level flight at about 470kt. I was about 30 nautical miles southwest of Geelong, with altitude about 17,000 feet.

RETURN TO BASE

Those with experience in the Mirage will know that without an engine it has the glide angle of a manhole cover with rough edges. Best glide speed is 300 KIAS and the aircraft travels approximately one mile for every 1,000 feet of altitude lost. The landing pattern speed is 240kt (limit for lowering the landing gear) which is minimum until established on final. With the gear down, limit speed is 270kt. The sink rate is then very high – about 20,000 feet/minute, and that requires the pilot to maintain a high-energy state to be able to arrest the descent rate in the landing flare. Thus the flare is normally initiated at 600-800 feet above the runway.

It was obvious to me that A3-2 was not about to carry out a flight manual flameout landing, if it was going to land at all.

In conjunction with engineering help, I did a full trouble-shoot but without success. Throughout I was slowly bleeding airspeed for altitude. Engine rpm was falling very slowly and eventually settled around 4,000 revs, but slowly crept down as attitude decreased. Hydraulic pressures remained at normal values.



A3-2 conducting captive carriage tests with an Australian-designed multi-store rack north-east of RAAF Base Edinburgh, SA. Photo: Defence.

As I came over Corio Bay at about 3,500 feet there was a chance of making the runway toward the north. All other aircraft had been cleared to the north of Geelong Road. I decided to ride it down to 1,000 feet and make a decision there. By 1,500 feet, the aircraft was approaching the north shore of Corio Bay and lined up with the northern runway. Hydraulics were still holding but engine speed was down to 2,500 revs without any exhaust gas temperature indication. I thought I could still eject safely at 500 feet at the present sink rate and moved the decision height accordingly.

From production testing I had done and having confidence in the hydraulics, I decided to leave the gear extension until about 30 feet during the flare. The gear required 3-3.5 seconds to lock down under normal conditions.

At 500 feet and crossing the airfield boundary, I decided to continue, quietly hoping the bottom would not drop out of the hydraulic systems when I selected gear down.

A couple of hundred meters from the threshold, I started a gentle flare and when the altitude was about one wingspan, selected gear down. After about three long seconds there were some reassuring clunks and green lights, then the bump of touchdown in the under-run. The aircraft rolled 44m to reach the runway threshold and continued down the runway. There was no need for a brake chute; the aircraft came to a stop under gentle braking halfway along the runway. Engine rpm

were down to 1,600 or so and did not respond to any action I took other than final shutdown.

The aircraft did not sustain any damage from its cross-country tramp to the runway, even though the left main wheel dislodged a 2m plank of wood. We only had to clean the grass from the bottom of the engine nozzle.

The cause of that unscheduled return to base was found the next day, after a preliminary inquiry was launched. The ATAR 9K has a low-pressure fuel pump and a high-pressure pump combined into a single assembly. The low-pressure pump is a centrifugal unit. When the pump unit was removed for disassembly, the problem became obvious. A bright yellow plastic blanking plug was resting neatly in the eye of the impeller of the low-pressure pump.

Such plugs were standard items used to prevent the ingress of foreign material into engine lines during servicing. The immediate action following the discovery was to quarantine all such plugs, replacing them with plastic caps.

Some questions were never answered. How did the plug get pushed into the fuel system line? Where did it hide during the ground engine tests at RAAF Williamtown (the fuel flow at full afterburner is impressive)? Where did it hide during the functional test and Mach 2 flights at Williamtown, the transit to Avalon and the Mach 2 flight there? What made it come loose during a stabilised flight condition with decreasing fuel flow? **W**

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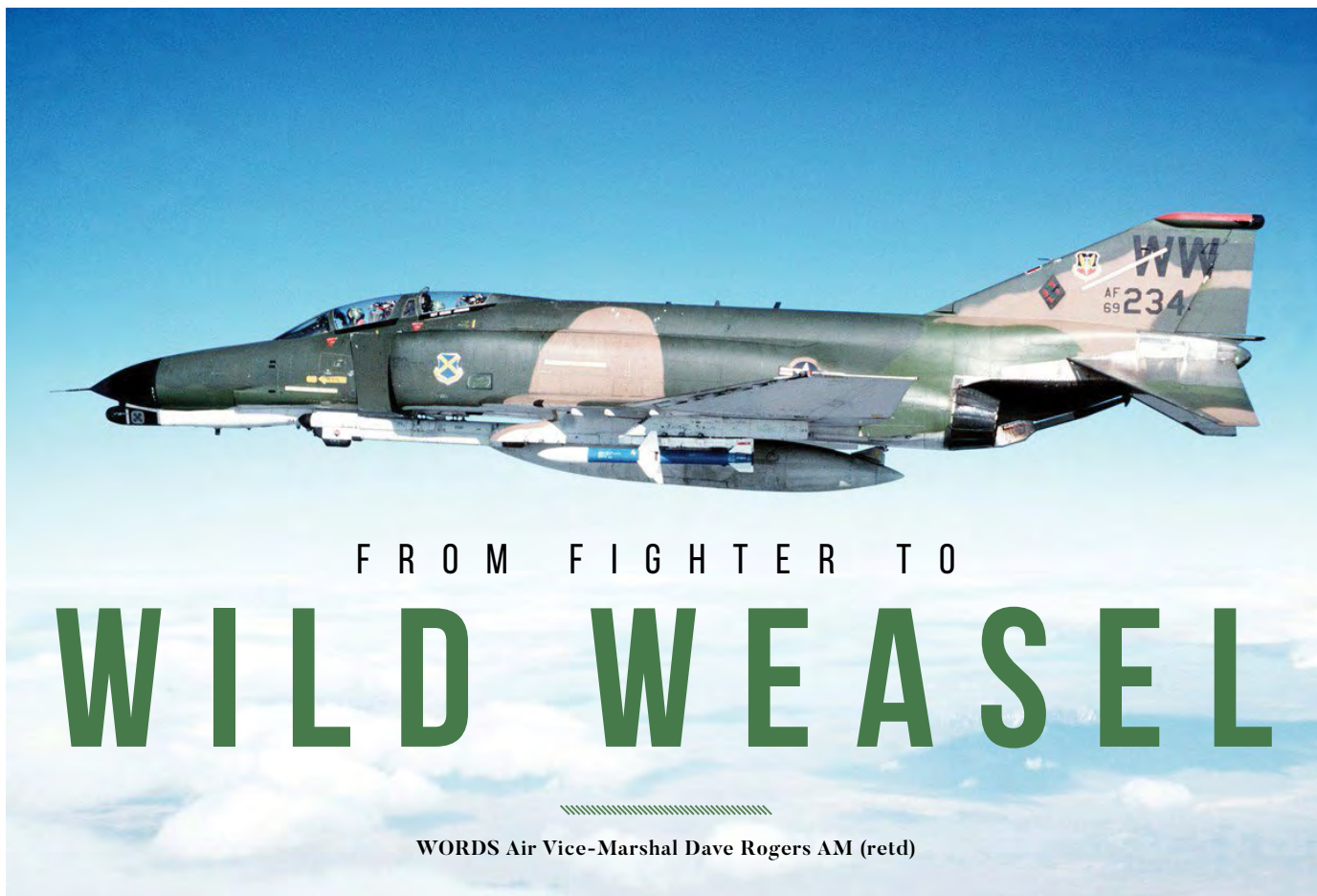


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FROM FIGHTER TO
WILD WEASEL

WORDS Air Vice-Marshal Dave Rogers AM (retd)

A LATE INCLUSION INTO A GROUP OF 24 F-4E PHANTOM AIRCRAFT LEASED BY THE RAAF FROM THE USAF, PHANTOM A69-7234 HAD A LONG, EVENTFUL CAREER.

UNEXPECTED CIRCUMSTANCES IN THE LATE 1960S resulted in the RAAF becoming one of the early military services around the world to operate the remarkable Phantom, flying F-4Es for three short years between 1970 and 1973. Acquired out of necessity to fill the RAAF's capability gap while waiting for the delayed General Dynamics F-111C, the Phantom came to be loved by all the RAAF personnel who flew and maintained it.

The RAAF's 24 F-4Es were leased from the US Air Force (USAF) under Project Peace Reef. Aircraft allocated were the first Block 43 configured Phantoms assembled and were numbered in the sequence from 69-7301-304 to 69-7201-220.

Delivery was scheduled to take place

in four ferries of six aircraft between 14 September and 4 October 1970. Delivery crews were a mix of RAAF and USAF pilots and navigators. The four ferries were planned a week apart, with KC-135 tanker support from the USAF's Strategic Air Command (SAC). The route to RAAF Base Amberley, Queensland was in four hops: from McDonnell Douglas (McAir) facility, St Louis, Missouri to George Air Force Base (AFB) California, Hickam AFB, Hawaii, and finally Andersen AFB in Guam.

Operations were proceeding uneventfully until the first leg of the third ferry. During an air refuelling check with aircraft A69-7218, the KC-135's boom locked in the F-4E's receptacle and could not be separated. The 'brute force disconnect' procedure to release the boom

damaged the aircraft which was directed to return to St Louis. A spare aircraft was collected and flown to George AFB to join the ferry. The damaged aircraft (A69-7218) was replaced by the out of sequence tail number A69-7234, which joined the fourth and last ferry a week later.

BRIEF SERVICE

From that inconspicuous, bridesmaid-like debut to its RAAF service career, Phantom A69-7234 would go on to have an interesting and, at times, exciting operational life.

On arrival at Amberley, the new F-4Es underwent a standard post-ferry acceptance check that took a few weeks. After acceptance, 234 was placed on the flying programme for No.6 Squadron with first flight scheduled for 19 October 1970.

A two-hour mission was planned with Flight Lieutenant John 'Jack' Ellis as pilot and Squadron Leader Brian Bolger as his navigator. Unfortunately, after an hour the aircraft lost a generator and experienced a bus tie contactor failure that resulted in the loss of a few systems. Significantly,

the crew would not have anti-skid braking or nosewheel steering on landing back at Amberley.

With a 20kt crosswind, Jack elected to take the approach-end, arrestor system cable. Jack had flown the F-4C on exchange with the USAF during the Vietnam War and was highly experienced on type and had multiple cable engagements. With the base emergency crews at the ready and most base personnel watching, Jack touched down about 500 feet before the cable and engaged it as planned. Then all hell broke loose.

Shortly after engagement, the cable drum on the right side locked and the cable snapped. With the cable now only secured via the left side drum, it started feeding through 234's arrestor hook. The 'rubber donuts' (rubber rings fitted to the cable to hold it clear of the runway and thus enable hook engagement) were pulled to the hook and dislocated from the cable.

Finally, a five-foot long aluminium shock absorber on the right end of the broken cable was dragged through the arrestor hook. The impact tore the hook from the aircraft and imparted a nose up, right yawing moment. The Phantom lurched about a foot into the air, landed pointing about 30 degrees to the right and continued to skid sideways along the runway drifting to the right. It left the runway at about 90kt and ground-looped to the left as the nosewheel dug into the grass verge. The right main undercarriage and nosewheel collapsed, an underwing

tank was torn off and the right wing failed as 234 came to rest pointing about 300 degrees off its original runway heading.

With the aircraft stopped, Brian jettisoned his canopy while Jack opened his normally. Both exited their cockpits rapidly with no injuries apart from the odd scratch.

The same could not be said for 234. With barely 30 hours of flight time since manufacture, the aircraft looked forlorn. With a broken right wing, no tail hook, crumpled nose and collapsed undercarriage, 234 was unlikely to return to flight anytime soon, if at all.

A survey of the damage was undertaken by USAF and RAAF engineers assisted by the now resident McAir representative. The USAF assessed that the aircraft would need to be returned to the USA for a complete rebuild on one of four jigs available in the States. RAAF tradesmen and engineers had different ideas and developed a plan to build their own jig and repair 234 in country, with the USAF providing the parts. While sceptical, the US reluctantly agreed.

A team from 482 Squadron and No.3 Aircraft Depot set to work. It was not going to be an easy task but they were determined. Phantom 234 became a fixture in the corner of the No.482 Squadron hangar, colloquially known as the Taj Mahal, for nearly a year as the team disassembled it, manufactured the jig and set about replacing its wings, nose, undercarriage, flight controls and other components.



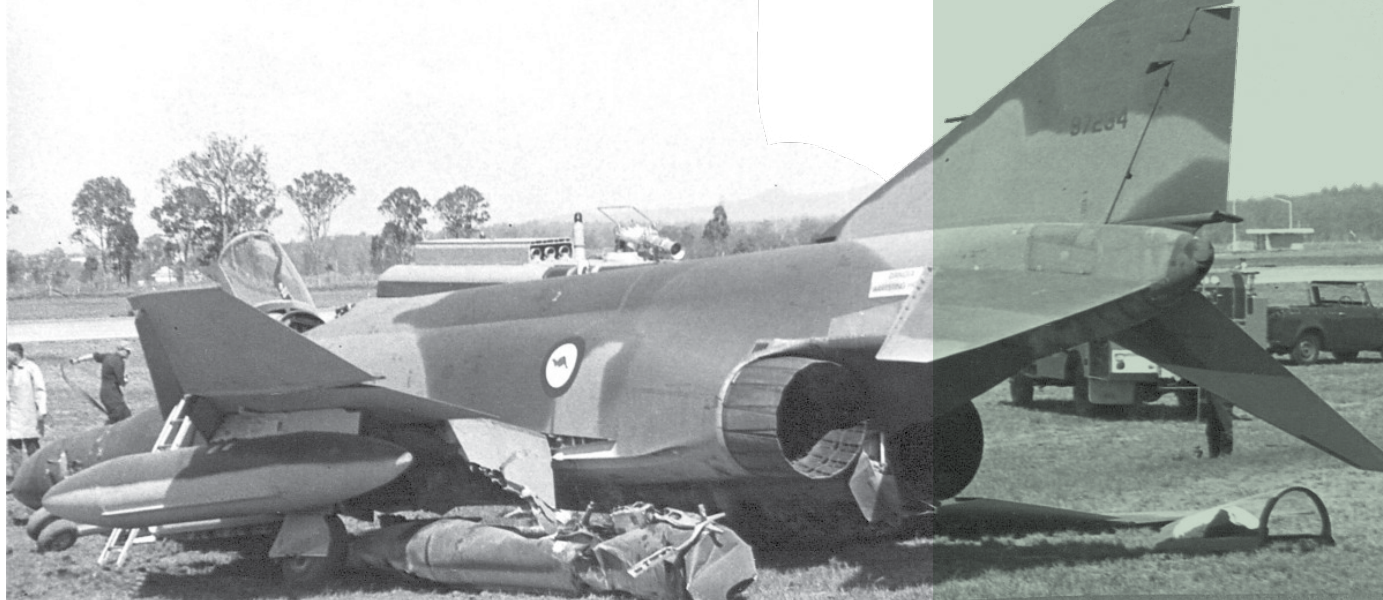
LEFT F-4G 234 wearing its 35th TFW George AFB tail code WW (Wild Weasel). Photo: USAF.



BELOW The forlorn look of a new Phantom with about 30 hours on the clock was not a nice sight. Photo: RAAF via Bob Howe.



BELOW Another view of 234 as it came to rest.



Finally, in late 1971, A69-234 was rolled out for functional test before flight testing after some 18,750 man-hours were expended on the rebuild.

The crew for the unique test flight was carefully selected. Squadron Leader Ken Smith, who had more than 1,000 hours on the F-4E and performed the 'wing walking' displays for the RAAF's 50th Anniversary airshows during 1971, was given the task with navigator Flight Lieutenant Frank Burtt.

Some 355 days after the accident, Ken and Frank performed the test flight on the rebuilt aircraft. In the post-flight debrief, Ken remarked that it was perfect, and he could not find any 'squawks' at all. The rebuild team had done a remarkable job.

Unfortunately, 234's time in RAAF colours would be short lived. In October 1972, as the RAAF's F-111Cs were soon to be delivered, 234 was identified as one of the first tranche of aircraft to be returned to the USAF in accordance with the terms of the lease.

On 22 October 1972, just over two years since delivery to Amberley and with just under a year of actual flying service with the RAAF, 234 was back in USAF hands and about to enter the next phases of its life.

BACK TO THE USAF

Of the 23 remaining Phantoms (one aircraft, A69-7203 and crew was lost into the sea off Evans Head on 16 June 1971) returned to the USAF, the first 11 were flown to Hill AFB, Utah, where some were converted to F-4G 'Wild Weasel' Electronic Warfare aircraft. The F-4G was equipped with new sensors, electronic counter measure equipment and anti-radiation missiles for the Suppression of Enemy Air Defence role.

A few ex-RAAF Phantoms, including 234, initially remained in their F-4E configuration and were re-assigned to USAF squadrons; 234 was allocated to the 526th Tactical Fighter (TF) Squadron, based at Ramstein Air Base, West Germany.

In late 1978, 234 returned to the States to join the F-4G conversion program at Hill AFB, emerging in 1981 as a new F-4G Wild Weasel V. It subsequently flew with a number of USAF Operational Fighter Wings: the 3rd at Clark Air Base, the Philippines; the 35th and 37th at George AFB, California; the 52nd at Spangdahlem Air Base, Germany; and finally the 57th Fighter Weapons Wing at Nellis AFB, Nevada.

In 1991, it was deployed from Spangdahlem Air Base to the Middle East



ABOVE An RAAF Phantom being refuelled during the ferry flight across the Pacific Ocean by a SAC KC-135. Photo: Lance Halvorson.



ABOVE 234 post its rebuild alongside other RAAF F-4Es on the RAAF Amberley flightline. Photo: RAAF.



as a participant in Operation Desert Storm over Iraq. During that deployment, its crews were credited with destroying four enemy radar sites.

By the end of the Gulf War, 234's active service career was drawing to a close. Along with many other F-4E and F-4G models, 234 was assigned to USAF's Aircraft Maintenance and Regeneration Center (AMARC) at Davis Monthan AFB, Tucson, Arizona. The AMARC, more commonly known as the Boneyard, is a joint US Services facility where retired aircraft are stored and preserved for possible future use or sold for scrap.

F-4G 234 was an inmate of the Boneyard for nearly eight years, during which time the USAF officially retired the Phantom from active duty in 1996. Many of the now surplus F-4s would be scrapped or placed in museums or on poles at display locations around the USA. Fortunately, 234 avoided that fate and went on to another useful phase of its eventful life.

BEYOND THE USAF

In August 1999, 234 was flown to Mojave Airport, California, into the hands of Tracor Corporation for conversion into a QF-4G Full-Scale Aerial Target (known colloquially as a FSAT or drone). More than 300 RF-4C and F-4E/Gs were converted to the QF-4 configuration. Those aircraft were stripped of all unnecessary operational equipment and fitted with telemetry and controls which enabled them to be flown manually by a single pilot or as an unmanned target.

234 was officially designated as AF212, its QF-4 code, but still maintained its originally assigned Phantom tail number.

In its QF-4G guise, 234 flew with Detachment 1, 82nd Aerial Targets Squadron (ATRS) at Holloman AFB, New Mexico, as a manned FSAT for missile development programs. Its final move was to the 82nd ATRS Tyndall AFB, Florida, where, on 21 July 2005, like a true fighter, it was shot down on a live missile test.

EPITAPH

For 35 years, 69-7234 had an indisputably worthwhile service career, with the RAAF and the USAF. From fighter to Wild Weasel and finally as a target drone, 234 served across the world in different liveries and configurations. It survived accidents and wars, and gained due credit for its service in the Gulf War. Sadly, 234 along with 13 of her sisters who served with the RAAF, now lies at the bottom of the Gulf of Mexico.

Looking back, if not for the sterling efforts of the RAAF team at Amberley in 1971, 234 may not have survived beyond that unfortunate accident in 1970. While long gone, 234 is not forgotten, especially for its short but eventful time in RAAF service. **W**

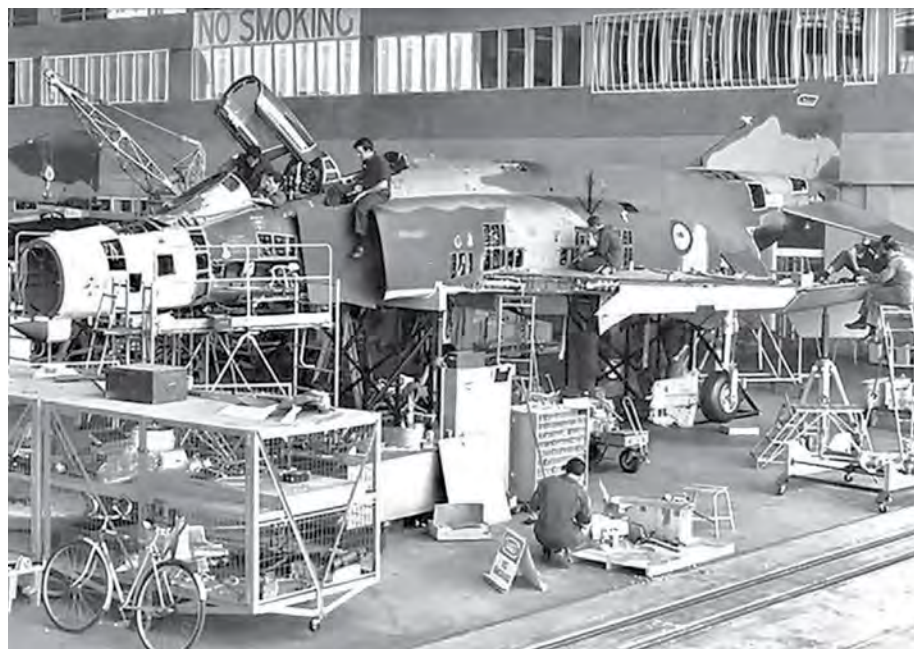
Assistance in compiling this article involved Mark Richardson, Bob Howe, Lance Halvorson, David Fredericks, Peter Condon, Clarrie Stjernqvist, Rob Portengen (ex-USAF pilot) and Gregg Stansbery (ex-USAF pilot).



ABOVE 234 in her FSAT livery as a QF-4G with final tail code, TD, while employed at Tyndall AFB, Florida. Photo: Greg Stansbery.



RIGHT 234 in the 482SQN hangar, the 'Taj Mahal', undergoing its extensive rebuild. Photo: RAAF.



THE RAAF'S FIRST PEACEKEEPERS

MORE THAN 75 YEARS AGO,
RAAF PERSONNEL TOOK PART IN THE
UNITED NATIONS' FIRST PEACEKEEPING
OPERATION, WRITES **GRAHAM RAYNER**.

IN SEPTEMBER 1947, Squadron Leader Lou Spence RAAF deployed to Indonesia in support of the United Nations' (UN) first international mission involving military officers. They served in what should be regarded as the UN's first peacekeeping operation.

While Spence was only in Indonesia for three weeks as he became seriously ill and had to be repatriated, he was followed in February 1948 by a team of four RAAF personnel led by Group Captain Redmond Green, a third contingent in mid-1948, and two more contingents in 1949. The RAAF's involvement in Indonesia ended with the departure of Squadron Leader Valentine Roland in September 1950. In total, 25 RAAF officers had served the UN in Indonesia, together with 38 from the Australian Army and two from the Navy.

WHY WERE THEY THERE?

An indigenous nationalist movement had formed in the late 19th century on the main islands of the East Indies, wishing to rid themselves of their colonial masters, the Dutch. The movement had gathered sufficient momentum to cause

difficulties for the Netherlands East Indies (NEI) government and by the mid-1930s, leaders such as Sukarno and his deputy Mohammad Hatta had been imprisoned in the hope of quelling disquiet. Hatta had been sent to the Dutch concentration camp of Tanah Merah in the highlands of West Papua where conditions were such that the prisoners were described by Dr Sutan Sjahrir, Indonesia's first prime minister (himself a former prisoner) as in "profound spiritual misery ... and permanently broken in spirit".

When the Japanese occupied the Indonesian archipelago in 1942, the NEI government took refuge in Australia and the nationalists realised an independent republic may be possible. Japan's 'Greater East Asia Co-Prosperity Sphere' depended on the occupied countries essentially managing their own affairs. The commander of the Japanese occupation force also realised he had insufficient forces to repel an Allied invasion and so established, trained and armed an indigenous force, Pembela Tanah Air (PETA), to fight with the occupation force.





BELOW The image that became the symbol of the Indonesian republican struggle for independence. Bung Tomo giving a fiery speech in Surabaya, Java.



RIGHT Wing Commander Lou Spence receiving the US Legion of Merit for service in Korea. He was killed in action a month later. Photo: Australian War Memorial.



Japan released Sukarno, Hatta and other nationalists and allowed them a degree of freedom to prepare for independence, even taking Sukarno and Hatta to Japan to meet Prime Minister General Hideki Tojo in November 1943. Japan's 'support' of independence increased as the tide of the war turned against it.

Two days after Japan surrendered, Sukarno declared the independent Republic of Indonesia, but it was not recognised by the Allies, particularly The Netherlands. In the following weeks, Sukarno formed military forces, drawing largely from PETA and including an air force with Japanese pilots. As the Dutch recovered from the war and prepared to re-establish government in the East Indies, the British Army, consisting mainly of elements of the British Indian Army, provided the security force on the islands.

Fighting broke out between the republicans and, initially the British

and later the Dutch armed forces when they returned in early 1946. Bloodshed continued with no letup, other than a brief ceasefire under the Linggadjani Agreement of November 1946.

In 1947, the republicans appealed to the fledgling UN for help. However, Indonesia was not a recognised country nor a member of the UN and The Netherlands, as a member state, objected. Australia stepped in to formally recommend that the UN, acting in accordance with the UN Charter, order a ceasefire and find the means to resolve the conflict. The Security Council did so and established a Consular Commission at Batavia (now Jakarta) to review and report on the security situation across the islands, and a Committee of Good Offices to help settle the differences and establish peace.

The Consular Commission was made up of the consuls of each UN member state represented in the Netherlands East Indies: Australia, USA, UK, France, Belgium and China; and the Committee of Good Offices, known unofficially as the UN Good Offices Committee (UNGOC), comprised of three eminent people, one each from Australia, Belgium and the US.

At its first meeting on 1 September 1947, the Consular Commission agreed that each country would send a small team of military officers to help in its appointed task.

Australia was the first to respond and its team of four, Brigadier Lewis Dyke, Commander Henry Chesterman, Major David Campbell and Squadron Leader Lou Spence, arrived on 13 September and deployed into the field the next day. The UK team deployed a couple of days later, followed by the French, Belgian and Chinese teams, with the larger team from the USA arriving some weeks later.

While the military observer group, as it became known, was ostensibly attached to the Consular Commission, its value was immediately apparent to UNGOC, and the group became recognised as a part of the UNGOC.

Across Indonesia, UNGOC was referred to as *Komisi Tiga Negara* (KTN), meaning committee of three states, and KTN was printed on armbands worn by the observers and painted on the vehicles they used, along with 'United Nations'.

MILITARY OBSERVERS

The military observer group's initial work was centred on the islands of Java,

Sumatra and Madura, with short visits to the provinces of Kalimantan and Sulawesi, to assess the security situation and the effects on the population. The group's observations and opinions were incorporated into both an interim and final report of the Consular Commission submitted to the Security Council of the UN in October 1947.

As soon as the members of UNGOC arrived in Batavia in December 1947, they began using the services of the military observer group to help broker a ceasefire agreement. Negotiations were held aboard the USS *Renville* in Batavia Harbour as the two sides couldn't agree on a land-based venue. Officially the agreement was known as the Ceasefire Agreement, unofficially as the Renville Agreement, and it ordered the armed forces of The Netherlands and the Indonesian Republicans to stay within agreed areas. The geographical demarcation between the forces was known as the Status Quo Line.

The military observer group was deployed to monitor the conditions of the ceasefire, movement of the population over the Status Quo Line and how the population was being policed. It also investigated breaches of the agreement, especially any incidents of violence. The number of military observers in the country at any time varied, but they were split into 10 teams of two to four observers, spread over Java and Sumatra, with a few remaining in the headquarters in Batavia.

The observers' work was not without risk. More than 50,000 Indonesians, Dutch, British, Indians and Chinese were killed in the conflict which presented an atmosphere of constant tension. Surprisingly only two observers were wounded; a British Lieutenant Colonel was seriously wounded and his colleague, a USAF Lieutenant Colonel, received minor wounds when their UN jeep was ambushed in central Sumatra in February 1949. They would have been killed had it not been for the bravery of their Dutch escort officer who was seriously wounded in the engagement with a group of Indonesians. He was later awarded The Netherlands' second highest medal of valour, the Bronze Lion.

UNGOC continued to negotiate towards a lasting solution, relying on the observer group to not only provide independent monitoring of agreement conditions, but to provide a constant flow of intelligence to assist in its work. The final negotiated settlement, signed in The Hague on 1 November 1949, led to the transfer of sovereignty of the previous Netherlands East Indies to the Republic of Indonesia on 27 December 1949.

As part of the Hague Agreement, The Netherlands agreed to repatriate all members of its armed forces who had been deployed to the East Indies (about 60,000), and to disband the Netherlands East Indies Army (about 50,000). The UN's military observer group remained in Indonesia to monitor the repatriation and disbandment. The last Australian observer



TOP UNGOC initial appointees, from left, Supreme Court of NSW judge Justice Richard Kirby (Australia); university educator and later Senator Frank Graham (USA); and ex-prime minister of Belgium, M. Paul van Zeeland.



ABOVE Squadron Leader Alan O. McCormack RAAF served in Indonesia for nine months in 1948/49.



LEFT Squadron Leader Hackshall RAAF with Indonesian military and his UN observers group's jeep on the Status Quo Line in central Sumatra.



MAKING CONTACT

If you know, or knew, any of the observers listed below and/or their families, please contact, or invite the veteran or his family to contact, the campaign coordinator Graham Rayner at service.UN1947to51@gmail.com.

As well as maintaining an avenue to alert the families of the UN Medal (if the UN approves), the families are invited to share an image of their veteran, any images of their time in Indonesia, and a paragraph or two about them.

The Australian War Memorial will be improving its exhibition on the history of Australia's involvement in peacekeeping when its new exhibition building is opened. It is believed that the Indonesian mission, Australia's first, will feature prominently. It is hoped that the display will include the images and stories the families of the veterans might provide.

RAAF PERSONNEL POSTED TO INDONESIA IN THE SERVICE OF UN 1947 - 1951

	SERVICE NO.	BORN – DIED
SQNLDR W. (Warwick?) Addison	405707	
SQNLDR D.S. (Dudley Slater?) Addison	1210, O3188	
SQNLDR Cedric Lewis Arnold	415107	
SQNLDR Percival Curtis Burdeu	52, O386	Burdeu 13 Apr 1913 - 2 Jun 1999
SQNLDR James Russell ('Jungle Jim') Crowther	401323	6 May 1942 – 31 May 2004
FLTLT R. E. (Robert Edward?) DeLacy	13065	
WGCDR Alexander Ronald Emslie	548, O395	4 Sep 1916 – 14 Nov 1993
SQNLDR Royston James Fairbank	4120	1910 – 3 Jul 1974
SQNLDR R. B. Fenton	423694	
GPCAPT Redmond Forrest Michael Green	146, O349	4 Feb 1916 – 22 Oct 1999
FLTLT Reginald Hackshall	3481, O3485	14 Nov 1911 – 13 Aug 2003
SQNLDR A. I. Ker (Resigned as FLTLT)	419185, O33152	
SQNLDR A. E. Knights	2965	
SQNLDR Leslie Norman Kroll	404615, O11334	14 Jun 1919 – 26 Jun 1980
FLLT Kenneth Alan Seymour Mann	402377	10 May 1918 – 2 Jul 2006
WGCDR Alan Ower McCormack	375	19 Mar 1919 - ?
SQNLDR S.C. Medley	4640	
SQNLDR A.J. Milburn	4248	
SQNLDR S.J. (Stanley James?) Nichol	3485	
SQNLDR Patrick Stanislaus Norris	2940	18 Oct 1902 – 2 Aug 1982
SQNLDR Ernest Goldsmith Page	407623	11 Jun 1918 – 28 May 1985
SQNLDR Valentine Vasey Roland	1026, O3199	1903 – 23 Sep 1968
SQNLDR Thomas L. (Thomas John?) Sharpely	1872, O3320	19 Feb 1906 - 30 Sep 1968
SQNLDR Louis Thomas Spence	839, 270839, O11315	4 Apr 1917 – 9 Sep 1950
SQNLDR Christopher John Sugden	W588, 406887, O5813	3 Apr 1022 - 2009

to depart was LTCOL Edward Aitken who headed home on 20 March 1951.

RECOGNITION OF SERVICE

The ADF deployment to support the UN in Indonesia was its first involvement in peacekeeping and made at a time when the ADF was in a state of reorganisation and uncertainty in the aftermath of World War II. The 2nd Australian Imperial Force (the army) had been disbanded following the end of the war. Most of its members were demobilised, but a few were retained on transfer to an 'interim army'. The Navy had been downsized from 40,000 to 7,000, and the RAAF, renamed the 'interim air force', was reduced from a force of 173,600 at the end of the war to less than 8,000 by late 1948. Writing for the *Melbourne Herald* at the time, recently retired Air Vice Marshal Bill Bostock described the air force as in a "ruinous state."

Furthermore, the structure and purpose of the ADF in a peace environment had yet to be properly articulated and communicated. Entering into that administrative vortex was a request from our consul in Batavia to send a team of experienced officers to help sort out an internal conflict to Australia's immediate north, and then to continue replacing them over the next three years. Australia ended up sending more than 60 officers to help and, together with the US (which sent 60-80), provided the majority of observers attached to UNGOC and the Consular Commission. The UK deployed about 30 officers to Indonesia, France about 20, Belgium 10 and China five.

There was no immediate recognition of Australian military officers' service in Indonesia, either by Australia or the UN. Eventually, on 22 February 1995, after Australia had participated in other peacekeeping missions, the Australian government created the Australian Service Medal (ASM) 1945-75 for peacekeeping and non-war-like circumstances. Service supporting the UN in Indonesia was deemed to be peacekeeping and attracted the award of the ASM – nearly 50 years after the service.

The UN, however, has never formally recognised the service of the military observers in Indonesia. In 1959, it created the UN Medal for service by military personnel to the UN and identified several UN missions prior to that year as warranting the award of the medal, but



not Indonesia. A formal approach to the UN to correct that anomaly is currently being made during the 75th anniversary of the UN's involvement in Indonesia. Australia is leading the campaign and is seeking the support of the other countries which deployed military observers.

If the UN promulgates the award of the UN Medal to the military observers of the Consular Commission at Batavia and the Committee of Good Offices, then the Australian government, following previous practice, should issue the medal to the observers or their closest relatives on behalf of the UN.

As most, if not all, of the ADF observers will have died, it will be important for their families to be aware of their potential eligibility and entitlement if the UN promulgates the award.

Australia has a long and proud tradition of peacekeeping, beginning with our Minister for External Affairs 'Doc' Evatt's leading role in establishing the United Nations, our wartime Minister for the Navy, Norman Makin, chairing the first meeting of the Security Council, and our military providing the UN's first peacekeepers. A formal recognition by the UN of the contribution made by our military personnel during what is essentially the UN's first peacekeeping mission will be very appropriate. **W**

Graham Rayner is a retired federal public servant. For more than a decade, he was the Canberra representative on the committee that organised the construction of the national memorial to Australian Peacekeeping in Canberra.



ABOVE Squadron Leader Spence (leaning forward) briefing the Consular Commission at Batavia, September 1947. Australia's consul, Group Captain Charles Eaton, is smoking his pipe and looking at the camera.



BELOW Australia's first ambassador to the USA and President of the UN Security Council, Norman Makin, presiding over the first meeting of the UN Security Council in London, 17 January 1946. Photo: UN.

BOTTOM Some of Australia's first peacekeepers, from left: Commander Henry Chesterman, Acting Australian Consul-General Charles Eaton, Brigadier Lewis Dyke, and Major David Campbell, Batavia, 1947. Photo: Australian War Memorial.





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THE TOWN THAT DIDN'T STARE

AT THE BEGINNING OF WORLD WAR II
A SMALL HOSPITAL IN EAST GRINSTEAD,
SUSSEX ESTABLISHED A PLASTIC SURGERY
UNIT TO TREAT BURNED AIRCREW.

THERE CAN BE NOTHING MORE TERRIFYING than to be caught in an aircraft dependant on highly flammable fuel that is on fire. World War I aviation histories are full of horrific stories of pilots trapped in burning aircraft with no hope of survival. With the long-overdue issue of the parachute in the latter stages of the war, the prevention of a fire was not resolved. Even if a pilot made it to the ground, severe burns victims rarely survived the ordeal.

During the inter-war years, it was common practice to give seriously burnt patients a saline solution, a large dose of morphine and send them home to die. However, from the 1930s onward, advances in medical science meant severe burns victims had a better chance of survival and clinical breakthroughs in treatment were just becoming available at the beginning of World War II.

As the outbreak of conflict with Germany seemed increasingly inevitable, the Emergency Medical Service was established in the United Kingdom. Part of its remit was to establish hospitals out of London that would be able to deal with airmen who, it was anticipated, would

need treatment for burns. One such hospital was the East Grinstead Cottage Hospital in Sussex. Rebuilt just prior to the outbreak of war, and renamed the Queen Victoria Hospital, it had plenty of land to establish a centre for plastic surgery.

Plastic surgeon Archibald McIndoe took charge of the hospital's new unit on 4 September 1939.

Born in Dunedin, New Zealand, McIndoe studied medicine at Otago University winning medals in both medicine and surgery and was awarded the first NZ Fellowship at the Mayo Clinic, USA where he went on to become first assistant in surgery. He moved to London in 1930 to work with his cousin, Harold Delf Gillies, who ran a private practice specialising in plastic surgery. As a result of his pioneering work, Gillies became widely accepted as the father of facial reconstruction.

McIndoe went on to be appointed as a consultant plastic surgeon to St Bartholomew's Hospital, the Chelsea Hospital for Women, Hampstead Children's Hospital, the Royal North Stafford Infirmary, Croydon General Hospital and, perhaps more importantly, a consultant in plastic surgery to the Royal Air Force.

FLAMING FIGHTERS

As the German Air Force began bombing England in 1940, the Battle of Britain was being fought with predominantly Hawker Hurricane and Supermarine Spitfire aircraft. Both were susceptible to fire due to the position of their fuel tanks and highly flammable fuel.

The Spitfire fuel tank was directly in front of the pilot between the engine and the cockpit. If the fuel tank caught fire, the flames were blown back towards the cockpit. The Hurricane had two main tanks between the wing spar and a reserve tank in the fuselage in front of the pilot. Virtually surrounded by fuel and without armour plate protection, the pilot of a Hurricane was more likely to go down in flames than his Spitfire counterpart. As 32 squadrons of Hurricanes took part in the Battle of Britain as opposed to 19 Spitfire squadrons, the rate of burn victims for Hurricane pilots was naturally much greater.

As the air war over Britain proceeded, casualties mounted and surviving fighter pilots suffering serious burns were taken to East Grinstead.

AN EARLY PATIENT

On 12 August 1940, a group of German aircraft was intercepted by the RAF 10 miles north of Margate. One of the RAF pilots was Flying Officer Geoffrey Page, a Hurricane pilot with 56 Squadron. During the ensuing dogfight, return fire from a Dornier Do 17 hit his aircraft's fuel tank.

Page abandoned his doomed aircraft with his parachute. As he descended towards the sea, the realisation of what had happened set in. "It was then I noticed the smell," he later recalled. "The odour of my burnt flesh was so loathsome that I wanted to vomit. I began to laugh. The force of the exploding gas tank had blown every vestige of clothing off my thighs downwards, including one shoe."

Page was rescued by a tender, put on board the Margate lifeboat and eventually transferred to East Grinstead. His painful recovery took two years and involved countless operations.

THE GUINEA PIG CLUB

On a sunny Sunday in June 1941, some of the recovering airmen were chatting in a newly erected hut at the hospital when one suggested forming a club. The airmen recognised by that reconstructive surgery



TOP Clark Gable visited convalescing Guinea Pigs in 1942.

ABOVE The Queen Victoria Hospital, East Grinstead.



LEFT Archibald McIndoe at work in the operating theatre.



was new and experimental, so someone proposed that as they were being used as guinea pigs, why not call it the Guinea Pig Club? Flying Officer Geoffrey Page was one of the club's founding members.

Another early patient, an ex-Royal Canadian Air Force navigator, observed that there were three types of Guinea Pigs: fried, mashed or hash browned. He described himself as belonging primarily to the mashed category having suffered 32 facial fractures, three spinal fractures, as well as arm and leg fractures, when his aircraft crashed in Belgium.

The Guinea Pig Club was duly formed with McIndoe as its president. With typical black humour, the secretary was a pilot with badly burnt fingers which excused him from writing many letters, and the treasurer's legs were burned, ensuring he couldn't abscond with the funds. To qualify for membership, a candidate had to be a member of an aircrew and to have had at least one operation at the hospital. Scientists, doctors and surgeons were honorary members.

The club grew in strength and through the generosity of many people became financially sound. Officers and other ranks ate together, meals were served when patients felt hungry and beer was allowed in the wards. Each member's progress



TOP McIndoe and some of the Guinea Pigs enjoying a drink at a restaurant in East Grinstead.

ABOVE The wedding of Bill Foxley and Catherine Arkell, East Grinstead, June 1947. Catherine met Bill while she was working at the hospital. He underwent 33 operations before they married.



RIGHT Albert Ross Tilley.



was eagerly followed and shared. Patients could watch operations from the gallery and new patients were escorted to theatre by the old timers who had already 'been under the knife'.

From 1941 onwards, as the strategic bombing program intensified against the industrial heart of Germany, the patient emphasis switched from burnt fighter pilots to burnt bomber crews. In time, Bomber Command aircrew would come to represent 80 percent of the total.

In 1942, Canadian Albert Ross Tilley, one of the first physicians to train in plastic surgery, joined McIndoe on the hospital staff.

Dr Tilley had been a member of the Canadian Army Medical Corps and was transferred to the new Royal Canadian Air Force Medical Branch at the beginning of the war, becoming the branch's principal medical officer in 1941.

COMMUNITY SUPPORT

Not everyone at Queen Victoria Hospital was a burns victim. Many needed reconstructive plastic surgery for other related reasons. Many men's injuries were so extreme that they stayed at the 'Queen Vic' for at least four years, enduring in excess of 50 operations.

New grafting techniques were successful in partially restoring physical features and allowed hands to function again, but McIndoe and Tilley did not consider their work complete until the patients were fully integrated back into the community.

Recognising that the patients' future lives depended on them returning to a normal life, McIndoe enlisted the help of the people of East Grinstead. He explained that his patients needed to be able to mingle in the local community and not be stared at because of their injuries. The town's people responded with enthusiasm. Even the most disfigured of the patients were invited to garden parties, pubs and dances, and made welcome in private homes.

East Grinstead citizens became an essential part of the patient care and endorsed McIndoe and Tilly's faith in not only the kindness of the local people but their efforts in rehabilitation.

Sadly, the residents of 'the town that never stared' endured a tragedy of their own on 9 July 1943 when a German bomber dropped his bombs on the town,

hitting several shops and the cinema. A total of 108 civilians, many of them children attending the cinema, were killed and 235 were wounded; largest loss of life of any air raid in Sussex.

INTERNATIONAL FAME

The Queen Victoria Hospital gained international status in 1944 when 50 American plastic surgeons were sent for 10 days to train as part of the medical preparations for the D-Day landings on 6 June.

Entertainers such as Tommy Trinder, Joyce Grenfell, Douglas Byng and Francis Day, to name a few, came to entertain the patients. When the Americans arrived in England to begin preparations for D-Day, their stars also came, including actor Clark Gable.

In 1944, Archibald McIndoe was awarded a CBE and in 1947 a knighthood. When he passed away in April 1960, his ashes were buried in the RAF church of St Clement Danes in London – the only civilian ever to be interred in that church.

By the end of the war, there were 649 Guinea Pigs. The majority were British, but there were also Canadians, Australians, New Zealanders, Poles, Czechs, French, Americans and even a Russian.

After the war, communications with club members were maintained by the publication of a twice-yearly magazine distributed throughout the world. The club's aim was to ensure that any Guinea Pigs in financial difficulties were assisted. After McIndoe's death, Prince Philip, Duke of Edinburgh became the club's president.

The Guinea Pigs held an annual reunion at East Grinstead, many of them flying from abroad for the weekend which included hospital check-ups, a formal dinner and a darts match.

Sadly, the demise of the club came in 2007. With the youngest Guinea Pig aged 82 and the oldest 102, it was felt the time was right to end the gatherings. On 6 November 2007, the 66th and final dinner was held for 60 of the original 649 members at the Felbridge Hotel in East Grinstead in the presence of the club president, Prince Philip. ❖

Ken Wright

The author wishes to thank E.R. Mayhew for her invaluable help and permission to use material from her book, Reconstruction of Warriors.

THE GUINEA PIG ANTHEM

*We are McIndoe's army,
we are his guinea pigs,
With dermatomes and pedicles,
glass eyes, false teeth and wigs.
And when we get our discharge,
we'll shout with all our might;
'Per ardua ad astra'
we'd rather drink than fight*

John Hunter runs the gas works,
Ross Tilley wields the knife,
And if they are not careful,
they'll have your flaming life.*

*So, Guinea Pigs stand ready,
for all your surgeons calls;
and if their hands aren't steady,
they'll whip off both your ears.*

*We've had some mad Australians,
some French, some Czechs, some Poles,
we've even had Yankees,
God bless their precious souls.*

*While as for the Canadians –
Ab! That's a different thing,
They couldn't stand our accent,
and built a separate wing.*

**Chief anaesthetist*

FLYING LOW



A QUEENSLAND TOWN REMEMBERS A YOUNG RAAF PILOT, 78 YEARS AFTER HIS TRAGIC DEATH.



ABOVE No.5 Squadron Boomerang and Wirraway aircraft lined up on the tarmac during an army air co-operation exercise, Mareeba Aerodrome, 21 July 1944.



ON 5 NOVEMBER 1944, Flying Officer Robert John Granger attached to No.5 Squadron RAAF departed Mareeba Airfield at 2.15pm

flying Boomerang MK.11 Serial A46-192. Briefed by Captain J. Excell of the 46th Australian Air Liaison Section, he was to carry out a tactical reconnaissance flight in and around the small Queensland township of Mount Molloy, to ascertain if the road was suitable for heavy transport, paying particular attention to bridges. The exercise was to be carried out at a minimum height of 200 feet above ground level.

During the flight, the aircraft was observed by witnesses making runs over the township and the surrounding area. At about 2.45pm, it was seen attempting to

climb over a far range of hills. It was then lost to sight and almost immediately a cloud of thick black smoke appeared.

Having observed the crash, Constable William Crossley Jenkin, stationed at Mount Molloy Police Station, rode a horse to the crash site where he found the plane burning. He was initially unable to approach due to intense heat and exploding ammunition. When the explosions eased, he and several other men located the remains of FLGOFF Granger.

FLGOFF Granger's funeral took place at the Atherton War Cemetery on 7 November 1944. He was 23 years of age.

COURT OF ENQUIRY

On 27 November 1944, an official Court of Enquiry was conducted by Squadron

Leader P.S.K. Ashton. The enquiry received detailed accounts of the events before and after the tragic loss of FLGOFF Granger and Boomerang A46-192.

Flight Lieutenant Charles Henry Ryder, Cypher Officer, attached to No.5 Squadron RAAF Mareeba had surveyed the crash scene and the aircraft shortly after the crash and reported that the wing tip of the plane had hit the top of a tall pine tree. Thrown off course, the pilot had then flown through several trees, ultimately colliding with a large fig tree which snapped off at approximately 18m and fell over the engine and cockpit, killing the pilot. According to observers, the aircraft had carried the tree 20-35m before plunging into the gorge in flames. The altimeter reading showed 600 feet and the clock had stopped at 14.44 hours. Logbook examination indicated the aircraft was serviceable.

The Court of Enquiry found that FLGOFF Granger lacked experience for the type of flying required in Army Co-operative work, after just three hours of low-flying practice during his Fighter Course.

The enquiry concluded that the pilot had flown into a tree while flying upwind, up a steep narrow gorge. The possible cause, down draught of katabatic wind. It was recommended that pilots posted to that type of unit have at least 500 hours experience and be warned of the danger of meeting the down draught of a katabatic wind when flying upwind in a gully.

A SHORT LIFE

Robert John Granger was born on 9 March 1921 in Footscray, Maribyrnong City, Victoria. Prior to enlistment, Robert worked as a clerk within the, Union Insurance Society of Canton Ltd, Melbourne. He then served with the 58/59th Australian Infantry Battalion as a Corporal from August 1941 to February 1943, before joining the RAAF.

On 25 February 1943, aged 21, Robert enlisted as aircrew and posted to No.1 Initial Training School at Somers, Westernport Bay in late April. He was promoted to Leading Aircraftman in July and posted to No.11 Elementary Flying Training School at Benalla, Victoria where he trained primarily in Tiger Moth aircraft.

In late October 1943, he posted to No.5 Service Flying Training School at Uranquinty, NSW, where he completed his




pilot training in April 1944, attaining the rank of Pilot Officer. He posted to No.3 Wireless Air Gunners School, then to 1 School Army Co-op to complete the No.29 Army Co-Operation Course before posting to No.2 Operational Training Unit, Mildura in late June. Robert was attached to No.33 Fighter Course in August 1944.

On 10 September 1944, he posted to 1 Reserve Personnel Pool based at Aitkenvale, Townsville, Qld before being assigned to flying duties with No.5 Squadron Mareeba on 27 September 1944. He was promoted to Flying Officer on 9 October 1944.

MOUNT MOLLOY REMEMBERS

On Saturday 5 November 2022, 62 people gathered at the Mount Molloy RSL Memorial to attend an official service dedicated to FLGOFF Robert John Granger – 78 years after his death.

After the service, President of the Mount Molloy RSL Sub-Branch, Kerrie Pashen and Group Captain David Turner unveiled a bronzed plaque in honour of FLGOFF Granger and wreaths were laid to remember and honour his sacrifice. 

Michael Musemeci



ABOVE The official plaque dedicated to FLGOFF Granger at Mount Molloy, Qld.



ABOVE Boomerang Serial A46-192 on the left.



BELOW Boomerang A46-192.

BOTTOM Pilot Officer Robert John Granger.



THE ROAR OF VINTAGE

ENGINES



WORDS Michael Nelmes;
PHOTOS courtesy of NAHC

WHILE THE TOWN OF NHILL IN WESTERN VICTORIA HAS SEEN SEVERAL AVIATION FIRSTS, ITS AVIATION HERITAGE CENTRE FOCUSES ON WWII WHEN TWO AIRCREW SCHOOLS USED THE AERODROME.



THE TOWN OF NHILL, in the Wimmera region of western Victoria, has an unusual claim to fame: a crater on the planet Mars is named after it. It can also claim some state aviation firsts.

In 1920, a few months after the first aircraft landed on the town's racecourse to take joy flights for the extravagant sum of £3 for a brief 'flip', Nhill was the first regional Victorian town to receive airmail – in those days the mail was simply dropped from the aircraft. Sir Ross Smith's famous crew threw an aerogram letter, addressed to the Nhill Free Press, from their Vimy biplane as they passed overhead between Melbourne and Adelaide.

It was another four years before Nhill became the first town in inland Victoria with an officially designated airfield. Bert Hinkler, Amy Johnson, Charles Kingsford Smith and Nancy Bird were among the famous aviators who landed there. And in 1930, thanks to its location halfway between Adelaide and Melbourne, it became a stopover on an airline service between the two cities.

However, it is the early 1940s, specifically World War II, that is the main focus of the Nhill Aviation Heritage Centre (NAHC). Located at the aerodrome just north of the town, the centre has been a hive of activity since its establishment 15 years ago. Volunteers took on the mammoth task of restoring an Avro Anson reconnaissance/bombing trainer (still ongoing) and a Link Trainer flight simulator, completed in 2020. The other aircraft on show are an airworthy Tiger Moth, a 1930s de Soutter, and a Wirraway, which was flown in from Tyabb in 2018.

NHILL'S WARTIME STORY

In 1940-41, the Australian landscape was transformed by history's largest aircrew training program, the worldwide Empire Air Training Scheme. Commonwealth countries each committed to train thousands of aircrew to help Britain win the war against Germany. In Australia, airfields and



schools were established in every state, often in rural settings. Schools for initial training, elementary and advanced flying, navigation, bombing, reconnaissance, wireless operation and air gunnery, as well as operational training units for conversion onto operational aircraft types, taught aircrew their various musterings. Schools for ground personnel, including women, taught the full gamut of technical and other support trades.

For two years from September 1941, No.2 Air Navigation School at Nhill Aerodrome trained 2,000 young men in the art of navigation before they were posted around the world for wartime service.

Then on 8 December 1941, the day (in Australia's time zone) of the Japanese attack on Pearl Harbor, No.1 Operational Training Unit was formed in Nhill as a school for multi-engined aircraft crews using Hudson and Beaufort bombers, and Oxford and Anson trainers. After six months the school moved to Bairnsdale and, later, East Sale. Between the two schools, an estimated 10,000 wartime personnel passed through Nhill air station before the aerodrome's RAAF era ended with disbandment of its Care and Maintenance Unit in 1946.



TOP Airco DH.6, the first aircraft to land at Nhill showground in 1919.

ABOVE Training and accommodation huts at RAAF Station Nhill, 1941.



OPPOSITE The Avro Anson restoration project.



TOP NAHC's airworthy Wirraway during an engine run.

ABOVE The Tiger Moth trainer.



LEFT Paul Bennet performing low-level aerobatics at the Nhill Airshow .



LEFT NAHC's Link Trainer, an early US flight simulator used for pilot training at Nhill and other RAAF stations.

THE HERITAGE CENTRE

The NAHC was formed in 2008 to highlight Nhill's significant aviation story. The following year, the remains of an Avro Anson fuselage, serial W2364, were transported from Graham Drage's farm shed at nearby Warracknabeal to Mike Kingwill's Nhill workshop for restoration.

Restoration of a pre-war 'aeradio' wireless communications building, the only remaining example of 19 such facilities built around Australia to support air navigation training, began in 2011. Then in 2015, the first Nhill Airshow attracted 170 aircraft and some 5,000 visitors, helping to put Nhill more firmly back on the aviation map.

NAHC is a not-for-profit organisation run by a team of more than 40 volunteers: board members, weekend tour guides, restoration and maintenance workers, and many more taking on roles for events such as airshows and engine-running display days.

The displays feature photos and memorabilia in addition to the aircraft, and visitors can also walk a 1.4km heritage trail through the wartime site, with explanatory notices at some 40 points of interest including the historic aeradio building. Visitors can imagine the sounds of those now far-off days: the crunching of boots on the parade ground, the chatter of aspiring airmen and women as they set their sights on defending the Empire, and the roar of aircraft engines. On 'start-up days', you don't have to imagine the engine sounds.

NAHC made national news in 2018 when its CAC Wirraway trainer (RAAF serial A20-722) landed at Nhill Aerodrome for permanent display. Its owner, aircraft engineer Borg Sorensen, had spent 18 years sourcing parts and restoring the aircraft – one of only five airworthy Wirraways in the world – and another 16 years flying it. The small town had raised a remarkable \$300,000 to buy it – still only half its market value.

START-UP DAY 2021

A much-anticipated event on the Nhill calendar is the day the aircraft engines are brought to life. On Saturday 10 April 2021, the Anson's engines were first started after their fitment into the aircraft. All eyes were on the aircraft, well into its restoration though still without its port wing.

Brian Creek climbed into the cockpit to work the controls. The propellers were pulled through, and then the crank handles laboriously turned. Finally, much to the

delight of onlookers, the two Armstrong Siddeley Cheetah 9 engines roared into life in clouds of smoke. It was a major achievement after 11 years of dogged determination and hard work by Mick Kingwill, Len Creek, Wimpey Reichelt and others. (You can follow the story of the Anson restoration on the website, nhillaviationheritagecentre.com.au, via a newsletter archive.)

The Tiger Moth and Wirraway engines also sprang to life, while Brian Farmers gave a running commentary on each aircraft's history. Due to windy conditions the de Soutter, Nhill's first locally owned aircraft, remained hangared, but a restored Gypsy four-cylinder in-line motor was started in its place. Tractors from the Nhill Vintage Machinery Club were on show, and their start-up procedures were also demonstrated. Onlookers waited in suspense as engines were primed, flywheels and crank handles turned, and blowtorches or gas cartridges applied as each coughed into life in a cloud of smoke. Nowadays, a simple key will start an engine.

Vintage model aeroplanes were started, as were a whole row of Harley Davidson motorcycles. Daryl Meek brought a pristine 1936 Bugatti racing car to be started, while vintage Army trucks and classic cars were on display. The Country Fire Authority demonstrated its fire-fighting capabilities, and the whole program was repeated in the afternoon, allowing more people to enjoy the demonstrations.

The next Nhill Airshow, organised by Paul Bennet Airshows and also featuring much ground entertainment, is planned for Saturday 13 April 2024, see nhillaviationheritagecentre.com.au for details.

VISITOR INFORMATION

The heritage centre is open on weekends and public holidays from 10am-4pm, and visits can also be arranged during the week (ph 0490 657770, email admin@nhillaviationheritagecentre.com.au). Entry fee is \$10 or \$8 for seniors/concession; free for children, students and members. Free onsite motorhome camping is available. 

*With thanks to Jenny Creek
(Asst Secretary, NAHC)*



Scan the QR code to watch a one-minute video the Anson's engines running on start-up day 2021.

RAAF SCHOOLS AND TRAINING UNITS, 1939-1945

AIRCREW TRAINING

- INITIAL TRAINING SCHOOLS
 - 1 ITS Somers Vic
 - 2 ITS Bradfield Park NSW
 - 3 ITS Sandgate/Amberley/Kingaroy Qld
 - 4 ITS Victor Harbor SA
 - 5 ITS Pearce WA
 - 6 ITS Bradfield Park NSW
- ELEMENTARY FLYING TRAINING SCHOOLS
 - 1 EFTS Parafield SA/Tamworth NSW
 - 2 EFTS Archerfield Qld
 - 3 EFTS Essendon Vic
 - 4 EFTS Mascot NSW
 - 5 EFTS Narromine NSW
 - 6 EFTS Tamworth NSW
 - 7 EFTS Western Junction Tas
 - 8 EFTS Narrandera NSW
 - 9 EFTS Cunderdin WA
 - 10 EFTS Temora NSW
 - 11 EFTS Benalla Vic
 - 12 EFTS Bundaberg/Lowood Qld
- SERVICE FLYING TRAINING SCHOOLS
 - 1 SFTS Point Cook Vic
 - 2 SFTS Forest Hill NSW
 - 3 SFTS Amberley Qld
 - 4 SFTS Geraldton WA
 - 5 SFTS Uranquinty NSW
 - 6 SFTS Mallala SA
 - 7 SFTS Deniliquin NSW
 - 8 SFTS Bundaberg Qld
- AIR OBSERVER SCHOOLS
 - 1 AOS Cootamundra/Evans Head NSW
 - 2 AOS Mt Gambier SA
 - 3 AOS Port Pirie SA
- AIR NAVIGATION SCHOOLS
 - 1 ANS Parkes NSW
 - 2 ANS Mt Gambier SA/Nhill Vic
- WIRELESS AIR GUNNERY SCHOOLS
 - 1 WAGS Ballarat Vic
 - 2 WAGS Parkes NSW
 - 3 WAGS Maryborough Qld
- BOMBING AND GUNNERY SCHOOLS
 - 1 BAGS Evans Head NSW/
 - 2 BAGS Port Pirie SA
 - 3 BAGS West Sale Vic
- AIR GUNNERY SCHOOL
 - West Sale Vic

- CENTRAL GUNNERY SCHOOL
 - Sale Vic/Williamtown NSW/Mildura/
 - Cressy Vic
- OPERATIONAL TRAINING UNITS
 - 1 (Bomber) OTU Nhill/Bairnsdale/East Sale Vic
 - 2 (Fighter) OTU Port Pirie SA/Mildura Vic/ Williamtown NSW
 - 3 (Seaplane) OTU Rathmines NSW
 - 4 OTU Williamtown NSW
 - 5 OTU Forest Hill/Williamtown/Tocumwal NSW
 - 6 (Torpedo) OTU Nowra NSW/Jervis Bay ACT
 - 7 (Heavy bomber) OTU Tocumwal NSW
 - 8 OTU Narromine/Parkes NSW
- CENTRAL FLYING SCHOOL
 - Point Cook Vic/Camden/Tamworth/
 - Parkes NSW
- GENERAL RECONNAISSANCE SCHOOL
 - Point Cook/Laverton/Cressy/
 - Bairnsdale Vic
- RADIO SCHOOL
 - Richmond NSW/Maryborough Qld

TECHNICAL TRAINING FOR GROUND STAFF

- ARMAMENT TRAINING STATION
 - Laverton/Cressy Vic
- ENGINEERING SCHOOL
 - Ascot Vale Vic
- SCHOOLS OF TECHNICAL TRAINING
 - 1 STT Carlton Vic
 - 2 STT Canberra ACT
 - 3 STT Ultimo NSW
 - 4 STT Adelaide SA
 - 5 STT Perth WA
 - 6 STT Hobart Tas
 - 7 STT Geelong Vic
- SCHOOL OF RADIO
 - Ballarat Vic
- SIGNALS SCHOOL
 - Point Cook Vic

WOMEN'S TRAINING

- WAAAF TRAINING DEPOT
 - 1 WTD Geelong/Melbourne Vic
 - 2 WTD Robertson / Bradfield Park NSW
 - 3 WTD Karrinyup WA
 - 4 WTD Bradfield Park / Penrith NSW

WORDS Flight Lieutenant (AAFC) Paul A Rosenzweig OAM



CCPL Chitra Dave holds a Gliding Training School badge, presented to her after flying Balaklava Flight's first Pilot Experience Flight for 2023.

A PASSION FOR FLIGHT

THE GLIDING TRAINING SCHOOL, a subordinate unit of the Australian Air Force Cadets (AAFC) Aviation Operations Wing (AOW), delivers flying pathways through gliding experiences and training using a fleet of DG1000S gliders.

For the start of Balaklava Glider Training Flight's training year, Cadet Corporal Chitra Dave, aged 14, was the first cadet to fly a Pilot Experience Flight (PEX).

CCPL Dave from No.613 Squadron (RAAF Edinburgh) said of her first pilot experience flight: "I'll never get over that first flight feeling. From the moment the aircraft lifted off the ground, to the moment my guts started floating inside of me. I absolutely loved it. The thrill of being able to fly, something others merely dream of."

While she has her eye set on a Defence career, CCPL Dave said: "I'll never forget Balaklava. The winch launches, the feel of thermals against the airframe, the place where my passion for flight began."

Meanwhile, Bathurst Glider Training Flight has continued to offer flying training opportunities to Air Force Cadets in NSW.

Cadet Corporal Zoe Campbell from No.322 (City of Ryde) Squadron based at Timor Barracks in Dundas, NSW, was one of several who attended a glider PEX weekend earlier this year.

During the activity, it was noted that CCPL Campbell demonstrated foresight and initiative in identifying potential aviation hazards, and openly brought them

up during an operational debrief.

In recognition of her contribution to building a positive safety culture, CCPL Campbell was presented with an Aviation Operations Wing Safety Medallion.

The medallions have been introduced by AOW for presentation to a Cadet or trainee assessed to have displayed a significant level of safety practices and knowledge.

Gliding trains pilots to be well coordinated on aircraft controls, and helps them develop in-flight situational awareness and respect for other airspace users.



Scan the QR code for more information on gliding opportunities.



ABOVE CCPL Zoe Campbell receives an Aviation Operations Wing Safety Medallion from FLTL(AAFC) Brad Lochrin, Bathurst Flight's Unit Aviation Safety Officer.

FIRST FOR RICHMOND

RICHMOND FLIGHT of the AAFC Elementary Flying Training School (EFTS), recommenced flying operations late last year.

Flight-Lieutenant Kate Hobson, flying instructor and Deputy Head of Operations-Power for Aviation Operations Wing, reported a particular highlight of the continuation flying weekend: Cadet Corporal Adil Shaikh became the first Cadet from 3 Wing (NSW) to go solo in a Diamond DA40 at RAAF Base Richmond.

CCPL Shaikh has since been promoted to Cadet Sergeant and now holds the position of Cadet Executive Officer at No.338 Squadron (City of Shellharbour). CSGT Shaikh said achieving his first solo flight was an unforgettable experience.

"It was an amazing feeling to know that I was achieving something nobody else had yet had the opportunity to do," he said. "I learned a lot, both about flying and myself. Climbing out of the plane to the cheers of my instructors and friends is something I will never forget."

"Flying is an incredible experience that's hard to put into words. There's a sense of freedom and exhilaration that comes from leaving the ground on take-off. It's a feeling of accomplishment and mastery, as you navigate through the skies and take control of the aircraft."

"The excitement of flying is a unique and unforgettable experience that I feel privileged to have experienced through my involvement in the AAFC."

The EFTS, a subordinate unit of the AAFC's Aviation Operations Wing, has the mission of delivering flying pathways to Cadets through powered flying experiences and training.



Scan the QR code for more information, and to download the AAFC Powered Flying brochure.



PILOT OFFICER (AAFC) MATTHEW DOWS was recently acknowledged for flying his first solo flight.

PLTOFF(AAFC) Dows is the Commanding Officer of No.226 Squadron, Bray Park, Queensland. His recent flying training reached its climax late last year when he gained his recreational pilot's licence. Prior to that, on 10 October 2022, he flew his first solo powered flight in a VH-registered aircraft.

Flying Officer (AAFC) Jack Tautz, Staff Officer Operations with AOW, presented PLTOFF(AAFC) Dows with a well-overdue badge acknowledging his first solo flight (power).



LEFT FLGOFF(AAFC) Jack Tautz (right) presents PLTOFF(AAFC) Dows with a badge acknowledging his first solo flight (power).

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Image: © Hars Aviation Museum



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ON A STORMY WEDNESDAY EVENING IN MARCH, the Australian Air League (AAL) Forest Lake Squadron held its annual Women in Aviation Night.

Each year the squadron is privileged to hear from women in various aviation and aerospace roles, from international airline and domestic pilots, flight-test-systems specialists to loadmasters and engineers, and this year was no different.

The evening got off to a rocky start with a large microburst passing over the airfield. Luckily it cleared within 15 minutes, providing a picturesque backdrop for guests and speakers.

The first speaker was Erin Douglas, a flying instructor at the nearby Redcliffe Airport. Erin was initially fearful of flying, however, she was determined to beat her fear, and after a trial flight, has never looked back. She is now teaching student pilots the art of flying aircraft.

Erin had the cadets enthralled with amazing tales of the many aircraft she has flown in and the multiple jobs she has held across the aviation industry so far. She inspired the cadets to pursue an aviation career, which may not even be the traditional pilot role.

Erin will appear in an upcoming documentary called *Touch the Sky*, which follows eight Australian women overcoming barriers and getting to where they want to be – flying.

Those women include mothers, daughters, influencers and refugees who together share what it takes to overcome internal expectations and external pressures to take to the skies. Some are just beginning their aviation journey while

others are further along, but they all want to encourage more female participation in an industry they have come to love. To learn more about the documentary, visit touchthesky.au.

With the cadets still buzzing from Erin's presentation, they were then joined by SGT Jaci, an Air Movements member with the RAAF.

Jaci explained some of the many tasks that are involved with her job, such as how cargo and passengers are prepared and briefed before a flight, how pallets of cargo are built and weighed, then loaded onto aircraft and communicated to the flight crew who then enter the weights into the aircraft computer and make sure it is all reflected accurately. Jaci also explained how she is responsible for refuelling aircraft, including the C-130 Hercules and C-17 Globemaster.

Some of the more interesting experiences she shared included moving a Role 2 Medical Hospital from Vietnam to South Sudan and loading Australian Army helicopters into the back of a C-17 Globemaster transport to be flown quickly to where they are needed.

The night was rounded off by a presentation by Dr Carmel, a RAAF Aviation Medical Officer.

Dr Carmel discussed the pathway to medicine in the Air Force from her time at school, through her medical training, to practising winching operations off a rescue helicopter and flying with the Roulettes as their doctor and deploying on operations worldwide.

As with previous years, the night was a great success.



ABOVE A brief storm delayed the evening but provided a picturesque backdrop for speakers and guests.



BELOW Air League cadets on parade shortly before the storm interrupted proceedings.



ABOVE Dr Carmel discussed the pathways in medicine with the RAAF.



HOW TO AVOID DEFAULTING ON YOUR HOME LOAN.

IN TIMES OF RISING INTEREST RATES, some borrowers are experiencing cash-flow problems that could lead to defaults on their home loan repayments, which can have serious consequences.

As a general statement, defaulting on a home loan simply means you have missed a loan repayment and haven't corrected the situation quickly. Lenders have different rules relating to defaults. One lender may consider a loan in default when a repayment is overdue at least 90 days, another might specify 60 days.

A relatively minor delay of, say, seven to 14 days is often treated as a 'period of grace' after which late payment fees may be incurred and a late payment recorded on your credit file, which may be a red flag for lenders considering future loan applications.

A default is much more serious. Typically, you will be sent a default notice with a specified period within which you'll be required to bring your payments up to date and pay any late fees. The default will be recorded on your credit file and will almost certainly impact your ability to borrow money or refinance debts for many years.

If you're in a default situation, it's

important to contact the lender to discuss your options. Simply ignoring your financial situation could lead to the repossession of your property. Short of the best option, which is to repay the outstanding amount quickly, other possibilities include negotiating to reduce your loan repayments, delaying enforcement (legal action), or a combination of the two.

TIPS TO AVOID A DEFAULT

- 1 If possible, make a month's payment one month in advance to provide a buffer.
- 2 Contact your lender to discuss your options, which may include temporarily pausing repayments, a review of your major outlays or assistance with budgeting.
- 3 Establish a direct debit arrangement where the repayments are taken out of your account automatically.
- 4 Where you have multiple loans (e.g., car, personal loan and credit cards), talk to your lender about consolidating them under one loan, such as your home loan, with one single payment at a rate that is typically lower than other forms of debt. However, be warned, some debt consolidation arrangements sold by promoters for considerable fees (often called debt agreements) are not what they appear and are typically treated as an act of bankruptcy which may have serious consequences for your credit rating and even your employment.

5 Consider the use of offset accounts and redraw facilities to reduce the pressure, but be aware that using them may lengthen the term and cost of your loan.

6 Talk with your lender or broker about refinancing your current loan into a facility that you can more easily manage. Maybe you can get a better deal elsewhere, so don't be afraid to try. Alternatively, consider restructuring your current loan by extending its term and reducing repayments. But remember that those options can be expensive due to fees/charges and the additional interest incurred over the term of the restructured loan.

GETTING HELP

If you're experiencing financial difficulties, there are free resources available to help you develop strategies to manage your finances. They include the National Debt Helpline (1800 007 007) and Mob Strong Debt Helpline (1800 808 488). You can also source a free financial counsellor through moneysmart.gov.au. Unfortunately, waiting times can be a month or more, so don't leave your approach to a counsellor until the last minute. ❗

Air Commodore Robert M.C. Brown AM FCA (Ret'd). Chartered accountant, financial educator and independent member of the ADF Financial Services Consumer Centre (adfconsumer.gov.au).



GROUP CAPTAIN RONALD GEORGE GREEN AFC

21 November 1930 – 14 March 2023

RON GREEN COMPLETED NO.4 COURSE at the RAAF College in 1954, graduating as a pilot, before completing No.22 Vampire Course on 3 July 1955. He specialised in fighter operations flying Sabre aircraft at various locations in Australia and Malaya until 1961.

He was selected to undertake Empire Test Pilot School in UK 1962, and on successful completion was assigned to the acquisition team for the Mirage IIIO Project, spending six months in France.

After returning to Aircraft Research and Development Unit (ARDU) in 1963, he was involved in the early Mirage trials at Avalon, Victoria. Following the loss of the first instrumented Mirage A3-1 in December 1964, Ron spectacularly saved the only other instrumented aircraft, A3-2, from destruction in April 1965 following an engine failure off the coast south of Avalon. Struggling to reach the airfield, he had to delay lowering the undercarriage until five seconds before touching down 44m short of the runway at Avalon – without damage. After the flight, grass was removed from the afterburner nozzles!

In 1966, Ron was posted to the F-111C Project Office in Washington DC, and attached to the US Air Force (USAF) Flight Test Centre at Edwards Air Force Base, California, for test flying duties for the next four years. In February 1967, he became the first Australian qualified to fly the F-111. Shortly after acceptance of the F-111C by Australia, the aircraft failed fatigue testing and were placed in storage at Fort Worth, Texas, for the next five years, while Ron continued test duties on USAF F-111 aircraft.

From 1970-74, he was responsible for the flight test activities at ARDU. Following a period of staff duties, he returned to command ARDU in 1979 as Group Captain until mid 1983.

Ron resigned from the RAAF in 1984, having acquired broad and extensive experience in all aspects of flight test and evaluation of aircraft and weapon systems.

He was an Associate Fellow Society of Experimental Test Pilots and for his service to the RAAF for test flying duties, Ron was awarded the Air Force Cross.

Source: Fighter Squadrons Branch



WARRANT OFFICER PHILLIP ALAN HARTCHER

29 October 1949 - 17 April 2023

PHIL HARTCHER ENLISTED in the RAAF in 1965 as a 15-year-old apprentice to join No.19 Apprentice Intake, otherwise known as the 'Snails'.

Qualifying as an airframe fitter in 1967, he was posted to Amberley to work on Canberra aircraft for a brief period. That was followed by a posting to No.76 Squadron at RAAF Williamstown, heralding the start of a career working on Mirage aircraft.

A much-cherished posting to No.75 Squadron at RAAF Butterworth, Malaysia in 1972 followed. Phil returned to Australia two years later to continue his work on Mirages, before being transferred to No.2 Operational Conversion Unit to work on Macchi aircraft. A posting to No.3 Aircraft Depot in 1978 was followed with

a refresher period on Mirages at No.77 Squadron before a return to Butterworth with No.75 Squadron in 1979.

With a quick wit, outstanding professional knowledge and an affinity to look after his troops, Phil excelled in the squadron. On return to Australia in 1981, he was posted to No.481 Squadron at Williamstown and spent 12 months at the Search and Rescue Section, operating Huey helicopters.

In 1991, he was promoted to Warrant Officer and posted to Headquarters Support Command as Warrant Officer Engineer for the PC-9 aircraft.

Phil resigned from the Air Force in 1993, after a rewarding career, working predominantly on Mirage aircraft.



REVIEW BY Bob Treloar

THE CLASSIC: F/A-18A/B Hornet Aircraft in Australian Service

By **JOHN QUAIFE**,
Big Sky Publishing and RAAF History and Heritage; RRP \$29.99

THE F/A-18A/B HORNET was introduced into RAAF service in May 1985 to replace the French Mirage IIIO, a short-range interceptor. It was a tactical fighter aircraft, designed to fight and survive in the air combat arena. With a simple cockpit switch change, it was also a very capable ground attack aircraft.

John Quaife, a former Classic pilot, has meticulously covered the history of the aircraft and its development, operations, the aircrew who flew them and the technical personnel who maintained them. Woven into the history is the story of those people who took the aircraft to war several times at the direction of our government.

The author describes the full spectrum of air combat operations flown by Australian F/A-18 pilots during the short, sharp campaign against Iraq's Saddam Hussein regime. He also explains the tedium of delivering smart weapons on an airborne 'conveyor-belt' system established by the coalition for more than three years of strike operations against ISIS in Iraq and Syria.

Associated with the challenges faced by the pilots – demanding rules of engagement and the difficulties of operating in a foreign environment amongst a multitude of foreign aircraft operating in a cramped airspace – the concerns, tension and excitement experienced by the aircrew in combat are captured.

The reader is provided with an excellent description of the aircraft, its systems and its capabilities in an easy-to-follow narrative, aligning the reader with a pilot's perspective from the cockpit. As with the rest of the book, the explanations are straight forward, catering for those not familiar with the aircraft or its systems. *the Classic* will stand the test of time as a hallmark publication of the RAAF Hornet.



REVIEW BY Bob Treloar

THE RAG TAG FLEET: The Unknown Story of the Australian Men and Boats that Helped Win the War in the Pacific

By **IAN W. SHAW**
Hatchette Australia, Sydney; RRP \$34.99

THE RAG TAG FLEET recounts the development and sustainment of a logistics support organisation of Australian fishing boats and sailors pressed into service by the US Army in April 1942. The sailors were all volunteers who, for one reason or other, were not eligible for military service.

The concept evolved from approaches to President Roosevelt by American brothers Bruce and Sheridan Fahnestock, adventurers with experience of the maritime environment of the South West Pacific. Sheridan accepted a US Army task, Mission X, to assemble a small-boats operation to ply the waters to the north of Australia. The operation became the Small Ships Section of the Water Branch of the US Army Transport Service.

The first operational venture was support to Allied forces at Milne Bay, the first ship arriving as the Japanese lodged troops in the region. Despite a lack of charts and local knowledge of the northern waters, the small ships subsequently ventured around the eastern tip of New Guinea to establish a supply line to support the land forces during the battle for Buna.

The Rag Tag Fleet is well written and provides a fitting tribute to the unsung heroes who manned the US Small Ships Section, of whom only a handful survive.

The book is well indexed, with good end notes. There are a few photographs of the men and ships which serve to illustrate the size and variety of vessels used. While there are a couple of maps that provide an overview of the operations, larger scale maps identifying the places of interest along the northern coastline of New Guinea would make it much easier for the reader to follow the activity of the small ships' operations.



REVIEW BY Michel Nelmes

HOLIDAYING ON THE CONTINENT: The Journey of an RAAF Volunteer 1940-45 – 460 RAAF Squadron

By **RICHARD MUNRO**
Australian Military History Publications (2009); \$22-\$33

AN ESTIMATED 10,000 Australians who volunteered for RAAF service were sent to the UK and Bomber Command, the arm of the Royal Air Force tasked with destroying German industrial capability and morale.

The Aussies suffered a 44 percent death rate overall, and even higher rates during the worst periods. One sobering statistic quoted in the book is that 460 Squadron alone lost, in three years, more men than the entire ADF lost in either the Korean or Vietnam wars.

One of those who survived by sheer good fortune was the author's father, Jim Munro. A trainee pilot who was 'scrubbed' and remustered as a navigator, Jim flew on 11 night bombing raids in Avro Lancasters with 460 Squadron. On his last, over Berlin on 23-24 August 1943, he was shot down on Bomber Command's worst night to date; 62 bombers were lost to German fighters, anti-aircraft fire and accidents. Four of his six crewmates were killed when the Lancaster exploded, but Jim parachuted safely to be taken as a prisoner of war to Stalag IVB.

In a letter home he referred to the atrocious conditions of his captivity – including near starvation and freezing temperatures – with dark Aussie humour as "holidaying on the continent."

Richard Munro, a driving force in the 460 Squadron Veterans & Friends Group, details his father's life story through the firsthand lens of letters, diaries and official documents. With a focus on his father's personal life through his RAAF service and captivity, it is a very human story. It is also well illustrated with photographs, letters, drawings and newspaper articles.

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ASSOCIATE PROFESSOR (GROUP CAPTAIN) NORTON DUCKMANTON OAM, RFD

12 November 1925 - 4 February 2023

BORN IN 1925, Norton was raised in humble beginnings on a dairy farm in the Clare Valley, South Australia. He left home at 15, to work in a foundry in Adelaide, living with his grandfather until joining the Air Force at 18. He was selected for Navigator training, graduating in early 1944 as a navigator and wireless operator and was assigned to No.93 Squadron flying Bristol Beaufighters on ground attack and antishipping operations, serving in Borneo until the end of WWII.

On 14 August 1945, his aircraft was to be the third on a sortie to attack a heavily fortified land-based naval gun. As the raid was scheduled for mid-morning,

the defenders would know the position of the attacking aircraft after the first pass and Norton knew that, as he was in the third aircraft, the defenders would anticipate his attack and he was unlikely to survive the mission. As the target was reached, he received a morse code message to return to base as hostilities would cease at noon and the war in the Pacific was over.

Norton served as part of the British Commonwealth Occupation Forces in Japan based at Bofu and, in Hiroshima in March 1946, he saw first-hand the effects of nuclear war. He was discharged in 1946 with the rank of Warrant Officer.


After the war, Norton was put through matriculation under the Reconstruction Scheme and subsequently studied dentistry. He joined the Citizen Air Force as a Flight Lieutenant Dental Officer in 1952, was promoted to Wing Commander in 1973, and subsequently Group Captain in 1977. He served as a dental officer at RAAF Williamtown and later with No.22 Squadron at RAAF Richmond

before retiring from the Air Force Specialist Reserve.

In 2007, he was awarded the Medal in the in the General Division of the Order of Australia for services to veterans and their families, and to dentistry as a practitioner and educator in the area of prosthodontics.

Norton was one of the last remaining WWII aircrew who served in the Pacific campaign.



 **ABOVE** FLT SGT Duckmanton, second from right, Labuan, Borneo.

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AIR FORCE ASSOCIATION