DEFENCE FLIGHT SAFETY BUREAU
DFSB

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Spotlight

AVIATION SAFETY
from far and wide

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FOREWORD

WELCOME TO THE second edition of *Spotlight* for 2024. This edition covers a broad range of aviation safety subjects, including the practical application of non-technical skills, critical thinking and problem solving, situational awareness (SA) and emergency-response planning and rehearsal.

The topics of self-awareness of impediments to safety performance, and speaking up and asserting when the situation does not appear normal are also explored. In many respects, the articles highlight lessons and observations from events where there was either recognition of decreasing SA, or it was regained before a more serious consequence eventuated.

SA can be degraded by threats such as high workload, information overload, prolonged monitoring of repetitive tasks and distraction from the task-at-hand. It can also be impacted by insufficient or poor communication, stress and fatigue, cultural and organisational norms, and confirmation bias. The outcomes of recent Defence Aviation near-miss investigations continue to highlight that the transition from apparent high levels of SA to that of complete loss of SA (often referred to as when the 'SA bubble bursts') can occur over a very brief period of time.

In the Defence Aviation context, and cognisant of the unique nature of military aviation operations, rebuilding SA and recovering the 'big picture' before the SA bubble bursts is at the very heart of Defence Aviation's system of education, graduated approaches to training, building of experience commensurate with the complexity of operations, supervision, authorisation and aviation risk management.

One aspect of aviation risk management that is often not well understood is how to analyse the point in time where satisfactory control over an aviation hazard (an activity, condition or object) could be lost. That is, the Top Event or Trigger Event that could lead to a risk consequence that directly results in an accident outcome (loss, damage and/or injuries). Serious aviation events are often described in terms such as 'loss of spatial awareness (the Top Event) leading to a near collision (the Consequence)'.

Analysis of threats to the Top Event requires experience and the application of organisational learning to fully appreciate why or how the Top Event could occur. Articulation of controls to prevent/eliminate the Top Event, recovery controls to stop the consequence from occurring and/or to mitigate the severity of the consequence, is the key to enable development of orders, instructions and publications (OIP).

OIP is the basis on which organisations document and standardise preventative and recovery risk controls. Experience shows that organisations with exemplary safety records have clearly defined processes and closed-loops systems for hazard identification and analysis. These organisations clearly articulate Top Events, independently assure the effectiveness of preventative and recovery risk controls, and document traceability to OIP within organisational aviation risk management artefacts.

I encourage supervisors, managers and operational staff to invest time to review your organisation's policy, procedures and processes upon which the foundations of aviation risk management and OIP are built. Developing your own awareness and understanding of the key Top Events within the context of your aviation operation may provide valuable insights as to how to recognise and prevent loss of SA.

Very respectfully,

GPCAPT David Smith
Director DFSB

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Above all, beware

Your choice: cultivate this so-called 'soft' skill or expose yourself to hard consequences

By Kreisha Ballantyne

RESEARCHING THIS ARTICLE, I came across the website FairyGodBoss which declared: 'Forget hard skills! This number one soft skill will get you the job!'

The number one soft skill? Situational awareness. According to the site, 'soft skills' are critical thinking, organisation and problem solving. Situational awareness sits in this skill set and is a learned technique that is essential for those acting in a role where factors are constantly changing. I have only one quibble: soft hardly seems the right word for such a fundamental skill.

As you might expect, aviation was listed as the number one career for which situational awareness is an essential skill. Human error is the primary cause of general aviation accidents, from fuel issues to flight into terrain to weather accidents – the phrase 'loss of situational awareness' is a frequent feature in ATSB aviation accident reports.

What is situational awareness?

In simple terms, situational awareness is being aware of what is happening around you in the context of where you are, where you are supposed to be and whether anyone or anything around you is a threat to your health and safety.

For a pilot, situational awareness means having a mental picture of the existing inter-relationship of location, flight conditions, configuration and energy state of your aircraft, as well as any other factors that could affect its safety, such as proximate terrain, obstructions, airspace reservations and weather systems (Skybrary online).

According to research conducted by Mica Endersley, a leading expert on situational awareness and former Chief Scientist of the United States Air Force, the three key elements are:

- perception
- understanding
- projection.

Perception

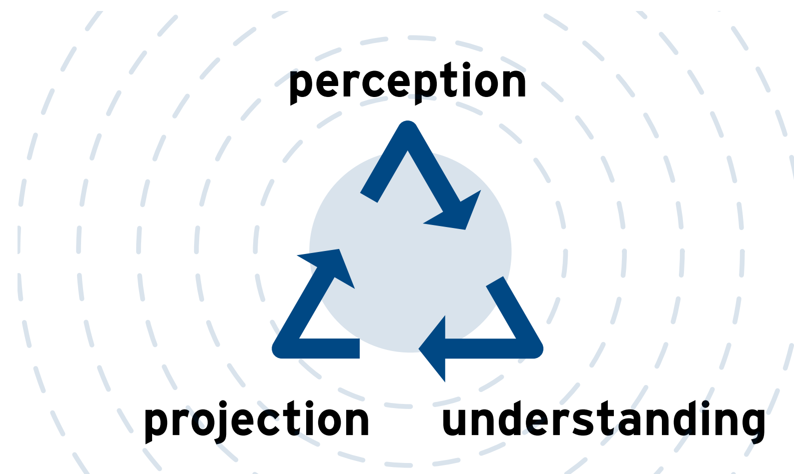
Perception is achieved as a result of data. This is the information absorbed about your surroundings, both inside the aircraft and out: the data from your flight deck/electronic flight bag (EFB) – airspeed, engine monitoring, position, traffic; from your radio – whereabouts of other aircraft, changes in weather, clearances; from outside the aircraft – weather, conditions at the airport and other traffic sighted visually.

Understanding

Our observations are used to build a visual picture of our surroundings which is added to our experiences and knowledge stored in our memory. By this method, we build a mental model of our situation, which is constantly updated. For example, in receiving a weather update inbound for an airport and discovering the wind has a crosswind component of 20 kts, we may fly overhead and check the windsock.

Projection

Having built up a picture of what to expect, we combine information and experience to formulate a potential plan, in this case to land elsewhere, if what we see is confirmed by what we heard and knowing 20 kts is above the crosswind capability of our aircraft.



How is situational awareness compromised?

A loss of situational awareness is generally reflected by being caught unawares. It's a typical flaw of being a human – tiredness, distraction, poor communication, stress. These are often caused by being overloaded, which in turn is caused by a pile-on of events such as poor weather, high workload and time pressures.

Warning signs that your situational awareness is starting to degrade include:

- **memory degradation:** for example, not remembering whether you've asked for clearance or changed a tank
- **confusion:** about where you are, what you're doing or what you're hearing/reading
- **too much head-down time:** in an attempt to 'pull things together', it's easy to focus on one thing, such as your maps or EFB, to the exclusion of visual/aural tasks
- **non-compliance:** descending below minimums, incorrect altitude for top of descent, incorrect approach speed, forgetting a radio call.

Basically, if you're behind the aircraft and are feeling an uncomfortable level of stress and discomfort, it's likely your situational awareness is compromised.

How is situational awareness restored?

For all skills, soft or not, practice is vital. Building situational awareness begins as part of learning to fly, but maintaining it is a life-long habit. Planning ahead is an important part of developing and maintaining excellent situational awareness skills. As Louis Pasteur said, 'Fortune favours a well-planned mind.'

Know yourself and what works for you and your particular strengths and weaknesses. If radio calls are your downfall, have a written script in preparation for your calls. If your memory skills aren't what they once were, set alarms to remind you to change tanks.

Remember the golden rule of 'aviate, navigate, communicate'; avoid fixating on one problem and always make sure you're not behind the aircraft.

And, if something feels wrong, that's because it is wrong. Never be afraid to ask for help.

Published courtesy of *Flight Safety Australia*

A leak in fuel checks

By CPL Matthew Bezett

Many factors within the safety realm come into effect in a scenario like this; everything needs to be considered to prevent future recurrence.

I WAS PART OF the return-to-Australia crew flying back to RAAF Richmond via Port Moresby after spending most of July in Guam for Exercise Mobility Guardian 23.

We had to decide as a crew whether we were going to press for Port Moresby or return to Anderson Air Force Base after we had realised that a tow motor, which was loaded on board, was leaking fuel.

I noticed the smell immediately after take-off. We quickly had to make a decision on whether the fuel vapours were strong enough to initiate the fire/smoke/fumes emergency checklist, or if it wasn't warranted, after we had cleaned the leak up.

Reflecting on various aviation safety reports and discussing them between personnel within the workplace, one glaring detail is evident – there is often never complete agreement or disagreement regarding the actions of the crew. When these discussions happen, we tend to think about what we would do personally if we were to put ourselves in their shoes, contemplating how we would do it better.

It's imperative to understand that not everyone will have the same thought process, but instincts and training should naturally come into play. The objective should always be to employ logic with our actions to achieve a safe and mutual result, minimising the risk of mild or catastrophic outcomes in the process. It's always beneficial to ask yourself – what would you do?

The tow motor was incorrectly declared as being less than three quarters full with fuel, and within limitations for flight. Therefore, the aircrew was provided with an inaccurate technical preparation certificate for the vehicle, as it was in fact over three quarters full. Although it was challenged by a loadmaster prior to loading the vehicle, when they realised the fuel gauge indicated it was nearly full, the aircrew was reassured by the preparation personnel the fuel gauge was faulty, and the fuel amount declared was indeed correct. Do you see a potential problem here? Swiss cheese? Holes in the system?

Skip forward two days, immediately after take-off, the loadmasters realised the tow motor was leaking fuel. After cleaning the site and temporarily stopping the leak, the aircrew had to decide whether to continue to Port Moresby or return to Guam on oxygen, due to exposure to fuel. The crew elected to continue, after agreeing that the fuel vapours hadn't exacerbated exposure. The nature of the leak was minor, and the emergency checklist wasn't required.

Many factors within the safety realm come into effect in a scenario like this; everything needs to be considered to prevent future recurrence. Was there organisational pressure to get the aircraft back to Richmond? What risk controls were implemented? Did local conditions influence personnel to operate a certain way – to provide incorrect information? Would the crew actions be supported?

The lead up to this event validates the idea of the Swiss Cheese Model and how several holes can lead to a control breaking down within the safety system, with high emphasis perhaps on culture. It also allows people to think about what they would do in a similar scenario. Through partial agreement/disagreement, one would say that another crew may have acted differently, or themselves as an individual, for that matter.

With respect to the scenario discussed, several holes within the system exposed the aircrew to a potential emergency, which could have led to a negative outcome. On that particular day, we made decisions we believed were appropriate for the tricky scenario that we faced.

When you learn about the contributing factors, you realise that this could have been avoided or resolved before the aircraft had taken off, much like a high percentage of other incidents within aviation.

Fire flight

By Leonie Gall

FOR FLTLT ASHLEA Waight (now SQNLDR), 27 January 2018 started out pretty much like any other Saturday morning on Nellis Air Force Base (AFB), Nevada, USA. This engineer was 'sitting in a little concrete room with no windows, essentially a bunker,' in the Las Vegas deploy area, with the CAMM2 Data Manager. Outside, two of three Australian aircraft had taken off for range familiarisation flights in their very first Vegas mission as part of Exercise Red Flag.

Ashlea recalls that on the day, most of the other technicians and people who were working were watching the aircraft take off. 'It wasn't just our aircraft taking off at that time, there was also a bunch of American and Euro-fighters from the British,' Ashlea says.

At around 1045, things got interesting. 'A sergeant came inside and said, "Hey ma'am, the plane's on fire!"' she says. 'I thought, "Oh god, I have to do things." I never actually asked him if he was joking; I didn't know if it was a joke, because the guy who came in is quite

Investigation re-cap

A RAAF EA-18G Growler, departing from Nellis Air Force Base (AFB), Nevada, USA, on 27 January 2018, experienced an uncontained engine failure during the latter stages of its take-off roll. As the aircraft approached rotation speed – about 140 knots indicated air speed (KIAS) – the ballistic material failure of the right-hand engine caused the almost simultaneous failure of the left-hand engine.

Faced with a resultant fuel/airframe fire and a marked increase in vibration and ambient noise level, the two aircrew enacted their emergency actions for multiple major malfunctions. About four seconds after the failure of both engines, the aircraft suffered the loss of all generated electrical systems, which disabled, among others, the majority of cockpit digital indicators (providing the aircrew with the warnings and the performance status of failing aircraft systems) and anti-skid braking.

During emergency (system) braking both the left and right main undercarriage tyres burst, severing the hydraulic line that serves the left-hand undercarriage brake. Throughout, the Pilot attempted to keep the aircraft on the runway using a combination of differential braking (from a dissipating hydraulic system) and aerodynamic/physical drag.

Approaching the runway's first arresting barrier, the aircraft departed the prepared surface to the right, at about 8400 ft (of a 10,000 ft runway). Remaining upright and influenced by the additional drag of the sand, the aircraft slowed and yawed left (back through the runway heading) before coming to rest on an adjoining runway intersection, marginally right of the runway in use, 9100 ft from the initial departure point.

Confronted by a significant fuel/airframe fire, the aircrew made a rapid manual escape from the cockpit, gathering at a safe point upwind of the aircraft.

The Pilot was later treated for smoke inhalation, while the Electronic Warfare Officer remained physically unharmed (save some bruising).

The loss of frame was classified as an accident, which triggered the formation and dispatch of a then-named Defence Aviation and Air Force Safety (DDAAFS)[1] Aviation Accident Investigation Team (AAIT) to the USA.

Aircraft fragments recovered at the scene of the accident indicated that the right-hand engine of the Growler had suffered an uncontained failure of the first-stage fan disc, which instigated the accident chain of events.

The AAIT undertook a comprehensive investigation into the causal factors behind the failure of the first-stage fan disc. In parallel, the AAIT also analysed potential contributing factors to the accident sequence and all associated human and aviation medical factors before, during and after the event. During the investigation, the AAIT made use of the engine's original equipment manufacturer (OEM) specialist facilities, proprietary information, operator and engineering subject matter experts (SMEs), computer-based training and aircraft simulation.

Endnotes

1. Rebranded the Defence Flight Safety Bureau in August 2018

dry and not the most expressive. So I couldn't tell if he was being serious or trying to make a really poorly executed joke.'

Ashlea soon discovered the sergeant was indeed serious. A 6 Squadron EA-18G Growler had experienced an uncontained F414 engine failure during the end states of its take-off roll. At about 140 knots indicated air speed (KIAS), the ballistic material failure of the right-hand engine caused the almost simultaneous failure of the left-hand engine. It also caused a range of major malfunctions and a fierce fuel/airframe fire.

Confronted by the fire, the aircrew quickly escaped the cockpit, gathering at a safe point upwind of the aircraft. As the Flight Line Maintenance Officer, Ashlea sprang into action. 'We had some procedures we had to follow,' she says. 'One of the first things we did was a strip clearance. A bunch of the technicians qualified on the platform, they go out to the runway to potentially assist with towing it or as a basic emergency response.'

In this case, because the aircraft was on fire, the 'firies' were responding. There was little the technicians could do at that point, so they sat and watched the unfolding emergency. Ashlea coordinated the quarantine of all toolkits, any equipment that had been attached to the aircraft that day and all of the CAMM2 records. 'I wouldn't say I personally did all these actions, but I was a "coordinator" of actions,' Ashlea says.

Making things slightly more complicated were the different methods United States Air Force personnel followed post event. For example, they wanted to conduct blood drug-and-alcohol tests on anyone who had touched the aircraft's maintenance data or the aircraft itself, that day. 'It isn't the way we do

drug-and-alcohol testing in Australia, we do it via a urine test,' Ashlea says. 'We actually had our urine testing kit with us in America (for potential random testing, as required). One of my other secondary duties in the squadron was as a drug-and-alcohol tester.'

The team had prepared the majority of the maintenance the day before. So the only person who'd actually touched the aircraft physically that day, was the technician who released it, and who'd done the pre-flight inspection. 'They only wanted him tested,' Ashlea says. 'He was quite shaken and scared that he'd missed something. We were trying not to add to his emotional stress, so we decided we would test everyone who was involved in the process.'

They tested Ashlea, because she'd signed off on some of the paperwork, and the Desk Sergeant, who coordinated the paperwork in CAMM2 for the aircraft's release. 'I was the first to be tested, because I had to explain to the testers how to conduct the test,' Ashlea says. '... it was a bit of an interesting process teaching someone how to test me.'

The situation with the drug-and-alcohol testing wasn't the only unprecedented aspect of this accident for the Australian personnel. Ashlea says because it had been so long since [such a serious] accident had occurred in the Air Force, there wasn't a tried and true system for how to handle it.

The squadron had only really done desktop exercises covering immediate response, after the first couple of hours of an incident or accident.

'It wasn't just, "The aircraft is on fire; the aircraft is now completely done,"' Ashlea says. 'There was quite a lot of additional work that we weren't necessarily prepared for.' For example, mobile phones were collected and discussion limited before interviewing witnesses. By having individuals write down what they saw in their own words, they would get a first-hand account of what happened.

At one point, the American team requested that the Australians move the aircraft off the runway. 'The Australian standard is that you leave it there until the Defence investigations people get there,' Ashlea says. 'That was 100 per cent not going to be an option for us. So then we had to look into how we would move the aircraft, but it had no tires; they shredded themselves to pieces during the accident. The aircraft was also burnt quite severely; you could put your hand through control surfaces, so it just wasn't in a state that we were used to working on.'

Meanwhile, the aircrew had been at the base hospital being treated for injuries. The Pilot was treated for smoke inhalation, while the Electronic Warfare Officer was physically unharmed (except for some bruising). 'It took about an-hour-and-a-half at least, if not more, before we actually got word that none of the aircrew were injured in the accident,' Ashlea says.

The Flight Line Technician was the last person to see the aircrew, put them into the aircraft, and do the final pre-departure from the lines. He was therefore the last person to see the aircrew before they went flying. He also witnessed the accident, so the team was trying to manage his welfare as best they could and ensure he wasn't too emotionally distressed.

'The team was really amazing,' Ashlea says. 'Everyone jumped in and would wait for instruction, and if you gave them instruction, would just go and do it. I know at one point, someone came up to me and the Senior Engineering Officer (SENGO) and said, "You haven't eaten any lunch, and it's 2 pm; there's a sandwich shop on Base, I'll go and buy you a sandwich, is there anything you don't eat?" And they came back with food, which was super great, because the SENGO and I probably wouldn't have had any food that day.'

Meanwhile, Ashlea says, the technician who'd released the aircraft was on edge, which continued until they got back to the hotel where they were staying. 'Then the aircrew invited him in to where they were decompressing and talking about how they were invincible and being larrikins; doing their own form of group processing of the accident,' Ashlea says. 'Once he saw them having a good time and laughing, that's when you could see the relief in him. They didn't blame him, and people had told him the aircrew were okay, but he could see with his own eyes they were okay.'

For Ashlea, the whole experience was significant, but during the chaos of that first day, she says she didn't really process anything. 'People had heard about it at home,' Ashlea says. 'When I got back to my hotel room, after I don't even know how many hours, I had a few messages and I went through some of them.'

'One of the things you can do as a junior engineer is what's called a Carried Forward Unserviceability (CFU) or Deferred Defect, which is defer away some maintenance, and not complete it before flight, based on a safety Risk Assessment. It wasn't until one of my friends said, "Are you worried about any of the CFUs," (or that process you might have done, being a cause of the accident) that I first thought about the fact that I could have been directly involved.'

On day two, people on the ground for Exercise Red Flag conducted some of the preliminary investigation work, including walking the runway, tagging the location of debris and collecting it for the investigation team. While walking the runway, they found a huge chunk of the engine component that had never undergone maintenance in Australia or elsewhere. This relieved the mood of the squadron members, and their concern that maybe they'd done something wrong.

While Ashlea's team worked the runway, another team lead by then-FLTLT James Francis (now SQNLDR) had to defuel the aircraft. They had to remove its external stores (jamming pods, training weapons and external fuel tanks) and have it towed back to a hangar to wait for the investigators to arrive.

'That was a huge effort for that team, removing all the burnt and charred remains and working with the US using some of their equipment, known as skids, to tow it back,' Ashlea says. 'We learnt after, we didn't have these Super Hornet skids in stock, so added it to a list of things we had to address. It was a very slow tow and took about an hour, if not a little more, to move not that far at all to the hangar.'

The team learned a great deal from the accident and the actions taken afterwards, including their base/squadron/wing readiness for something similar that might happen back in Australia. 'For example, the US had this guy with a Ghostbusters backpack on, who was spraying all the exposed composite material with wax to encase it, so it was no longer a threat to breathe in,' Ashlea says.

'This was not the first time for the US, so they were definitely much more experienced than we were. We know that at least for our wing, we didn't have any spray like that, so it's something we looked into a few days after.'

Ashlea says the Australians displayed incredible teamwork, despite not necessarily being trained to respond to such an emergency. She added that they dealt with everything that came their way effectively and efficiently, and were on their own for at least a day before the investigations team arrived at Nellis AFB.

'The investigations team gave us great advice and we took advice from anywhere we could find it,' Ashlea says. 'What we did went a bit beyond the scope of even what we thought we might have to do and what we would do if it had happened in Australia. Overall we were pretty proud.'

When investigators arrived, the squadron continued to help. 'Our armament technicians helped remove the heat-damaged explosive panel cover that contained the aircraft's black box,' Ashlea says. 'That was a huge risk assessment for the squadron to conduct, to ensure the safety of our people while enabling the investigators to gain vital investigative data needed. Squadron personnel who were working as the subject matter experts with the investigators, and being trained on the aircraft, helped to remove panels and access other components of it.

'The other engine did not destroy itself, so squadron personnel removed that. We also had to raise safety reports in Sentinel for exposure for all members in case the aircraft (which smelt very bad) was found to be toxic in the future. I raised a report that contained every member of the 6 SQN Red Flag detachment. Being surrounded by a squadron of professionals helps you get through but being involved in this incident reminded me (or demonstrated) just how important training, education and crash-exercise experience is for everybody when you find yourself in the "heat" of a real event.'

Personal profile: SQNLDR Ashlea Waight

- **Joined Air Force:** 2010
- **Qualification:** ADFA graduate in Aeronautical Engineering
- **Current job:** Product Quality Engineer for the ADF's fuel
- **Current posting:** Defence Plaza Melbourne
- **Hobbies:** Lego, board games
- **Pets:** A Kelpie cross German Shepherd and West Highland Terrier puppy

Quick thinking prevents collision

Above: Minister for Defence Personnel and Veterans' Affairs, The Hon. Matt Keogh MP, and 2 FTS QFI, FLTLT Zac Pearse standing in front of a Pilatus PC-21.

FLTLT Zachary Pearse's quick thinking during a standard syllabus training sortie gone awry, earned him a well-deserved nomination for the 2023 Royal Aeronautical Society-sponsored Dr Rob Lee Defence Flight Safety Award.

This experienced Qualified Flying Instructor's (QFI) 'timely intervention and outstanding display of airmanship likely prevented a near miss and quite possibly avoided a catastrophic mid-air collision' at Busselton on 7 September 2023.

Towards the end of a 'combination' student sortie with two No. 2 Flying Training School (2 FTS) PC-21s in formation (Aircraft 1 and 2), a civilian aircraft took off from Busselton Airport. It climbed to the PC-21s' circuit

Royal Aeronautical Society Dr Rob Lee Defence Flight Safety Award

altitude of 1000 ft. While his student in the front seat of Aircraft 1 was flying, during a touch and go, FLTLT Pearse had noticed the small civilian plane at one of the holding points, which he had not heard make any radio calls on the Busselton Common Traffic Advisory Frequency (CTAF).

At 1000 ft, and looking back and seeing the aircraft climbing out and turning into the circuit, he queried on the formation frequency if Aircraft 2 had the civilian aircraft in their sight. Aircraft 2 reported they did not, and realising a potential collision, FLTLT Pearse instructed them to climb to 1500 ft. As they climbed, they identified and passed over the top of the civilian aircraft.

FLTLT Pearse, who joined Air Force in 2011, says the incident highlighted that in formation training both on pilots course, and in subsequent training, leadership is a critical skill and should be emphasised at all stages.

'Identifying the aircraft at the holding point and the fact that it wasn't in my mental model of the traffic around Busselton and Bunbury (shared CTAF frequency) meant that I felt it important to inform my wingman to see if they had the aircraft in their SA [situation awareness] bubble,' FLTLT Pearse says. 'When they informed me that they did not, as formation lead I gave a de-confliction instruction which avoided the conflict.'

'I feel pleased [about the award nomination], however, I feel like any QFI would have done the same in my position.'

FLTLT Pearse's award nominator clearly doesn't feel like just anyone would have done the same. 'The airmanship and dedication FLTLT Zachary Pearse displayed toward executing his duties as the formation leader were of the highest order and are in keeping with the fine traditions of No. 2 Flying Training School and the Royal Australian Air Force,' his nomination says.

FLTLT Pearse, who grew up around aviation and was drawn to the Air Force through his father, who is also a pilot, completed his flight training in 2015.

'I enjoy the challenges of flying military aircraft, the roles are extremely diverse and bringing a team together to complete a mission is very rewarding,' he says. 'I have especially appreciated the opportunity to fly PC-21 and instruct students – watching them develop through pilots course and achieve wings is very satisfying personally and professionally.'

FLTLT Pearse is now posted at 33SQN flying KC-30A at RAAF Amberley.

Do you know a Flight Safety Champion?

ROYAL AERONAUTICAL SOCIETY AUSTRALIAN DIVISION

Dr Rob Lee Defence Flight Safety Award

The Royal Aeronautical Society (RAeS) Flight Safety Award recognises individual or collective efforts that have enhanced Defence flight safety. Nominations for the RAeS Flight Safety Award are open to all members of Defence Aviation, including foreign exchange and loan personnel, Defence civilians and contractors.

The award covers a broad range of flight-safety initiatives, from a single act that prevented or could conceivably have prevented an aircraft accident or incident to implementation of long-term aviation safety initiatives and programs.

For details on the nomination process for the 2025 award please visit the DFSB Intranet site.

DEFENCE FLIGHT SAFETY BUREAU DFSB

Award nomination for safer Triton

TO CALL SQNLDR Michael Berry and Mr Jack Walters high achievers, might well be an understatement. These two award-winning Defence members were recently nominated for the 2023 Royal Aeronautical Society-sponsored Dr Rob Lee Defence Flight Safety Award for their work on Uncrewed Aircraft System (UAS) – MQ-4C Triton.

SQNLDR Berry (then FLTLT) and Mr Walters were nominated for their innovative work in ensuring that a bespoke means of compliance with the Defence Aviation Safety Regulations could be developed and implemented for Triton operations.

'Together, FLTLT Berry and Mr Walters delivered a completely novel, fit-for-purpose, credible and defensible airworthiness system for an aircraft type that has never before been operated by an Australian organisation,' their nomination says.

MQ-4C Triton is a large (40 m wingspan), high altitude, long-endurance UAS. It's comprised of an Air Vehicle that is flown over satellite communications networks by a remote Mission Control Station (MCS). The system provides Intelligence Surveillance and Reconnaissance (ISR) sensing capabilities for maritime patrol and other surveillance roles.

> 'Although UAS are by definition "uncrewed", they can still pose a risk to people in the air and on the ground.'

Royal Aeronautical Society
Dr Rob Lee Defence Flight Safety Award

On 31 July, Deputy Prime Minister Richard Marles, supported by Chief of Air Force Air Marshal Stephen Chappell, announced that Air Force had taken possession of its first MQ-4C Triton.

Mr Walters says that as a large, non-certified UAS, there was limited well-established guidance to base the Triton airworthiness program on. 'The work we have been doing is both in constructing and executing the program for Triton,' Mr Walters says. 'For a system of Triton's complexity, this has required bespoke tailoring of existing airworthiness regulation established for certified aircraft, and consideration for emerging worldwide practices, all folded into a risk-based, system safety approach. The resultant plans and processes that we have been executing will ensure that Triton can fly safely in shared airspace, within the Australian physical and legislative environments.'

The team has encountered many challenges with the Triton Aviation Safety Program, in relation to nuances in UAS design and operation, and the organisational or cultural impacts.

SQNLDR Berry considers that Triton has a significant design pedigree back to Globalhawk, but was not designed to meet DASA's recognised airworthiness code for UAS, which came much later in the program (around 2020).

'As a consequence, we couldn't rely on the traditional aviation safety framework, which scaffolds on "safety of design" as the cornerstone,' SQNLDR Berry says. 'So that lead to a bunch of hard questions: How do you determine the technical contribution to risk? How do you eliminate or otherwise minimise those risks while ensuring capability requirements can be met? For example, we couldn't operationally restrict Triton to Defence-controlled land and/or water as we do for other smaller UAS.'

As far as the cultural challenges go, SQNLDR Berry suggests that Defence has been accustomed to operating crewed-certified systems where we can comfortably achieve safety to certified standards.

'That's the norm in Defence and our natural comfort-zone,' SQNLDR Berry says. 'Specific Type A systems like Triton challenge those norms, and as a result, has taken the organisation some time to understand and accept a "risk-based approach". I think we'll need significant advancement in DASR and Defence Risk Management policy to enable a Future Force of increasingly autonomous, high-volume/low cost systems that will inevitably come.'

Despite the challenges, SQNLDR Berry and Mr Walters both consider safety to be a critical aspect of UAS operations. 'Although UAS are by definition "uncrewed", they can still pose a risk to people in the air and on the ground,' SQNLDR Berry says. 'Defence has a legal and moral obligation to ensure the risks of operating these systems have been eliminated or otherwise minimised so far as reasonably practical.

'The personnel safety risk for an uncrewed system is highly dependent on how it is designed and operated,' Mr Walters says. 'While that introduces certain UAS-specific opportunities, the safety outcomes can be highly unique and sensitive to those decisions. A clear understanding of the safety considerations of UAS are very important to allow for weighted decisions based on operational need for the system.'

SQNLDR Berry was born in Hobart, but grew up in small town Burnie, TAS, joining the Air Force in 1999 at 19 years old. Mr Walters grew up in Canberra and has been working with Defence in the APS full time since 2018 after joining the Defence Graduate Program. He is currently in Canberra working for Future Intelligence, Surveillance, and Reconnaissance, Systems Program Office (FISRPO), and has been since 2021. SQNLDR Berry is working remotely to Air Force Headquarters from Perth.

They are 'honoured' and 'privileged' to have been nominated for the Dr Rob Lee Defence Flight Safety Award.

'Safety of design' explained

a. **Design.** The design is safe (that is it meets Authority-recognised airworthiness code standards and requirements).

b. **Construct.** The aircraft (and fleet) conforms to that safe design.

c. **Maintain.** The aircraft that conforms to the safe design is in a condition for safe operation.

d. **Operate.** The aircraft is operated in approved roles, with correct mission equipment, by competent and authorised individuals, according to approved procedures and instructions, under a system of supervision and monitoring.

Benefit of shared learnings

By FLTLT Chris Davis

AS A FRESHLY-ENDORSED controller, I made an error that shook my confidence.

The subsequent investigation showed me that education, transparency and meaningful changes based on lessons learnt benefit everyone, and encourage people to proactively and positively interact with the Aviation Safety Management System (ASMS).

I had only finished my tower training two weeks previously, and I was still adjusting to controlling solo, without the safety net of a training officer or supervisor. On this day, I was controlling alone in the tower, with very low traffic levels and a few vehicles on frequency. I invited some Security Forces trainees who had been doing airfield driver training upstairs to tour the tower, as I had nothing going on.

During the tour, I spoke to my first aircraft in over an hour, a C-130 departing for Richmond. I lined them up and departed them, providing visual separation between the C-130 and a civil helicopter transiting overhead to the east. Shortly after they took off, I assessed that I had incorrectly projected the civil helicopter's flightpath, and I would shortly lose visual separation without action. I asked the C-130 for their altitude, which thankfully was greater than 1000 ft higher than the helicopter, ensuring vertical separation existed.

However, it was through luck alone that the situation didn't degrade into a loss of separation. I ended the tour, and called downstairs to report what happened. A new controller was shortly sent to replace me, and the Aviation Safety Reporting (ASR) process began. From the outset, I was never treated punitively, and the entire event was treated as a learning opportunity not only for me, but for all tower controllers at the flight.

Through interviews with myself and other tower controllers, our Aviation Safety Officer (ASO) was able to establish some universal deficiencies in knowledge and understanding of procedures across the flight, and implemented some actions that have addressed these (for example, changes to standing instructions (SIs) and training guides).

One of my largest takeaways from the event is a recognition that the systems and safeguards we have in place can be difficult at times to recognise and apply in the moment, especially to yourself. At the time I did not recognise the warning signs. Despite being comfortable with the Rule of Three/traffic light system, nothing in the lead up to the actual loss of separation assurance stood out to me as being out of limits or abnormal.

CHRIS'S AMBERS

- recently completed tower training
- visitors touring the tower
- quiet shift
- incorrect projection of helicopter's flightpath.

In hindsight, there were several ambers, all of them contributing factors – non-compliance with SIs, lack of experience, low workload and distraction.

One of the most effective risk controls we have in Air Traffic Control and aviation generally is the team – if there had been another controller in the room, it is likely they would have detected the ambers that I couldn't detect myself, especially being such a junior controller.

Sharing lessons learnt from safety events benefits the entire team, and my experience is now used as a training example for new members at the flight. How I was dealt with by my ASO and senior controllers also sparked my personal interest in the safety system, and demonstrates how investigating with the intent to educate and improve, rather than punish, perpetuates a transparent and effective safety culture.

Aviation safety from far and wide

Shared experiences at the International Aviation Safety Officer Course

By Leonie Gall

MILITARY PERSONNEL FROM as far as Kenya, Lebanon and the Kingdom of Jordan, including two women from the Philippines, gathered in Canberra in July for the Defence Flight Safety Bureau-run International Aviation Safety Officer (I-ASO) Course.

DFSB Training Manager SQNLDR JJ Rozells says the course is a means through which DFSB supports International Engagements Air Force in working with our neighbours and strategic partners. 'The course is an avenue for DFSB to share aviation safety experiences from the ADF and aviation safety lessons learnt from our partners, and it also presents an opportunity for us to learn how those nations approach aviation safety, SQNLDR Rozells says. 'Aviation Safety has universal mutual benefits to us and our military partners. Keeping our people safe and preserving our assets, is an important part of capability, morale and effective operations.'

SQNLDR Rozells says this year's course comprised 22 students who also travelled from countries including India, Indonesia, Malaysia, Pakistan, Papua New Guinea and Thailand. He was pleased to say the engagement from the attendees was outstanding. 'They were open to sharing their experiences and hearing about our experiences and the topics we taught on the course,' SQNLDR Rozells says. 'There's a lot of participation activities in this course and they all took to it really well. We learn just as much from the students as the students learn from the instructors, so it's a really good exchange of information. And everybody comes with that right attitude of being able to share and learn from each other.'

The I-ASO Course has been running for a number of years now, and is presented over five days. SQNLDR Rozells says the course is very similar to the ASO initial course for ADF students. 'We focus some of the learning on

'Keeping our people safe and preserving our assets, is an important part of capability, morale and effective operations.'

the human factors side of aviation incidents,' SQNLDR Rozells says. 'We talk about culture, we cover risk management, and we spend a bit of time taking them through a basic investigation process. We don't go into the reporting side of it because the students' systems for reporting might be different from ours. We certainly take them through an event from the start when they find out something has occurred.'

This includes how the students gather information and organise and analyse that information so they can come out with meaningful findings, actions and recommendations to stop an incident from occurring again. SQNLDR Rozells believes the main take out from the course is understanding the safety journey, including safety culture, understanding risks, and prevention.

'Those three are tied together,' he says. 'What we promote in a safety culture is a "just" culture; not every organisation in every country might be at that level yet. Some of them might still be at the "blame the individual" level. What we are trying to do is promote the fact that in a just culture, we accept that errors occur. We don't accept violations, but we understand that everybody makes mistakes.

'We attempt to put the students in the mindset of the affected people in that situation. And understand which organisational issues may have contributed to that occurrence.'

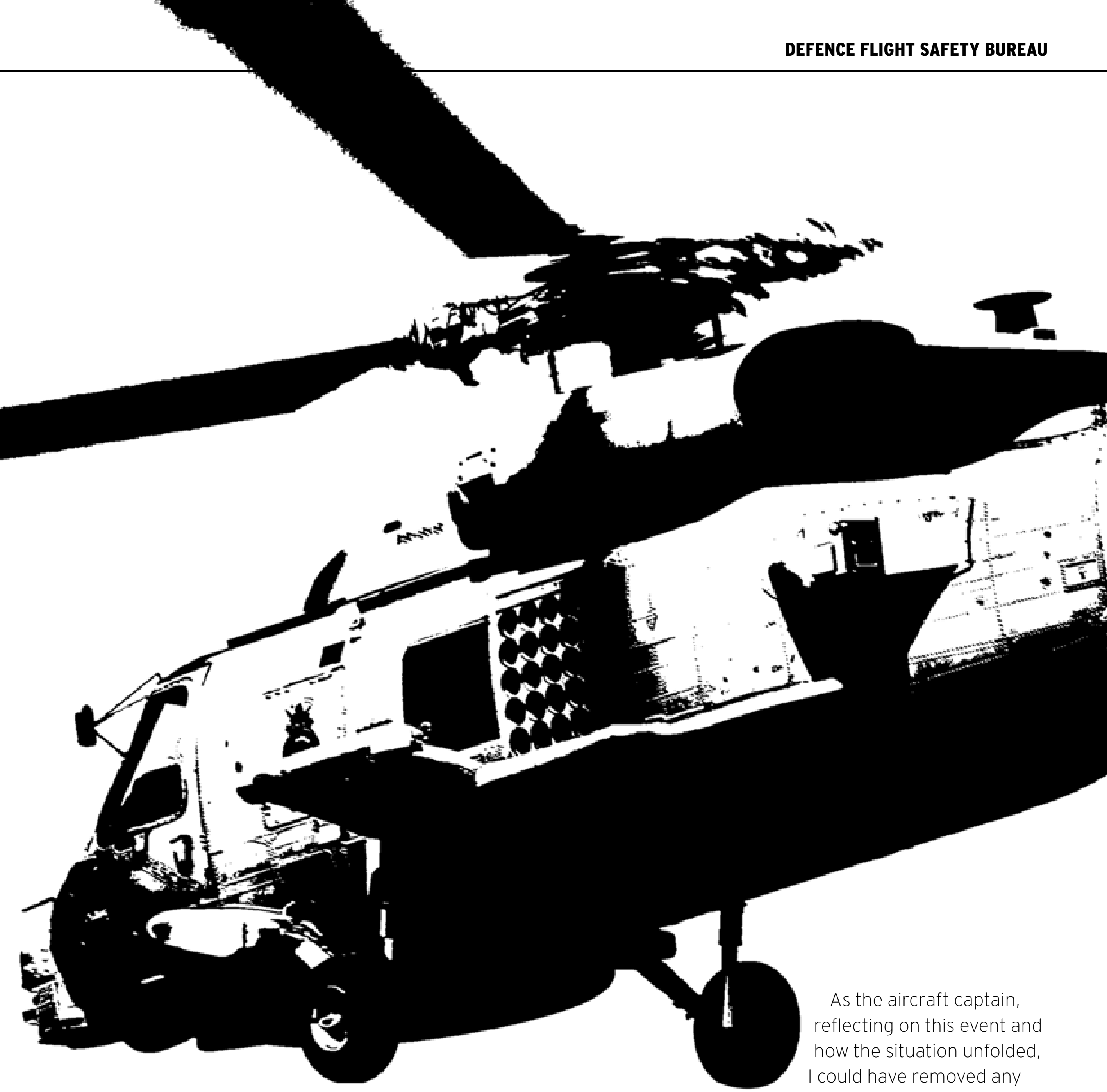
Major Abdulaziz Al Awamleh or 'Aziz' is a fighter pilot, flying instructor and safety officer with the Royal Jordanian Air Force 11 Squadron, who also flies at air shows. He was invited to join this year's I-ASO Course and says it will help him to qualify to become a Commander next year. 'I liked the materials they gave us,' he says. 'They gave us everything, even a magazine about their activity in the recent year, and this year also. I think it's useful and I can use it in my country. It's like a baseline for me.'

Aziz is married with two sons and a daughter. The course was his first time in Australia. 'I find the people to be very kind and hospitable,' Aziz says. He says he learnt a lot from the course. 'I took a safety course in France before, but here in this course it's expanded my vision about safety aviation theories. It organised the thoughts in my head.'

Aziz was quick to thank the team for their hospitality and work. 'They are professional – the Defence Flight Safety Bureau,' Aziz says. 'They run the course with smoothness and clarity. It's not easy to give a safety course in five days. From my perspective, it would take more than a month, so they did a great job.'

The I-ASO Course will return in 2025, dates to be confirmed.

Invisible bird strike



By LEUT Adrian Pace

MH-60R SEAHAWK FLIGHT 808 was embarked on HMAS *Brisbane* when assigned a Defence Assistance to the Civil Community Category 1 (DACC 1) task to evacuate four people from Willis Island. A bird strike during one of the flights caused a breakdown in the crew's shared mental model and the aircraft captain continued the mission with the aircraft in an unknown serviceability state.

At the time, Willis Island – a small sandy island located about 200 nm off the coast of North Queensland – was in the path of a Category 4 tropical cyclone. The plan was to conduct five trips between the island and the ship. Due to the weather, it was unsuitable to evacuate personnel via small boat transfers and if the evacuation was unsuccessful, it could have been fatal to the members on the island.

On the first approach to the island, the aircraft captain noted, and it was discussed among the crew, that there was a significant number of birds. The first two approaches were completed without incident. On arrival to pick up the third passenger, the aircrewman commented that a bird had gone through the disk in the final stage of the approach.

The crew landed and conducted an inspection, with rotors running, due to the risk of shutting down (rendering the aircraft unserviceable) on the island with a cyclone impending. The aircraft captain directed the aircrewman to jump out and visually inspect the other side of the aircraft paying particular attention to the engine intakes.

The aircrewman said there were no signs of impact, which led to the front-seat crew believing the bird may not have been hit, rather passed by unscathed. The aircraft captain did not feel anything through the flight controls. This was a form of confirmation bias towards the idea that the bird did not strike the airframe.

Based on this information, the crew elected to conduct the third passenger transfer and returned to the ship approximately 10 nm away. The crew informed the Flight Commander of the bird, and the aircrewman again conducted a rotors running inspection. The aircrewman told the crew there were no signs the bird had impacted the airframe. The aircraft captain was satisfied, with concurrence from the Flight Commander, there was no doubt of aircraft serviceability and proceeded with a departure to pick up passenger four.

During transit to the island, the aircrewman informed the crew they had blood on their glove and the rotors had hit the bird while they were at the open door, with blood splatter evident. This was the first confirmation the front-seat crew had of the impact.

The crew elected to continue the task, noting the lack of any abnormal indications or vibrations, and the deteriorating weather.

On completion of the mission, after shutdown, the crew and maintenance team observed that there was blood on the rear of the airframe, on the tail and above the hoist, with no damage to any part of the aircraft.

As the aircraft captain, reflecting on this event and how the situation unfolded, I could have removed any potential ambiguity about the nature of the bird strike had I asked the aircrewman direct questions. At the time, there was a high level of pressure to complete the task. When the aircrewman did not give any clear indication of the bird strike, I didn't probe further as I felt the need to get the job done, ultimately placing the aircraft and crew at greater risk.

Moving forward, I hope this event serves as a reminder of the real pressures placed on crews and the importance of all members maintaining a shared mental model.

Aviation safety reporting enhancement

Fixing the DASR in ASR

By WOFF Brendan Church

DESIGN ACTIVITY IS underway to update the ASR in Sentinel application to satisfy the requirements of the Defence Aviation Safety Program and accompanying Defence Aviation Safety Regulations (DASR).

The reform aims to achieve a holistic aviation safety reporting system that compliments the regulated Defence Aviation environment, directly supports safety Occurrence Reporting (OR) obligations to Defence Aviation Safety Authority (DASA), and elevates the effectiveness of our safety information exchange through greater alignment with global aviation conventions.

The update will introduce a single report type with enhanced data tagging and event keywords that are specific to each of the regulated domains. The forecast completion date of this project is Q4 2024, with Defence Digital Group indicating deployment in Q1 2025.

Why the change?

Since the introduction of Aviation Safety Reporting (ASR) in Sentinel in 2018, the baseline functionality of the four report types has remained largely unchanged (Flight Operations; Maintenance; Other Support Systems; Operational Hazard). Initially designed as a 'one-for-one' replacement for the Defence Aviation Hazard Reporting and Tracking System (DAHRTS), ASR in Sentinel has been successful in meeting the initial brief. However, significant changes in the Defence Aviation safety reporting landscape has forced ASR in Sentinel to reform.

The current report types in ASR in Sentinel do not adequately support the depth and breadth of the regulated aviation environment.

The Aviation domains regulated by DASR have expanded to include additional organisational functions (for example, Air Navigation Services, Uncrewed Aerial Systems, Air Cargo Delivery, Aerodromes, et cetera).	Each domain brings its own unique attributes, and as the ASR data set grows over time, data separation, categorisation and analysis increases in complexity.

There are opportunities to improve on current ASR in Sentinel design to more adequately support the OR intent required by DASR GR.40 – Occurrence Reporting.

The Occurrence Reporting regulation (AMC GR.40) references Defence Aviation safety event reporting (vide ASR in Sentinel) as meeting the intent of GR.40.	However, shortfalls in current system design prevent the full exploitation of ASR in Sentinel to directly support OR notification to DASA.

There are opportunities to improve on safety information exchange by aligning ASR in Sentinel reform with contemporary aviation safety reporting standards.

Current ASR system design does not support effective or efficient data exchange, whereby taxonomies and terminology are not consistent with those used by the International Civil Aviation Organisation, European Union Aviation Safety Agency and in some cases the Australian Transport Safety Bureau.	This reform has embraced the DASR design principle of being as civil as possible, but as military as necessary in adopting contemporary aviation safety reporting taxonomies and terminology.

What's different?

A key design principle for the update to ASR in Sentinel is to ensure the application remains recognisable with regard to the interface functionality and useability that current ASR users are familiar with. To that end, the update will have the look and feel of the ASR in Sentinel that we know, with enhancements that provide a reporting solution tailored for each domain and that support enriched aviation safety data analysis. The update to ASR in Sentinel will not impact shared functionality or disrupt the other joint users of the Sentinel system. The affected ASR elements are summarised in the table.

TABLE: AFFECTED ASR ELEMENTS

General	Scope	Description
Dashboards	Revised	Updated dashboards to reflect new report type data tagging and event keyword selections.
Keywords	New	Improved and integrated taxonomy that allows selection of the most appropriate keyword(s) from any domain/function. (ICAO, EASA & ATSB aligned.)
Event	**Scope**	**Description**
Report type	New	Single report type (Aviation Event) with new data tags to identify your organisational type. (Replaces Flight Operation, Maintenance, Other Support Systems report types.)
General questions	Revised	Reduced quantity and improved language to support heightened data quality.
Conditional questions	New	Organisation-specific questions tailored for each domain/function. Keyword-specific questions have been reduced in quantity and improved in language. (Supports heightened data-capture quality.)
Operational Hazard	**Scope**	**Description**
Report type	Revised	Report type renamed (Aviation Issue) with new data tags to identify your organisational type.

What about the other stuff?

All new ASRs raised post go-live of the update will be raised using the updated format, however, extant open ASRs will remain accessible and able to be progressed to closure (post go-live).

Work is also underway to update Salus, supporting ASR guidebooks, other documentation and training to ensure minimal disruption to these products and services.

For additional information regarding the update to ASR in Sentinel, please contact the ASR Service Desk (asr.servicedesk@defence.gov.au).

Safety training first

PNGDF first taste of locally delivered DFSB Non-Technical Skills training

By Leonie Gall

TWENTY-EIGHT STUDENTS FROM the Papua New Guinea Defence Force (PNGDF) Air Transport Wing (ATW) attended their second in-house Defence Flight Safety Bureau (DFSB) Aviation Non-Technical Skills (NTS) Foundation course in March this year.

Course convenor and trainer, SQNLDR Rod Geisler, is the Airworthiness Advisor to the PNGDF – Air Element. As an ex-Avionics Technician, he completed the Maintenance Human Factors facilitator's course in 2007 and has delivered Human Factors, Coaching 101 and now NTS training courses, over the last 17 years.

SQNLDR Geisler says it was the first time this NTS course was delivered by a trainer on their staff, rather than visiting trainers from Australia. 'I delivered this course in PNG after posting here in January in support of the Defence Cooperation Program,' SQNLDR Geisler says. 'This specific course was offered in support of the broader goal – delivery of a Part 145 Licensed Maintenance Organisation certification for the ATW, where NTS training is an important foundational course.'

Participants on the course were from all over PNG including northern beaches, western provinces, highlands and outer islands. They were all members of the Air Element and were primarily technical personnel, while some engineers and senior regulatory representatives were also involved.

'Members were engaged and provided some invaluable input to the course,' SQNLDR Geisler says. 'For the majority, the concepts we introduced were not necessarily new concepts, but for some they have not had these presented within a facilitated style. While it took a little while for them to open up due to

inherent cultural differences, once the course settled into the training style some really good discussions developed. Their enthusiasm and "bubbly" spirit is infectious and it certainly made this course one of my more memorable.'

All in all, he says, the course was an outstanding success. 'The students were well engaged, punctual and knowledgeable on the basics of NTS, as it applies within the aviation environment and particularly the military aviation environment,' SQNLDR Geisler says. 'The results of a tower building exercise were very entertaining, particularly as many thought "outside the box" to create their towers.'

SQNLDR Geisler works alongside a PNGDF Major and forms part of the Defence Aviation Safety Command, the equivalent of the Defence Aviation Safety Authority in Australia. The full team is only small (five RAAF members in total – two Qualified Flying Instructors, two Engineers and one Maintainer) and collectively they are there to help reinvigorate the Air Element within the PNGDF.

The Command intends to deliver annual training, either foundation or refresher, where they can continue to build on the safety culture within the ATW.

What's this course about?

The DFSB Aviation NTS Foundation course is designed to graduate personnel with a common understanding of human factors and Non-Technical Skills principles, as well as to support the development of practical knowledge relevant to skilled performance.

The course provides instruction on the Non-Technical Skills and human factors aspects of individuals and systems that contribute to effective performance in aviation-related occupations.

Content covers human performance limitations, error management principles as well as the cognitive, social and self-management skills that complement the technical skills of personnel.

Near miss in the fog

By SQNLDR Brett Hopewell

KNOWING WHEN TO speak up and call 'time-out' when things aren't as clear as they should be, prevented a potential civil aviation disaster and saved numerous lives one American December night in 1999.

In a nutshell

A United Airlines Boeing 757 inadvertently taxied onto an active runway on a foggy night, narrowly avoiding an aviation disaster when a FEDEX Boeing 727 departed from the same runway. As a result of subsequent communication issues and a breakdown in situational awareness, a US AIR Boeing 737 was issued a take-off clearance with the Boeing 757 still occupying the runway.

The detail

A fog rolled in at Theodore Francis Green State Airport, which reduced visibility to about 400 metres. The airfield was not equipped with surface movement radar to help Air Traffic Control (ATC) in determining where aircraft were located. A United Airlines Boeing 757, call-sign United 1448, had just landed on the active runway (Runway 05 right/23 left) and reported clear of the runway to ATC. A FEDEX Boeing 727, call-sign FEDEX 1662, was awaiting take-off clearance. Another aircraft, US AIR 2998, a Boeing 737, was behind the FEDEX, also awaiting clearance to take-off.

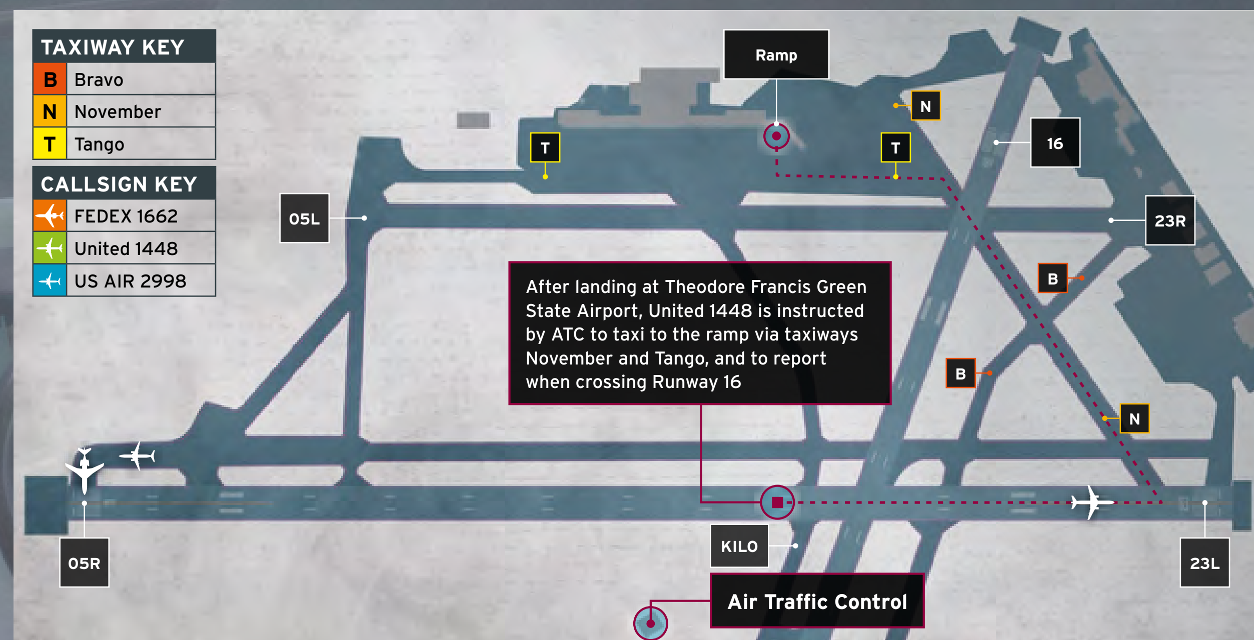
ATC: *'United 1448; thank you, taxi to the ramp via taxiways November and Tango, report crossing Runway 16.'*

United 1448: *'OK, November Tango, we'll report crossing Runway 16, United 1448.'*

After a delay in transmissions

ATC: *'FEDEX 1662, Runway Five right, fly runway heading, cleared for take-off.'*

FEDEX 1662: *'Runway heading cleared for take-off Five right, FEDEX uh 1662.'*



Tower Control instructs the pilots of United 1448 a United Airlines Boeing 757, to taxi to the terminals via taxiways November and Tango, and to report in when crossing Runway 16.

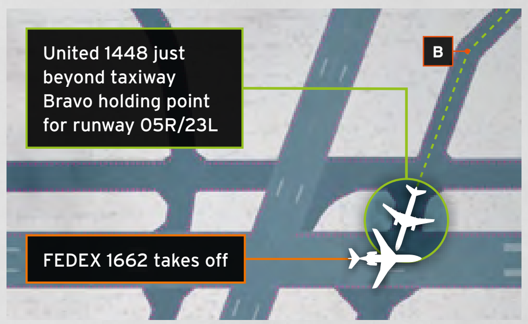
While taxiing, United 1448 becomes confused in the fog and makes a mistake, turning left onto taxiway Bravo. Leading the Boeing 757 back towards active Runway 05R.

Inadvertently, United 1448 had taken a sharp left-hand turn (greater than 90°) at taxiway Bravo, rather than continuing straight on November to the intersection at Runway 16. This led United 1448 to the intersection of taxiway Bravo and Runway 23 left (active runway) intersection.

United 1448: *'United 1448 is on November by the runways here. We don't see the uh, are we cleared to cross straight ahead on November?'*

ATC: *'United 1448, affirmative, cross Runway 16 join taxiway November Tango on the other side.'*

United 1448: *'And uh United 1448, we're approaching Kilo here uh um – somebody just took off.'*



FEDEX 1662 takes off, narrowly missing United 1448, as it ventures on to Runway 05R.

Why would the controller ignore cues that, at a minimum, created some doubt as to where the aircraft was located?

United 1448's confusion led them to the active runway, and FEDEX 1662 taking off can be heard in the audio recording as they take off over the top of United 1448, narrowly avoiding a collision. Other than the crew of United 1448 hearing the FEDEX Boeing 727 take off and its proximity, the situation was not appreciated by the controller as the fog was preventing them from being able to see the aircraft. The crew of FEDEX 1662 also did not see the United 1448 aircraft, or appreciate how close the two aircraft came to colliding, with a normal handover to radar control after departing.

ATC: *'United 1448, you shouldn't be anywhere near Kilo. Hold your position; please just stop.'*

United 1448: *'Tower, this is United 1448. We are currently on a runway. I'm looking out to the right with a Kilo. Uh, we need to go onto the Kilo taxiway.'*

ATC: *'United 1448, you were supposed to taxi November and Tango. I need to know what runway you're on; I can't see anything from the tower.'*

United 1448: *'Uh ma'am, we are on 23 right intersection of 16 and we did not connect on November. We are by Kilo to our right and we just overshot Kilo; we did not see it.'*

Air Traffic Control believes United 1448 is at the intersection of Runway 16 and 23R (where it should be). When in reality it has encroached on to active Runway 05R, and clears US Air 2998 for take-off.

Effective communications

The effectiveness of communications relies on a shared mental model between the controller and pilot. The mental models between pilots and air traffic controllers overlap (they are not coincidental) and errors in communications can complicate the shared mental model. This is exacerbated when communications are solely relied on for situational awareness. This was the case in Providence, where no ground radar was available, and due to the fog, voice communications were used for aircraft position.

United 1448 relayed their position as being the intersection of Runway 23 right, Runway 16 and taxiway Kilo (which does not connect with Runway 23 right). In actual fact, they were in proximity of Runway 23 left, Runway 16 and taxiway Kilo. An inaccuracy in content from United 1448, being that the message was accurately relayed and received, but inaccurate information conveyed, led to ineffective communications.

Despite information that an aircraft just took off close to United 1448, and their proximity to taxiway Kilo, the crew of United 1448 relayed inaccurately that they were in close proximity to Runway 23 right. Whether stating they were at Runway 23 right instead of Runway 23 left was a slip, or they believed they were at Runway 23 right, the crew of United 1448 relayed inaccurate information. This created enough confidence in the controller that the aircraft was not near the active Runway; 23 left.

ATC: *'US AIR 2998 Runway Five right, fly runway heading, cleared for take-off.'*

United 1448: *'Ma'am, I'm trying to advise you we're on active runway, United 1448.'*

ATC: *'Two three right is not an active runway, it's a taxiway when we're IFR (Instrument Flight Rules) or in the dark.'*

Information error

Despite United 1448 giving conflicting information of their position on the airfield, the controller elected to clear US AIR 2998 for take-off. An error was made by the controller. Known as an 'information error', this stems from how cognition works in the human brain. Information errors occur when the current situation is not understood correctly due to incorrect perception.

In the model of information processing, cognition is being bombarded with sensory information. In this instance, voice communications relaying position information was bombarding the controller. This type of information is moved into the working memory where it is matched against information that is stored in the long-term memory.

The crew had already made one error by not knowing where they were. In a short period of time, the authority gradient between controller and pilots became very steep.

Pattern recognition from the long-term memory (in this instance Runway 23 right being recognised as a position) matched against the expected position of the aircraft as per the original clearance of United 1448.

Not all patterns are recognised, and the combination of Runway 23 right and the mention of Kilo was not recognised. Nor was the taxi route that was taken, expecting that a left turn greater than 90 degrees onto taxiway Bravo from November would not normally occur.

Decision traps

Significant cues from the crew of United 1448, including their position close to taxiway Kilo, an aircraft taking off in close proximity and their assertion that they were on an active runway were all ignored by the controller. Why would the controller ignore cues that, at a minimum, created some doubt as to where the aircraft was located?

Decision traps are certain behaviours that are associated with poor decisions. A number of decision traps made by the controller contributed to the decision error. This included failing to consult adequately with United 1448, making an impulsive decision about the position of United 1448, and clearing US AIR 2998 for take-off.

Perceived time pressure to keep the traffic flowing into and out of the airfield was also a likely decision trap that led to the decision error. Understanding decision traps is akin to understanding your own personality traits and how they might influence your decision-making. Knowing that you're impatient may lead you to make impulsive decisions. Knowing that you have a relaxed attitude may lead you to complacency in the work environment.

Confirmation bias

The assertion that United 1448 was on an active runway and in proximity to taxiway Kilo conflicted with the controller's mental model of their location on the airfield. Confirmation bias interprets new information in a manner that confirms the current mental model and ambiguous or conflicting information is ignored. Confirmation bias may have played a role in the controller's decision-making. The controller ignored the conflicting information of United 1448 being on an active runway and the ambiguous information about the aircraft being next to taxiway Kilo, in favour of their current model that the aircraft was clear of the active runway, located on the intersection of Runways 23 right and 16.

United 1448: *'Ma'am, this is United 1448. We're on 23 right; we're looking at Kilo straight ahead. If we can go straight, we can get on Kilo and get off the runway.'*

ATC: *'United 1448 standby. Please don't talk, I have other things I need to do.'*

United 1448: *'Roger ma'am.'*

Authority gradient

United 1448 heard an aircraft pass directly over them, and were reasonably confident they were on an active runway and not where they should be, but not certain as to where they were. The controller had already cleared US AIR 2998 once to take-off. Why would the crew of United 1448 accept the controller's direction to not talk?

Authority gradients can be established quickly. The paralinguistics associated with the controller's communications likely raised the communications between controller and pilot from assertive to aggressive. Paralinguistics are the tone, volume, inflection and pitch used when communicating. These, combined with the words 'please don't talk', established at least the perception of aggressive behaviour towards the crew of United 1448.

The crew had already made one error by not knowing where they were. In a short period of time, the authority gradient between controller and pilots became very steep. Authority gradient is 'the established and/or perceived command and decision-making power hierarchy in a team, crew or group situation.'

In this scenario, the situational factor of United 1448 being lost in the fog, and the controller having the greater experience and knowledge of the airfield also played a large role in the crew deferring their authority for the safety of their aircraft, to the controller.

'Roger ma'am' underscored this deference of authority back to the controller and the breakdown of non-technical skills between United 1448 and ATC was complete.

ATC: *'USAIR 2998 Runway Five right, fly runway heading, cleared for take-off.'*

US AIR 2998: *'Uh tower, US AIR 2998. Till we figure out what's going on down there, we're going to stay clear of all runways.'*

Speak up!

Conversely, USAIR 2998 had been listening to the radio communications. Despite not being sure as to United 1448's position, US AIR 2998 decided that the instruction to take-off didn't meet their safety criteria and elected to not accept the clearance.

Why did US AIR 2998, who should have the least situational awareness of United 1448's position in comparison to the controller and United 1448 themselves, decide they wouldn't take-off? The crewmembers of US AIR 2998 weren't sure of anything, but they were sure they were going to call time-out until it was figured out.

By refusing the clearance, they established more time to determine exactly where United 1448 was on the airfield, avoiding the decision traps of time pressures, failing to consult and making an impulsive decision. The language used by the crew of USAIR 2998 balanced de-escalating language, while indicating concern assertively.

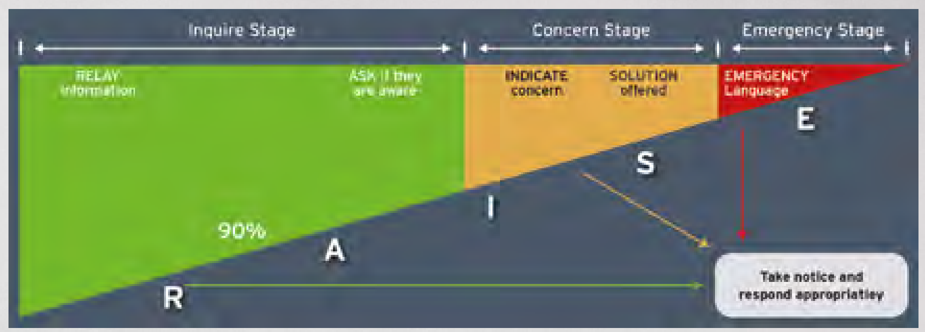
The principle of RAISE as a communication framework to communicate concern assertively without creating a confrontation, can be used to assert yourself while de-escalating any potential for conflict. In the RAISE scale, the crew of US AIR 2998 went straight to the indicating concern stage (INDICATE) given that the controller had already dismissed the crew of United 1448, but gave the controller cause to reconsider their assumptions. This struck the perfect balance of language to indicate a safety concern about United 1448's position on the airfield and the risk of a collision on take-off.

ATC: *'US AIR 2998, roger, hold short of Runway Five right. He's not anywhere near the runway, but you can hold short.'*

With the instruction to hold short for US AIR 2998, the controller had the time to work through the actual position of United 1448, determining they were in proximity to the active runway and a potential conflict. Instructions to taxi to the gate were provided and US AIR 2998 was cleared to take-off after United 1448 confirmed they were safely at the gate, and a disaster was averted. In a short amount of time, a relatively benign situation turned into a potentially disastrous situation.

Concepts of effective communication, decision errors, authority gradients and speaking up are not something that humans work through on a conscious basis each day. They are, however, reminders that these principles of non-technical skills, when executed correctly, can be the difference between a quiet evening and something much more sensational.

Near-miss situations like this in history are littered with examples of people who failed to speak up and assert themselves, and resulted in accidents. There are far more examples (but less documented) of people speaking up, asserting themselves and whether they were right or wrong, didn't find themselves depicted in an episode of *Air Crash Investigation*.



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2. Defence Flight Safety Bureau, 'Errors and Violations', 2023 – pages 29-30
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Set to DETECT

Phased-Array Ultrasonic Testing (PAUT) – a valuable tool for continuing airworthiness

By SGT Jason Brand and SGT Murray Schumacher

AVIATION ASSETS ARE under constant physical and environmental stresses due to the nature of the material used in manufacture, how assets are used in an operational setting or the surrounding environmental factors. The failure of components or structures is a major risk for any operational platform in the ADF. This is no different when it comes to the airframes housing Explosive Ordnance. In response to a unique problem, a bespoke, out-of-the-box solution, utilising what has traditionally been applied to aircraft, was developed to ensure continued airworthiness of an ADF weapon system.

Non-Destructive Testing

Non-Destructive Testing (NDT) aims to preserve the test subject for continued service without damaging the material or compromising structural integrity. The specialist trade group is frequently called upon to solve engineering issues where a platform needs to preserve the article but also needs to ensure its serviceability.

The Directorate of Aviation Engineering (DAVENG-DASA) provides specialist engineering advice and structural integrity services to Defence Aviation. The Non-Destructive Testing and Composite Technology (NDT&CT) team within DAVENG provides both initial employment training and post initial employment training. They also provide certification of Non-Destructive Inspection and Aircraft Structural Technicians. The NDT Engineering team develops Instructions for Continuing Airworthiness (ICA) and specialist Non-Destructive Inspection (NDI) procedures for ADF platforms.

The rigorous, iterative testing processes at NDT, combined with carefully recorded data helps support commanders to ensure they have structurally airworthy platforms.

NDT – first port of call

For an assessment of damage that is not detectable by visual inspection, or damage that is suspected under the surface, NDT should be the first port of call. NDT can inform maintenance planning; investigate failures of structure or components; provide information to commanders to support platform airworthiness decisions; or assist with platform life-extension assessments. When an organisation has a task that requires NDT, the customer discusses their requirements with NDT Engineering to determine the size and scope of the task. This can include a specific type and minimum size of discontinuity[1] that is required to be detected and if ICA is required. The ICA lists equipment, specific instructions for set-up and describes the procedure for the test.

The NDT Engineering team works to develop the procedure within the DASA ISO 9001 Quality Management System. This ensures the application of proper engineering rigour, including documented trials and decisions based on trial outcomes. The procedures undergo peer review and compliance verification. The NDT team aims to find the most efficient method to resolve the problem in terms of cost, time and effort. The NDT methods can be further broken down to techniques within the method. These techniques offer alternative equipment and procedures that may be better suited to the material, location or construction type of the subject under test. In this case, ultrasonics is the method, PAUT is a technique using ultrasonics.

Missile discontinuity test

Two years ago, a System Program Office (SPO) approached NDT&CT with the unique problem of detecting corrosion in a live missile airframe. This project presented a range of impediments such as lack of Original Equipment Manufacturer (OEM) data around damage tolerance limits and construction material specifications. Imposed constraints included safely managing stray voltage (static electricity), the inability to access certain parts of the item and a requirement to leave all surface finishes intact. As there were no OEM reference instructions available for consultation, the resultant procedure was developed from start to finish by NDT&CT.

Selecting the method

Ultrasonic Testing (UT) was determined to be the most suitable method as it was the only method that did not introduce new hazards. Some NDT methods employ strong electromagnetic fields or induce electrical currents in the material. These were eliminated due to the sensitivity of the test subject to the effects of stray electromagnetic radiation and potential heating. The ultrasonic test was the best method because the discontinuity was physically inaccessible and under paint. The standard compression ultrasonic technique, see figure 1, could not be used because the surface of the article was round and the discontinuity was located under an external fitting.

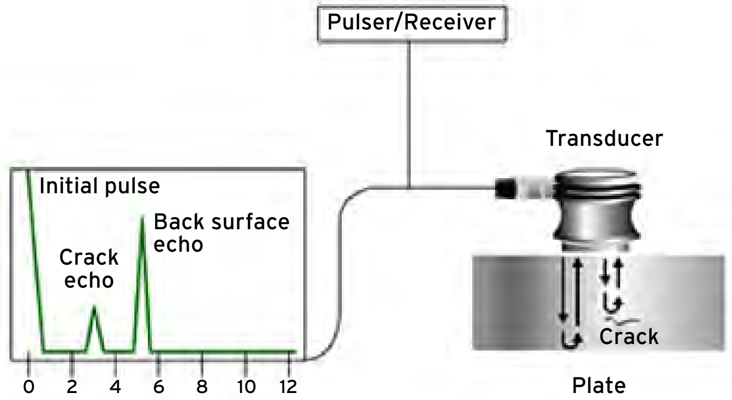


Figure 1: Basic Ultrasonic graphic
Source: https://ndtinspect.com/ultrasonic-testing-ut-handbook

Instead, Shear Wave, using an angled beam ultrasonic technique, was best suited to detect this type of discontinuity. The phased array means using multiple transducers allowing a band of testing rather than a single point, see Figure 2, resulting in a larger area being covered in the same amount of time.

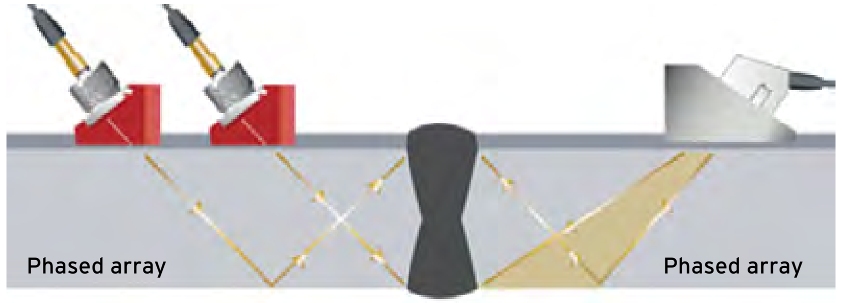


Figure 2: Comparison of conventional UT and phased array UT principles
Source: 'Phased Array – an overview', ScienceDirect Topics

The scope of the procedure also required the ability to quickly compare a previous result for a given asset in a given location that could be stored for future reference, without compromising accuracy while searching for an unusually small discontinuity. Single Crystal Shear Wave Ultrasonic transducers, manipulated by hand, have been safe and effective for decades, see Figure 3.

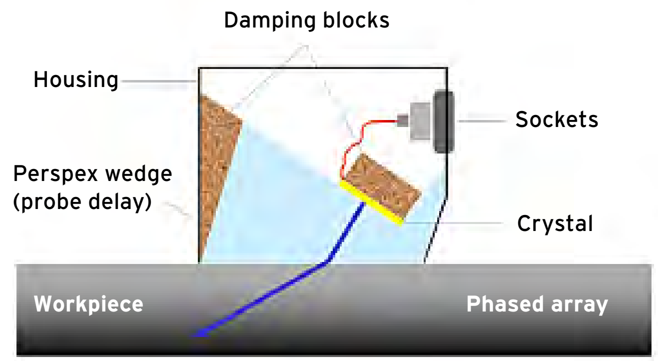


Figure 3: Angle beam probe
Source: What is Angle Beam Testing? – NDT-KITS

By sending soundwaves through an object, this testing then gathers data on depth and composition that can reveal critical information without damaging the item.

While this could have been used, it would have taken significantly longer and lacked the ability to store repeatable mapping data. The challenges presented here called for advantages that only PAUT could deliver, see Figure 4.

C-Scan – answers in colour

PAUT can examine a large area in a short time by using an array of crystals to transmit soundwaves through material and interrogate the reflected sound energy as it is received. Large quantities of data based on the reflective surface of a discontinuity disclose the exact size of the reflector without damaging the item. The scan area is also plotted accurately employing an encoder which digitises the position of the array relative to the scan start point. This facilitates precise reference to the location of an area of interest repeatedly. The data is represented as a topographical map known as a C-Scan, see Figure 5, showing the presence of the discontinuity relative to a location on the item.

Further development was requested by the customer to align discontinuity size to a colour palette for quick review and interrogation. Data can be recalled for future routine conditional monitoring inspections to compare degradation over time. One of the disadvantages of this technique is it requires a high degree of training beyond the standard eddy current method taught.

PAUT development

The RAAF has been using PAUT to perform inspections on large surfaces such as F/A-18 (Classic Hornet) and AP-3C Orion aircraft wings with great success using a straight beam (compression) of ultrasonic energy. NDT extracted the full potential of the PAUT equipment to get the results the team was after on this occasion. DASA's innovation was demonstrated by employing test equipment that was previously utilised on retired platforms. Not only was this an economical solution for Defence, it was also fit-for-purpose equipment for the SPO.

Figure 4: Staff from NTD Engineering conducting Missile Airframe PAUT Test Procedure

Figure 5: Phased Array Test Data – screen representation

Six months of development amid other tasking produced the first RAAF NDT-generated test using the shear wave function of the PAUT equipment. Obstacles encountered along the way included the lack of manufacturer source information, concept development creation and equipment issues were all dealt with as they arose.

Great relationships with Olympus Australia, suppliers of high-end NDT test equipment, aided the selection of peripherals and accessories required to accomplish the job. Expert consultation provided a range of off-the-shelf and custom equipment required for the specific nature of the test subject.

From specialist machining to process validation

NDT&CT's in-house machine shop manufactured the reference standard from an actual sample fragment of an expended statically fired missile. This standard allows the specialist to repeatedly confirm the accuracy of the testing being conducted. The fragment was precisely machined to place artificial discontinuities of known size and orientation to mimic the discontinuities that were to be detected.

In this scenario, because energetic material is present in the test subject, special consultation with armament experts working with the Explosive Materiel Branch Directorate of Engineering was paramount to ensure the procedure could be accomplished safely. Following the demonstration of the initial procedure, several adjustments were made to fine tune the calibration of the colour palette on the PAUT instrument display by scanning a missile that would be statically fired.

To verify the PAUT results, Defence Science and Technology Group (DSTG) sectioned the missile and viewed it under a Scanning Electron Microscope. This proved the PAUT scan results aligned with the physical sample sections of the missile airframe. By collaborating with DSTG, DASA was able to deliver world-class innovation and a product that met the customer's requirements.

Future uses

The rigorous, iterative testing processes at NDT, combined with carefully recorded data helps support commanders to ensure they have structurally airworthy platforms. Maintaining capability and reducing risk with older systems make this type of testing increasingly useful as demands on capability increase. The same processes of research and development, peer checks and careful documentation informs all NDT Engineering work.

As well as providing NDT Centre of Expertise advice and designs for NDT procedures, NDT&CT also provides policy and regulation guidance in assuring continuing airworthiness, fostering confidence in Australia's Defence Force capability. As this example shows, using dedicated, detailed and repeatable processes and consulting with customers as well as manufacturers delivers impressive results.

Endnote

1. The term discontinuity is used to describe an irregularity in a material resulting from in-service damage or manufacturing flaws which can include cracks, corrosion, foreign body ingress or latent defects like inclusions or voids.

LOOKOUT, THE WIRES!

By Dr Mark Lax

THESE WERE PROBABLY the last words of the copilot of a USN P-3C 158213 seconds before part of the starboard wing section and tail sheared off during a low flypast. The aircraft, flying at about 300 ft (90 m) up the bay, hit four cable car wires strung a mile across, and crashed before exploding. All six crew were killed as were two on the ground.

The scene was Pago Pago in American Samoa where 7000 dignitaries and guests were celebrating the 90th Anniversary of Flag Day. At least 30,000 others were in the main square. As well as locals, most were from Washington DC, Samoa, Tonga and Fiji. The date, 17 April 1980. Part of the celebrations included a parade and a parachute jump by the Tropical Lightning Parachute Club of Oahu, a professional US Army skydiving team. Lucky were these six parachutists who had already jumped and a Samoan marching band who had hitched a ride from Hawaii. They were now spectators to the accident. As American Samoa is an unincorporated US territory, the US Navy sent a P-3C from Moffett Field California to collect the participants from Hawaii, then head on to the American Samoan celebrations.

After dispatching the parachutists at higher altitude, the aircraft captain took the P-3 down for a run across the bay in front of the spectator dais, his third for the flight. On the ground was a large gathering of spectators including families celebrating the holiday and officials from nearby Pacific Islands. In fact, most of the population of the Faratogo main town area were watching the show. None were hurt in the crash.

According to Rob Shaffer, American Samoa's news director, 'The pilot made one last pass up the bay and his plane struck the wire(s) of a cable car. The plane immediately lost control, banked right and crashed into the Rainmaker Hotel. The plane exploded on impact. The hotel was engulfed in flames and burned out of control for two hours. The whole crew are dead. One occupant of the hotel is in a critical condition.' Another would die sometime later.

Thankfully almost all of the hotel occupants and staff were out watching the show. An entire wing of 99 rooms was completely gutted and just five remaining staff, who were in another wing, suffered minor injuries. Fortunately, the tram car which normally carried tourists to the top of the 1800 ft Mount Alava was not operating because of the holiday, so again, no casualties.

As well as the loss of life, the damage on the ground was considerable. Half the rooms in the prestigious heritage hotel were gone, the power was cut to half the island's residents and businesses, and the phones were also out for some time. It took weeks to clean up and make repairs.

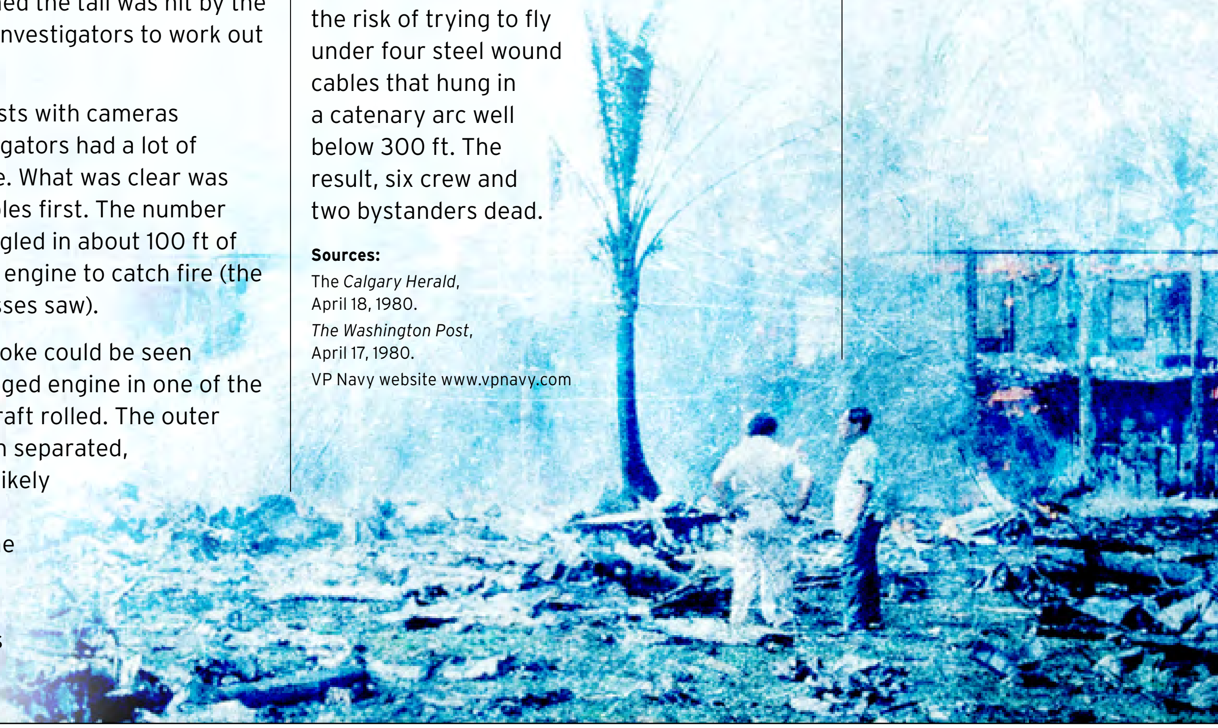
So what happened here? Some witnesses said the aircraft engine caught fire and exploded before it hit the wires. Others said the wires hit the engine first and ripped off the prop. Others still claimed the tail was hit by the wing. It was up to the investigators to work out probable cause.

Given so many tourists with cameras and videos, the investigators had a lot of photographic evidence. What was clear was the aircraft hit the cables first. The number four engine was entangled in about 100 ft of wire which caused the engine to catch fire (the explosion some witnesses saw).

Attesting to this, smoke could be seen trailing from the damaged engine in one of the videos before the aircraft rolled. The outer starboard wing section separated, and the tail was most likely torn off by the flailing wires. By this stage, the aircraft was unflyable with the inevitable result. All four engines remained attached as the aircraft hit the ground. While that was the physical evidence of the crash, what about the crew's actions? It transpired that the pilot in command without authorisation, decided to fly on a third pass 'to give the spectators a show' and he buzzed the crowd. It also came out that the night before the crash, while at a dinner at the Governor's mansion, the pilot said that he was going to fly under the cables. It is unknown if the rest of the crew knew that was the captain's intention.

Bravado, foolishness, over confidence in his flying abilities? We will never know but what is certain is that he knew the wires were there, so they were no surprise, and yet he still took the risk of trying to fly under four steel wound cables that hung in a catenary arc well below 300 ft. The result, six crew and two bystanders dead.

It transpired that the pilot in command 'without authorisation, decided to fly on a third pass "to give the spectators a show" and he buzzed the crowd.'



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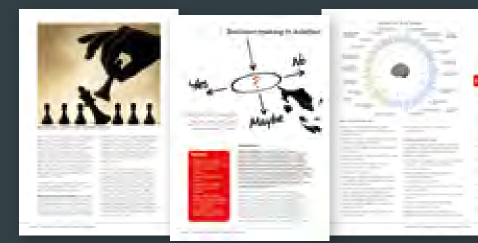
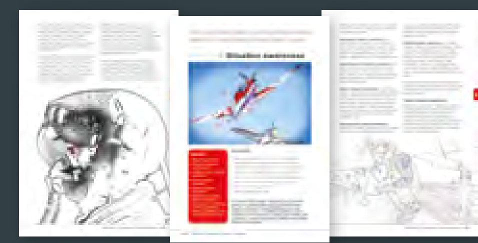
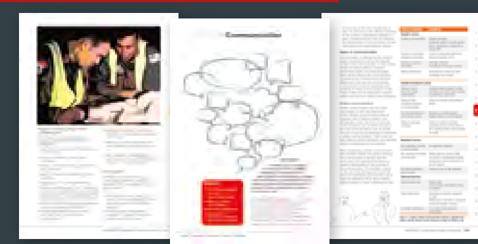
Decision-making



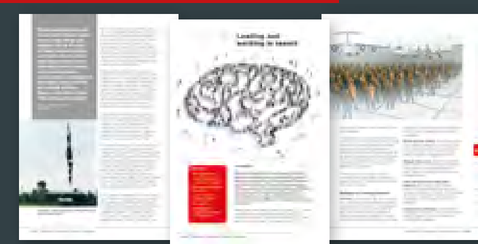
Situational awareness



Communication skills



Teamwork and collaboration



Stress and fatigue management

Aviation Safety Training Courses

Course	Course aim	Prerequisites	Course description
ASO (I) Aviation Safety Officer (Initial) Course	**COURSE AIM:** To graduate Unit ASOs, Maintenance ASOs and Flight Senior Maintenance Sailors.	**PREREQUISITES:** Personnel who are required to perform the duties of an ASO.	**COURSE DESCRIPTION:** The course is delivered as two separate weekly components (the first is online; the second is face-to-face) with a one-week break in between. The course provides theory and practical exercises in the broad topics of the Defence Aviation Safety Management System, risk management, human factors, the Defence Aviation Safety Analysis Model, safety event investigation and reporting.
ASO (A) Aviation Safety Officer (Advanced) Course	**COURSE AIM:** To graduate Base, Wing, Regiment, Fleet, Group and Command ASOs.	**PREREQUISITES:** ASO (I) practical and applied experience as an ASO (or equivalent).	**COURSE DESCRIPTION:** The course provides theory and practical exercises in the broad topics of the Defence Aviation Safety Management System, human factors and risk management, and base/unit emergency response.
NTS Non-Technical Skills Trainer	**COURSE AIM:** To graduate students with the knowledge and skills to deliver non-technical skills training.	**PREREQUISITES:** A solid background in crew/maintenance resource management and/or human factors.	**COURSE DESCRIPTION:** The course provides the theoretical background of aviation non-technical skills and trains students in the skills and knowledge for delivering non-technical skills training. The course also introduces students to scenario-based training and assessment techniques.
AIIC Aviation Incident Investigator Course *Available upon request	**COURSE AIM:** To develop members to support their ASO in conducting aviation incident-level investigations.	**PREREQUISITES:** Any personnel who are involved with Defence Aviation. There is no restriction on rank, Defence civilians and contractor staff are also welcome to attend.	**COURSE DESCRIPTION:** This one-day course provides theory (taken from the ASO(I) course) on the topics of: the Defence Aviation Safety Management System; generative safety culture; error and violation; the Defence Aviation Safety Analysis Model; aviation safety event investigation and reporting. Interested personnel should contact their ASO.

For further details concerning location and up-to-date course dates visit the DFSB intranet site or email dfsbet@dpe.protected.mil.au

All courses are generally oversubscribed, nominations from individual units or candidates will not be accepted, nominations are to be forwarded with the Commanding Officer's endorsement to:

- **Air Force:** relevant Wing Aviation Safety Officer, or for CSG, Staff Officer Safety HQCSG
- **Navy:** Fleet Aviation Safety Officer
- **Army:** Army Safety Section, DOPAW, AVCOMD.

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