



Aviation Human Factors

Do the fundamentals of aviation safety really change?

RAeS Australia Safety Award

Recognising an individual or team effort that enhances aviation safety in ADF

Communication

What if someone didn't tell you about the state of your aircraft?

01 2019
EDITION

Spotlight



Rule of Three

Can it be applied in the airborne environment?



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June 2019

FOREWORD

IN REVIEWING THIS edition of *Spotlight*, it quickly became apparent that the Safety Promotion and Communications team here at DFSB has managed to pull together what might be our most eclectic *Spotlight* magazine ever. There are excellent articles on human factors, there are externally sourced articles on safety investigations produced by our good friends at the Australian Transport Safety Bureau, and indeed from the US equivalent – the National Transportation Safety Board. There is even a fascinating historical piece regarding RAAF aviation safety efforts during WWII.

That last article was kindly produced by Drs Peter Hobbins and Elizabeth Roberts-Pedersen who used our archives while researching the journal article, ‘Accident conscious: accounting for flying accidents in the Royal Australian Air Force during the Second World War’, which is to be published in *War in History*.

I’d also like to extend my congratulations to the award winners featured in this magazine — our Goodshow Award recipient LAC Leigh Okunev [below], 2018 RAeS Australian Division Award winner, Army Captain Anthony Erwin, and RAeS Defence Aviation Safety Award Finalist, Jacob Rowe. Your dedication to aviation safety is highly valued.

In all, this edition represents the combined efforts of a great many people to bring the topic of aviation safety to life, to make it interesting, and more importantly to ensure we learn something from others’ experiences.

I thought this was a great read — I hope you do too, and I commend it to you.

Regards,

GPCAPT Nigel Ward
Director DFSB

GOODSHOW AWARD

LAC LEIGH OKUNEV from 453SQN Williamtown Flight was presented with a Goodshow Award by the squadron’s CO, WGCDR Peter Hartley, on 17 January 2019.

The award recognises his exceptional application of risk-management principles in assessing a serious risk to Williamtown Radar, which had the potential to cause critical damage to equipment and compromise personnel safety.

During a contracted maintenance activity on the radar airconditioning system, LAC Okunev discovered that the maintenance activity was not conducted correctly. This deficiency required a risk analysis in quick time and a decision made for rectification. Had he overlooked this, or not taken action at all, secondary effects had the potential for a loss to capability, equipment and/or human life.

LAC Okunev’s vigilance during a high-pressure situation and his perseverance to overcome the deficiency was pivotal in maintaining capability.



CONTENTS



An accident of history

Analysis of history suggests that the Air Force has had an understanding of the complexity of aircraft accidents as far back as WW2 but struggled with managing human factors. **PAGE 22**

Complacency and habit patterns

A pilot tells of the time the holes in the Swiss cheese aligned for him; and the results were not just embarrassing but potentially fatal. **PAGE 32**

Time management

Task slips and time slides see a maintenance crew continually extending duty hours to see the completion of a task on a P3C-A until fatigue is the inevitable result. **PAGE 4**

Crash of Asiana Airlines Flight 214

In July 2013 Asiana Airlines flight 214 struck the seawall at San Francisco International Airport during approach. The crash killed three passengers and critically injured 49 passengers and crew. The aircraft was destroyed in the ensuing fire. Are there lessons to be by learnt by ADF aircrew? **PAGE 6**

Can Rule of Three be applied in the airborne environment?

SQNLDR Chris Bassingthwaite explores the use of a simple tool to manage risk during flying operations. Using his own experience flying C130s in and out of Afghanistan he looks at applying the rule of three to a tricky flight to Tarin Kowt. **PAGE 12**

Loadmaster puts safety of team first

Identifying and correcting simple errors before they become a far more serious problem raises the safety awareness of a team. **PAGE 16**

Rule of Three helped save my life

LEUT Mick Regan gives the pilot’s account of the cockpit fire in a Bell 429 featured in the *Spotlight* investigation special and how using the Rule of Three prevented a bad situation from getting much worse. **PAGE 18**

RAeS Award

An army captain’s tenacity and commitment to improving safety is recognised by the Royal Aeronautical Society. **PAGE 28**

A joint-service approach better perparees aircrew

A comprehensive suite of modern and traditional training elements go into preparing the ADF’s newest helicopter pilots at 723 SQN based in Nowra. **PAGE 31**

Should we tell the crew?

Determining how much information we need to make sound decisions. We don’t always have all the information or reasoning behind a decision that has been made. **PAGE 34**

Hazard recognition

A drill bit lodged in a hand leads to an investigation and uncovers more questions and no simple answers. **PAGE 36**

Wirestrike

Wirestrike is a hazard that many ADF aircrew face. This is an ATSB report into one such incident that occurred in July 2018 to a Cessna 172RG. **PAGE 37**

Loss of control

A UAS takes off from Ballina and never returns because of a simple oversight. Read the ATSB report from 2016. **PAGE 41**

Tossed by a thunderstorm

A flight crew deviated from its planned route around a storm system, thinking the line of storms was fragmented enough to get through. **PAGE 46**



Shift creep

Pressure to meet a deadline

I WAS PART OF an Air Force project team managing a contractor who was responsible for a major aircraft avionics upgrade on the P3 Orion from 2000 to 2004.

The project team provided an engine runner and trade SMEs, as well as assistance and guidance to the contractor. The day started off as normal with the usual maintenance planning briefs and a schedule for the day. The contractor was under a substantial amount of pressure to meet a

deadline as production had been slipping. The schedule had us performing the first engine generator runs to power up new systems. This was a fairly straightforward task, carried out utilising multiple checklists, and would take three to five hours.

The first issue we had was getting the aircraft to the run up area. The airfield was shared with a Qantas heavy maintenance facility and a Boeing 747 was parked on the taxi way leading out to the

run up area. The 747 took two hours to vacate the taxi way. The team decided to work through lunch to negate the delay.

Engine runs were started and as the second generator came on line it indicated a feeder fault – a major imbalance between phases of 3-phase power it supplies. The engine was secured and the contractor instructed to perform electrical checks and rectify the problem. An indicator on a supervisory panel had tripped making it mandatory to change out the engine generator.

A replacement generator was cannibalised from another aircraft and fitted, adding approximately six hours of maintenance to the task in addition to the previous two-hour delay. We had three-to-five hours to complete the task which would see us finishing at 2015 hrs at the latest.

This seemed acceptable as the day would be just over 13 hours long. Engine runs started again and after two hours we experienced smoke and fumes from an unknown source. The contractors were called back to determine the source and rectify if possible, so we could complete the runs.

I personally didn't see any problem with us waiting around until the fault was corrected, as we were just sitting around while the contractors performed the maintenance. By the time we recommenced engine runs it was 2315 hrs – 16 hours into the shift.

I was the least fatigued and decided that I would read the checklist and make sure we did not miss any steps. Engine runs were completed by 0230 hrs – 19.5 hours after initially started.

The following day the contractor was extremely pleased that they had achieved their milestone. However my boss was not so pleased with our performance. He explained it as being the light at the end of the tunnel.

The light was there and we were so close, but we should not have continued to move the goal posts for the night's work. We did though. And this time, we got lucky, it all went well. At least we think it did...was there something we missed, could we have done something better or more efficient, did we set the right example for those around us, in today's terminology were we reducing the risks SFARP?

All questions that in hindsight I am now able to ask myself and questions that I now force on myself before performing any task.

In hindsight I learnt that there is no real reason to put yourself or your workforce in a situation where fatigue can affect your judgement just to meet a milestone.

Everybody wants to achieve and get the job done, but sometimes you need to take a step back to make sure it is not being done unnecessarily.

Defence and myself have come a long way since this occurred – we now have more robust safety processes in place, and a workforce that is far more educated on managing risk. We still undoubtedly have a need to complete maintenance tasks and provide capability; however the 'capability first, safety always' mindset ensures greater awareness among all ADF members.

Author's name withheld by request.



Crash of Asiana Airlines Flight 214



SELECTIONS FROM THE NTSB ACCIDENT REPORT

Summary of the accident

ON 6 JULY, 2013, a Boeing 777-200ER, operating as Asiana Airlines Flight 214, was on approach to runway 28L when it struck a seawall at San Francisco International Airport. Three of the 291 passengers were fatally injured; 40 passengers, eight of the 12 flight attendants, and one of the four flight crewmembers received serious injuries. The airplane was destroyed by impact forces and a post-crash fire.

The flight was vectored for a visual approach to runway 28L and intercepted the final approach course about 14 nautical miles (nm) from the threshold at an altitude slightly above the desired 3-degree glidepath. This set the flight crew up for a straight-in visual approach; however, after

accepting an air traffic control instruction to maintain 180 kts to 5 nm from the runway, the flight crew mismanaged the airplane's descent, which resulted in the airplane being well above the desired 3-degree glidepath when it reached the 5 nm point. The flight crew's difficulty in managing the airplane's descent continued as the approach proceeded.

In an attempt to increase the descent rate and capture the desired glidepath, the pilot flying (PF) selected an autopilot (A/P) mode (flight level change speed [FLCH SPD]) that resulted in the autoflight system initiating a climb because the airplane was below the selected altitude.

The PF disconnected the A/P and moved the thrust levers to idle, which caused the autoflight (A/T) to change to the HOLD mode – a mode in which the A/T does not control airspeed. The PF then pitched the airplane down and increased the descent rate. Neither the PF, the pilot monitoring (PM), nor the observer noted the change in A/T mode to HOLD.

As the airplane reached 500 ft above airport elevation, the point at which Asiana's procedures dictated that the approach must be stabilized, the precision approach path indicator (PAPI) would have shown the flight crew that the airplane was slightly above the desired glidepath. Also, the airspeed, which had been decreasing rapidly, had just reached the proper approach speed of 137 kts. However, the thrust levers were still at idle and the descent rate was about 1200 ft per minute, well above the descent rate of about 700 fpm needed to maintain the desired glidepath.

These were two indications that the approach was not stabilized. Based on these two indications, the flight crew should have determined that the approach was unstabilized and initiated a go-around, but they did not do so.

As the approach continued, it became increasingly unstabilized as the airplane descended below the desired glidepath; the PAPI displayed three and then four red lights, indicating the continuing descent below the glidepath.

The decreasing trend in airspeed continued and at about 200 ft, the flight crew became aware of the low airspeed and low path conditions but did not initiate a go-around until the airplane was below 100 ft, at which point it did not have the performance capability to accomplish a go-around.

The flight crew's insufficient monitoring of airspeed indications during the approach resulted from expectancy, increased workload, fatigue, and automation reliance.

Select findings

- The flight crew's mismanagement of the airplane's vertical profile during the initial approach led to a period of increased workload which reduced the pilot monitoring's awareness of the PF's actions around the time of the unintended deactivation of automatic airspeed control. Nonstandard

communication and co-ordination between the PF and the PM when making selections on the mode control panel to control the autopilot flight director system (AFDS) and A/T likely resulted, at least in part, from role confusion and subsequently degraded their awareness of AFDS and A/T modes.

- Insufficient flight crew monitoring of airspeed indications during the approach likely resulted from expectancy, increased workload, fatigue, and automation reliance.
- The delayed initiation of a go-around by the pilot flying and the pilot monitoring after they became aware of the airplane's low path and airspeed likely resulted from a combination of surprise, nonstandard communication, and role confusion.
- As a result of complexities in the 777 AFCS and inadequacies in related training and documentation, the PF had an inaccurate understanding of how the AFDS and A/T interacted to control airspeed, which led to his inadvertent deactivation of automatic airspeed control.
- If the autoflight automatic engagement function (wakeup), or a system with similar functionality, had been available during the final approach, it would likely have activated and increased power about 20 seconds before impact, which may have prevented the accident.
- If Asiana Airlines had not allowed an informal practice of keeping the PM flight director (F/D) on during a visual approach, the PM would likely have switched off both F/Ds, which would have corrected the unintended deactivation of automatic airspeed control.
- By encouraging flight crews to manually fly the airplane before the last 1000 ft of the approach, Asiana Airlines would improve its pilots' abilities to cope with

manoeuvring changes commonly experienced at major airports and would allow them to be more proficient in establishing stabilized approaches under demanding conditions; in this accident, the pilot flying may have better used pitch trim, recognized that the airspeed was decaying, and taken the appropriate corrective action.

- A context-dependent low-energy alert would help pilots successfully recover from unexpected low-energy situations.

Contributing factors

Contributing to the accident were:

- (1) the complexities of the A/T and AFDS that were inadequately described in Boeing's documentation and Asiana's pilot training, which increased the likelihood of mode error;
- (2) the flight crew's nonstandard communication and co-ordination regarding the use of the A/T and AFDS.

Recommendations

To Boeing:

- Using the guidance developed by the low-energy alerting system panel created in accordance with recommendation, develop and evaluate a modification to Boeing wide-body automatic flight control systems to help ensure that the aircraft energy state remains at or above the minimum desired energy condition during any portion of the flight.
- Revise your 777 Flight Crew Operating Manual to include a specific statement that when the autopilot is off and both flight director switches are turned off, the A/T mode goes to speed (SPD) mode and maintains the mode control panel-selected speed.

Source: NTSB Accident Report (June 2014). *Descent below visual glide path and impact with seawall, Asiana Airlines Flight 214, Boeing 777-200ER, HL7742, San Francisco, California, 6 July 2013.*



What can we learn from Asiana Flight 214?

By SQNLDR Christopher Bassingthwaighe

AFTER REVIEWING THE crash of Asiana Flight 214, one question instantly comes to mind – could this happen to an ADF crew? The instinctive response to this question might be; it's unlikely that a highly trained ADF crew would make such fundamental errors during a basic flying sequence.

Of course, ADF crews aren't immune to errors and it's often a number of pre-conditions, the sequence of events and the context of the situation that can escalate seemingly minor errors into catastrophe.

The halo effect cognitive bias is very strong when we think of our own performance and that of our peers. This coupled with hindsight bias (knowledge of an occurrence makes it seem more probable and therefore more predictable) means that we can be blind to the critical lessons that lay under the surface, or indeed out in the open – lessons that can be directly applicable to our work environment.

Better questions to ask ourselves might be; what are the general themes and lessons learnt from this accident and could they be applicable to us, and are we doing what is best practice or is there room for improvement? When reflecting on the findings and contributing factors identified during the NTSB's Asiana Flight 214 investigation, there certainly are a number of themes and lessons learnt that are highly relevant to ADF operations.

Automation is a double-edged sword

The first and most obvious theme from Asiana Flight 214 and many accidents and incidents like it, is the issue of automation. Automation is a double-edged sword; it increases accuracy and efficiency, but it also brings about new hazards because of our dependence on it. The issue is not

just about the presence of automated systems and our interaction with them, it is also about the increasing level of complexity as aircraft are modified and replaced by new platforms with emerging technologies.

There are a range of more pronounced and directly perceivable hazards that exist where the erroneous and uncommanded activation of a system can potentially jeopardise the safe operation of the aircraft. An example is the recent 737 MAX accidents, where the uncommanded activation of the Maneuvering Characteristics Augmentation System (MCAS) had a direct effect on the commanded flight path.

Many ADF aircraft have anti-stall stick pushers, uncommanded activation of this system while flying at low level would most certainly result in a very high risk of CFIT. But behind the more pronounced hazard of uncommanded automated actions are the more nuanced and unknown hazards that sprout from new and complex technology and its interaction with the human.

In this case, true understanding may be hard to come by for a number of reasons; the information may not be available, there may be too much of it, or it may be too complex to understand for someone who is not intimately involved in the development of the system.

In the case of Asiana Flight 214, the most prominent automation issue that emerged was that the pilots did not have a thorough understanding of the nuances of the autopilot (A/P) modes and autothrottle (A/T) logic, particularly in this case during a visual approach, which for them was a 'non-standard' sequence. This led the Pilot Flying (PF) to select an inappropriate Flight Director mode, and when the aircraft did not respond as predicted, led to the PF disengaging the A/P.

The nuance of the system in this case is described by the following logic; during a descent in flight level change speed (FLCH SPD) mode or vertical navigation speed (VNAV SPD) mode, the A/T may activate in HOLD mode. When in HOLD mode, the A/T will not wake up even during large deviations from target speed and does not support stall protection. In other words, to increase thrust from IDLE the pilot would have needed to actively manipulate the thrust levers or engage an A/T mode.

If the A/T was in wakeup, it would likely have activated and increased power about 20 seconds before impact, which may have prevented the accident.

The recommendations to Boeing from the NTSB speak to the fact that the system design was (or still is) not ideal, and suggests that Boeing could have done a better job with providing operators with appropriate knowledge and recommended training, to ensure that crews fully understood the nuances of the system and its potential pitfalls. However, no system is perfect and there will always be nuances that can catch people out.

If design issues are problematic, the ADF is rarely in a position where it can directly affect re-design or improvement of a system and even if it could, the turnaround time on changes is often quite substantial. Therefore, the most useful course of action is to ensure the operators are well informed and well trained.

To tackle the issues surrounding automation we need to ask ourselves a number of questions. Do we intimately understand the functionality and logic of our automated systems? Do we understand the nuances that could result in undesired behaviour of the system? Are we able to immediately recognise undesired behaviour and respond accordingly?

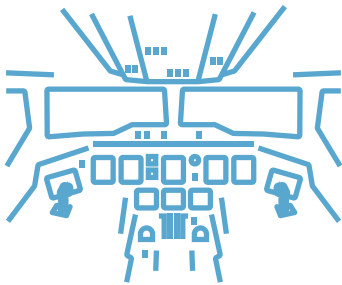
Are we training our people in normal and abnormal automation management so that during critical stages of flight, they can draw on recognition-primed decision-making and well-rehearsed skillsets in order to respond in the correct manner with little delay? These sorts of considerations should be addressed not just in initial training but also in recurrent training and upgrades.

Skill degradation

A second theme from Asiana Flight 214 is the issue of skill degradation. As aircraft become more automated, basic flying skills are practiced less and less so that when they are required, they are found wanting.

For those who own, manage and operate the complex systems, there is one blindingly obvious lesson here; train your people to handle the system in normal modes, basic modes and

The issue is not just about the presence of automated systems and our interaction with them, it is also about the increasing level of complexity as aircraft are modified and replaced by new platforms with emerging technologies.



The required training, especially when conducted in the simulator, should be aimed at putting crews outside their comfort zone so that they can practice regaining normal profiles during non-standard situations.

reversionary modes and ensure that these basic skills are kept current. This requirement should be easier for the ADF than commercial operators; ADF units generally hold the discretion to include additional training both in the simulator and the aircraft without excessive commercial pressure.

The pressure to shave off training in the ADF often comes from pressures on capability (linked to commercial pressure) such as requirements to reduce timelines for training courses or perhaps a lack of access to appropriate training facilities or assets. This can perpetuate into pressure to make ground school shorter or easier (for example, computer-based training with no instructor), pressure to reduce the duration of training/ simulator events or to cut-away sequences perceived as non-essential, and the pressure to reduce or avoid ‘discretionary’ training in the aircraft.

The required training, especially when conducted in the simulator, should be aimed at putting crews outside their comfort zone so that they can practice regaining normal profiles during non-standard situations.

Creating a high workload will highlight deficiencies in crew co-ordination, aircraft

handling and automation management; it is far better to identify and remedy these shortfalls in the simulator than the aircraft.

With regard to aircraft training and currency, flying a visual approach in an aircraft like the KC-30 is certainly a different challenge to flying a visual approach in a King Air and hence comes with a different level of associated risk. However, if the crews are expected to conduct certain sequences in the aircraft occasionally (that is, a visual approach), then they should be practicing this on a fairly regular basis rather than flying a fully coupled approach on every occasion.

Standard Operating Procedures which restrict training of certain sequences in the aircraft can sometimes be written to address obvious risk factors without fully considering the latent risks or second-order effects. Finding an appropriate balance between the risk of doing something versus the risk of not doing something can be very difficult.

Crew co-ordination

A third theme from Asiana Flight 214, and probably the most frustrating in hindsight, was the lack of appropriate monitoring and supervision of the PF along with the lack of

effective crew co-ordination. Certainly fatigue was a consideration; however, it can’t be ignored that the crew members were not effectively employing their non-technical skills.

The lack of effective communication (for example, standard calls like “Flight Level Change engaged” or “autopilot disengaged”) meant that there was probably a different mental model of the state of the system between the pilots.

The Pilot Monitoring (PM) in the right-hand seat was an experienced B777 captain who was on his first flight as an instructor pilot supervising a trainee Captain gaining operating experience. The PM did not have the opportunity during his instructor training to supervise and instruct a trainee during line operations while being observed by an experienced instructor.

During the critical final stages of Flight 214, the lack of effective monitoring and prompts, as well as the absence of a take-over from the PM indicates that he was either seriously fatigued, inhibited in some other way (that is, by interpersonal factors) or that his supervisory and instructor training was seriously inadequate (or a combination of all three factors).

Further issues emerge, such as the lack of awareness or acceptance of an unstabilised approach, and the crew interaction from the first officer who was on the flight deck but not in a control seat. Were the crew trained in recognising what constituted an unstable approach and were they disciplined (or reluctant) in applying unstable approach criteria or go-around criteria?

The first officer allegedly called “sink rate” several times during the last minute of the descent; however, whether this was heard, understood or ignored by the PF and PM is unknown.

It is critical that during training we emphasise crew co-ordination as a critical success factor and that we put our crews into non-standard situations which force them to employ their non-technical skills effectively.

Whenever possible, these training sequences should be scenario-based to increase realism and complexity. Preferably, the training sequences should be non-scripted so that the crew does not know the outcome, this will

ensure that people are not just following a preconceived path of how they think they should act and interact. These non-scripted scenario-based training events will bear out genuine issues and areas for improvement in aspects like crew co-ordination, communication and decision-making.

An example in supervisory training could be to have the PF role-play towards an unstable approach and see whether the PM reacts appropriately. Preferably this unstable approach is unexpected for the PM and not part of a ‘canned’ scenario so that their reaction to the training situation is as authentic as possible. Obviously a lot of this training has to be conducted in a controlled environment like a simulator to reduce unnecessary risk.

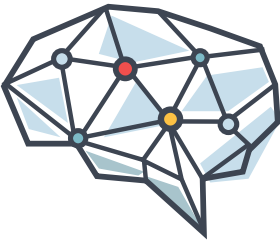
The ADF has in its inventory or soon to be acquired, a lot of highly automated aircraft and other complex systems.

The systems have unprecedented levels of automation and hence there will be a continuing challenge at the operator level to intimately understand how the automation works along with all the inevitable nuances and shortfalls embedded in the logic and functionality. This challenge extends into knowing how to effectively manage the automation and how to effectively train for expected and unexpected situations.

Skill-degradation will continue to be an issue when dealing with highly automated systems and hence training will need to be constantly reviewed to ensure that operators are equipped with the necessary skills to deal with low-frequency or non-standard situations.

Human-to-human interactions such as crew co-ordination and communication need to be enhanced by training that places crews outside their comfort zone with non-scripted and scenario-based training evolutions.

We would like to think that our crews would never fly an aircraft into a seawall during a visual approach on a nice sunny day. However no one can deny that there are essential lessons from the crash of Asiana Airlines Flight 214 that may offer areas for improvement for us in the areas of automation management, skill degradation and crew co-ordination.



This challenge extends into knowing how to effectively manage the automation and how to effectively train for expected and unexpected situations.



References:

DFSB Aviation Non-Technical Skills Guidebook (May 2018)

NTSB Accident Report (June 2014). Descent below visual glide path and impact with seawall, Asiana Airlines Flight 214, Boeing 777-200ER, HL 7742, San Francisco, California, 6 July 2013.

Can Rule of Three be applied in the airborne environment?

By SQNLDR Christopher Bassingthwaighte

A NUMBER OF YEARS ago I attended an Aviation Safety Officer – Initial (ASO(I)) course where I was required to write an article on a personal experience or an aviation safety issue. The article was published in *Spotlight* and the opportunity still exists for anyone to write an article (on ASO(I) course or generally) and have it published in this magazine. Naturally, as a pilot, I took the opportunity to write about myself with great alacrity.

The article was called *Pushing the Limit* which I admit is a pretty racy title for a trash hauler. It was about a C-130J mission in Afghanistan from Kandahar to Tarin Kowt, a short 20-minute hop. Tarin Kowt is a small city in a valley surrounded by mountains with an elevation of 4495 ft; at the time the runway was relatively short and could only be landed on in one direction.

The weather in Afghanistan was usually a challenge with snow in winter and dust storms in summer. This, mixed with the unreliable nature of a threat environment where the airfield could be closed at a moment's notice, meant that it was wise to carry alternative fuel for everywhere else in Afghanistan.

On this day there was rain on the lowlands and snow in the highlands with associated heavy cloud. At top of climb we entered a snow shower and the ice protection systems turned on automatically; however, about one minute later, one of the ice-protection zones failed. After popping out the other side of the snow


shower, we were met with sloping cloud and reduced visibility down into the bowl around Tarin Kowt. We had to assess whether we could continue without the ice-protection systems operating at 100 per cent. This chewed up some mental capacity and time but followed with the decision to press with the visual approach. I was confident that we could maintain clear of cloud with ground in sight, despite the fact the airfield environment couldn't be seen at this point.

In addition to the aircraft system malfunction and the complex visual approach, which were perceived to be manageable at the time, the co-pilot was having trouble trying to establish communication with Tarin Kowt Tower. A lot of interference was causing the comms to fade out, which meant we were missing critical pieces of information like the wind strength and direction. Adding further complexity to the decision-making process was the fact Tarin Kowt was a one-way, short runway – and you don't exactly want to be cutting circuits over an airfield environment where a portion of the populace want to shoot at you, and many of that portion have the capability to do so.


Despite the poor comms I was confident we had an ATC clearance to approach the airfield, we could assess the wind on finals and go-around if it was out of limits with a subsequent climb to a safe height to reassess the situation... but there was high terrain surrounding us with crappy weather and an ice protection system that wasn't fully functional... press.

With the confusing comms and the poor weather, I had inadvertently delayed the






PROCEED
Well within limits or assumptions



CONSIDER
Nearing the boundary of being acceptable



STOP
Out of limits or unacceptable

How to apply:

- Use PEAR to identify your AMBERS and REDS
- Speak up and discuss issues with team/supervisor
- Eliminate all unnecessary risk
- Apply all reasonable treatments/controls (ensure they are authorised for use)
- Ensure all decisions are made at the appropriate level
- Remember three or more AMBERS equals a RED

Authorised by DFSB – APR 2016

The result was an exceedance of an aircraft limit. In this case it was a minor transgression outside the flight envelope but the potential implications can be much worse.

slowdown and configuration of the aircraft leaving us high and fast – the age-old problem. On finals, with too much airspeed and what turned out to be too much tailwind, we conducted a go-around. At this point I was in a flurry and it was only a couple of seconds with too much power and too low an attitude before I over-spiced the flap. The over-speed was minor and we had already invested too much in this approach so I cut a circuit and landed. As an aside, read about cognitive bias in decision-making in our *Non-Technical Skills Guidebook*.

A minor over-speed is not a huge deal at the end of the day but the unmanageable workload and loss of SA has potential implications that can be far worse. I put the unmanageable workload down to three common factors; adverse weather, degraded comms and an aircraft issue. I can relate to many different situations where high workload was a concern and it often involved the same three factors.

If it wasn't these factors, it was similar dynamics like a tactical scenario involving problem solving, other aircraft traffic to consider, or flight on NVG in low-light conditions. As an instructor, I learnt to cook up a recipe of high workload for the crews in the simulator; mix some weather and a minor aircraft malfunction with a sprinkle of busy comms over the top, add in some time pressure and hey presto, peak workload.

Years later, an instructor from Central Flying School was reading my article while doing their daily business (so they told me), and by chance I spoke to them on the phone later that day about an unrelated issue. They said "I read that article and it sounds like Rule of Three right?" I had always thought of the incident as a workload issue but Rule of Three was a more simple and effective technique for analysing the situation.

Rule of Three is a simple method of identifying emerging risks and applying immediate risk management before and during the execution of an activity. The basic premise is the traffic-light system. You must always stop if you have a RED, but too many AMBER lights may be just as risky.

Safety events all too often happen because of a combination of relatively minor events and situations. RED is pretty clear cut; where a condition or circumstance is out of limits or unacceptable, you do not proceed until the RED is eliminated and returns to an AMBER or GREEN. Interpretation of AMBERS and what should be done in response is often misconstrued.

An AMBER is where the condition or circumstance, while within limits, is nearing the boundary of being acceptable. In the three common factors mentioned above, this could further be defined in the airborne environment as weather close to minima but acceptable to continue; degraded comms where the minimum information can be obtained but full situation awareness is not possible; and a failed or degraded aircraft system that is not required for the immediate task but could have implications in the near future. Each of these factors need to be analysed and where possible should be eliminated or minimised into a GREEN. For example, a visual approach in marginal conditions could be converted into an instrument approach, another instrument approach could be selected with a lower minima, or a hold could be entered to reassess and wait for improving conditions.

Rather than pressing with degraded comms, clarification can be sought, potentially through other means using another frequency, a different radio, via SATCOM or through other aircraft in the area.

Rather than quickly assuming an aircraft system is not required for the task, extra track miles or a hold can be entered to properly assess the impact, isolate the system, complete the checklist and brief the crew/wingman. These methods could be seen as eliminating or minimising into a GREEN.

If a condition or circumstance remains as an AMBER, continue if you are satisfied that nothing further can be done but maintain vigilance in this area. For example, an approach close to minima is not a huge problem if there are no other issues causing increased complexity or distracting you from the primary task. However, when three AMBERS are present, this is a cue that it's time to slow down, reassess and manage some of these AMBERS to GREEN.

PEAR is often used as a cue to identify threats and emerging risks during briefing. P = People

(for example, crew), E = Environment (for example, adverse weather), A = Actions (for example, communication requirements), R = resources (for example, aircraft status).

Not surprisingly, Rule of Three as a risk-management tool has links to Threat and Error Management (TEM). In the TEM model, individuals and crews will encounter a number of threats (external influences) and/or errors (internal influences) that could lead to an unsafe outcome. In our example, the threats are adverse weather, degraded comms and an aircraft issue (not to mention a few others such as high terrain, a combat environment, a short/one-way runway et cetera).

While flying an approach in adverse weather down to minima, an error could be made such as flying outside of tolerances, caused by distraction or increased workload due to other threats such as degraded comms or aircraft systems. Threat + Error = Undesired Aircraft State. More information on Rule of Three, PEAR and TEM can be found in the *Non-Technical Skills Guidebook*, chapters 11 and 15.

With infinite time and resources, any set of complicated dynamics could be carefully managed into a successful outcome. The reality in any workplace (and of the known physical laws of the universe) is that we do not have infinite time and resources, which is somewhat magnified by a mobile work environment moving forward at several miles per minute. Hence dealing with changing variables, threats and emerging risks results in complexity which ties into workload management.

Task demands vary according to difficulty, complexity, mode of input (for example, auditory), mode of response (for example, control input), the nature of competing and concurrent tasks, the priorities attached to those tasks, and the context. Difficulty and complexity can be brought about by tasks outside well established skills and routines which demand additional cognitive effort. When different complex tasks compete for cognitive resources, workload increases and when workload is too high (overload), the information-processing system will inevitably fail to detect or respond to important information.

The effect of high workload includes attentional and task focusing, task

shedding, poor decision-making, disrupted communications, increased fatigue, stress, and a higher likelihood of error and violation.

The workload during the approach to Tarin Kowt was increased by a series of threats and emerging risks that I could have dealt with by employing Rule of Three or TEM. The effect was 'overload' resulting in a failure to monitor a primary flight parameter and respond accordingly. The result was an exceedance of an aircraft limit. In this case it was a minor transgression outside the flight envelope but the potential implications can be much worse.

Preceding execution of an activity, high workload can be prepared for by effective training, knowledge, experience, planning, briefing, and a suitable physical and mental state. During execution, it is not possible to pop back into the simulator and practice the routine a few more times. High workload in the immediate context can be dealt with by increasing time available and effective task distribution. Time can be increased by slowing down, entering an orbit or creating extra track-miles. Effective task distribution can be obtained by using chunking to reduce complex sequences to manageable units, effective communication, team management and use of automation. Chapter 11 of the *Non-Technical Skills Guidebook* has more on workload management.

I feel that Rule of Three can be used effectively in the airborne environment as a tool to identify emerging risks and conduct immediate risk management. The article *How the Rule of Three helped save my life* [page 18] is an excellent example of this. Its utility is its simplicity and the result is a deliberate process to deal with emerging risks, manage them in chunks, and be safe so far as is reasonably practicable. TEM, in addition to risk management, is a useful method for predicting possible outcomes in planning, anticipating threats and errors airborne, and reviewing situations post-flight.

Poor risk management can propagate as increased workload when the risks are realised and suddenly have to be dealt with all at once. This increased workload can engender errors increasing the likelihood of an unsafe aircraft state, therefore it is important to prepare for high workload situations and know how to manage them in real time.



Addendum

The ASOR for the incident in 'Pushing the Limit' can be found through DFSB's Safety Information Intelligence System, SALUS. For information on how to access and use SALUS go to the DFSB website. Those who find the ASOR number can email: DFSB.NTS@defence.gov.au and receive a prize – a free hardcopy of the Defence *Aviation Non-Technical Skills* (NTS) *Guidebook* (hint: the incident occurred in February 2011). A softcopy of the guidebook is always available on the DFSB website and through the DASA internet page (see QR code below). If you're interested in a hardcopy and can't be bothered looking up the ASOR, just email us.





Loadmaster puts safety of team first

THE FIRST TIME I personally experienced the importance of all team members taking aviation safety seriously was on my first real ALS mission post C-17 conversion. I was taking over from a crew which had flown the aircraft home from the MER to complete the task down to RAAF Base Edinburgh.

I had a C-Cat Loadmaster along on the mission to report on my progression and ability to handle myself as a loadmaster. We were taking the jet over from two senior loadmasters – one a warrant officer who had years of experience on several airframes and had recently completed his re-conversion back onto the C-17, the other a senior B-Cat flight sergeant. The jet had a full load of pallets, around 14, loaded in the logistics rail orientation with some ADS pallets on the ramp.

The task was simple enough; we were going to get the handover from the first crew and do the final leg – pretty straight forward. Upon their arrival we stepped out to the jet, received a simple handover and was told our cargo was bonded through to Edinburgh. However, during my preflight checks of the cargo I noticed one of the pallets was loaded with an engine that was orientated perpendicular to the aircraft cargo hold. The engine itself had an A4 sheet on it with an arrow pointing to the side wall of the C-17 and

the words ‘front of aircraft for transport’. On closer inspection I also noted the engine and mount were restrained for transport in the ADS rail system, not the Logistic rail system as it was loaded.

I identified and explained the issue to the other loadmaster with me who discussed the situation but left me to ultimately decide on how to proceed. Despite being a junior D-Cat loadmaster the correct course of action was still blaringly obvious; however, still somewhat difficult to make. No-one wants to call out a more senior work colleague on their errors or insult anyone’s abilities, but that doesn’t make ignorance okay.

I took far too long to make the call to movements and unload the pallets in order to rotate the engine and rectify the issues with its current state. But I did make the right decision and the resulting investigation confirmed that.

The need to correct this mistake cost my team several hours of unloading and reloading, which delayed our arrival in Edinburgh by almost four hours. More importantly, we conducted ourselves in a manner that valued the safety of the team above all else. And I feel this is a vital trait of any team, especially in aviation as errors can cost us more than simply damage to assets. Ignoring or undervaluing safety can cost someone their life.

Author’s name withheld by request.

RULE OF THREE

helped save my life

By LEUT Mick Regan

I WAS AN interesting March day in 2017; I was posted to 723 Squadron and lucky enough to be building up my experience flying a Bell 429 after completing the Pilot's Rotary Conversion course on the AS350 Squirrel.

The weather for our planned staff continuation sortie was not great as isolated thunderstorms were forecast in the area and the weather at the aerodrome was degraded, yet still deemed suitable for our sortie. There were periods of reduced visibility to 5000 m with a cloud base of 1000 ft AGL. These conditions were above the minimas required for the flight we were about to conduct,

and as we had comprehensively reviewed the Nav route, with contingencies in place, we chose to fly in an environment where we may have to make some smart decisions with respect to the navigation of the aircraft due to the weather.

This was our first AMBER.

We launched out of Nowra for our planned day VFR into night IFR sortie. We aimed to transit from Nowra to Moruya via a coastal navigation south, fly a missed approach out of Moruya just before last light to get to our safe height and then head west to Canberra for an instrument approach before returning to Nowra for another instrument approach.

During our transit south we encountered the showers en-route that were expected. We briefed our thoughts on what we could do if we didn't make Moruya before last light and what our return plan and cut off day VFR time was.

It was only about 15-to-20 miles out of Nowra that we were faced with a heavy rain shower and visibility was reduced to a point that we were not happy to proceed. Noting the fading light and our minimum



visibility requirements of 800 m in G-class airspace, we made the decision to return to Nowra, just making it in before last light. At this point we both subconsciously knew this was our second AMBER.

We sat on the runway and discussed our options – either cut the sortie away completely or continue. We recalculated our fuel state and did a risk assessment, covering off on the ACMEE process (Navy risk mitigation: Aircraft, Crew, Mission, Environment and Equipment).

I made it clear that we could easily cut the sortie away and try again another day. However, there was no hesitation from the co-pilot, he was comfortable with what we were about to do so we made the decision to continue with the sortie, getting an

IFR pickup from our current position of Nowra.

We departed and climbed to 6000 ft heading south. En-route to Moruya we were utilising the weather radar and avoiding any cells with red, indicating heavy rain. We also had our Electronic Flight Bags flashed up using Ozrunways and were tracking any lightening activity in the area, while constantly updating our SA via updated weather to the aerodromes we were flying to. We had SA tools out the ying yang!

We encountered some moderate turbulence associated with moderate-to-heavy rain, which we were expecting from the area forecast; however, as we knew the tops of most of the rain clouds were

between 7000 and 8000 ft we requested traffic information from Melbourne Centre and then climbed to 8000 ft to make our flight a little smoother. This helped with the turbulence and the heavy showers and we were now just skirting the tops of the clouds.

We were about one third of the way to Canberra when we had a Master Caution alert us to a Left Static Heater Failure. This was not a common occurrence; however, it is not a severe issue as we had two pitot/static systems on the aircraft. I recycled power to the Left Pitot Static system and the issue resolved itself.

This was our third AMBER and it was at this point that we decided to return to Nowra.



I had no internal references as to what the helicopter was doing and I recall seeing Paddy's bright orange face out of the corner of my eye. For a second or two I honestly thought this was the night we were going to die, as I had lost control of the helicopter.

On our return we were alerted to a degraded weather SPECI by Melbourne Centre that was issued for Nowra noting the temperature and dewpoint were the same. This indicates that there is possibly cloud on the ground. We flew overhead Nowra and positioned to conduct an ILS approach while also discussing the current weather with the 723 Squadron Duty Aviator. We discussed not becoming visual and our actions as a result, as well as an alternative recovery plan if we could not get in after conducting a few approaches.

As we turned inbound to intercept the localiser, the co-pilot alerted me to a faint burning smell. I couldn't smell it, and associated it with the possibility of exhaust fumes entering the aircraft due to the 40 kt downwind component at height that we encountered as we made our sector entry.

I selected "George", the autopilot, to intercept the localiser and glide slope; however, poor old George would not intercept the glideslope. I disengaged George and flew the helicopter by hand, as I would normally do anyway.

The reason for using George on this occasion was that we wanted everything as smooth as possible, and George's reaction time is much quicker than that of a human being.

Down the chute we go, holding 90 to 100 KIAS indicated with a ground speed of 140 kts. We

were approximately 3000 ft and eight miles from Nowra when Paddy shouts out "Holy moly, we are on fire!"

I could hear circuit breakers tripping and due to my extensive electronics experience, assumed it was just some sparking and arcing as some breakers tripped due to the possibility of water ingress. During all of our flying training in the 429, we were told it is impossible for the 429 to ever encounter an electrical failure in which you would have no options for a display and would need to transition onto the standby instruments. Rather, we would always have an electronic display unit showing everything you need to fly in cloud. This pre-set mindset was about to give me the shock of my life.

I was quite concerned; however, I immediately thought that I'd just continue the ILS and everything would be okay. I briefly looked over to Paddy, who had started calling out cautions, warning and advisories from the crew alerting system, and I focused back on the instruments to ensure we didn't go outside any ILS tolerances. It was at this point there was an abundance of smoke with an orange glow that emanated from behind the console near Paddy's footwell.

This flickering glow became so bright that it looked as though someone was welding inside the helicopter. To top it all off, the whole cockpit

went black with the associated stability control augmentation system going offline as well. This turns a relatively stable helicopter into something as unstable as a unicycle with a drunk clown riding it, so the helicopter lurched forward and yawed to the right. I had no internal references as to what the helicopter was doing and I recall seeing Paddy's bright orange face out of the corner of my eye. For a second or two I honestly thought this was the night we were going to die, as I had lost control of the helicopter.

I put a movement into the cyclic and collective and the helicopter responded, so that was a good thing. I attempted to get established on the standby instruments which were unlit, and the green lip light for my helmet gave me enough light to see that we were still upright; however, this was not adequate for a long period of time. At this stage I looked up and outside of the aircraft. There was a big wall of cloud to my front and left.

To my right, at 1-to-2 o'clock low I could see an opening in the cloud about 1 mile wide with about 10 lights to the north of the Shoalhaven River (we were tracking south). I could also see Pig Island to the south (Mick Regan Island now) illuminated from the cultural lighting of Nowra township.

I needed to make a decision and make it quickly. I could either climb away and punch back into cloud in an aircraft that was on fire with no comms and no instruments apart from the standby instruments that were not lit very well, or I could utilise my local knowledge. I knew I could fly from the position I was in to the Southern Side of the River and Mick Regan Island while not hitting any hills or obstructions. I informed my AVWO to open his windows and that we were conducting an emergency no aid letdown.

As I made the right turn and started my descent (PWR by feel + ATT out the front = PERF), the standby lights and other lighting inside the aircraft started to flicker between full bright and nothing at all. I made a comment about how well the aircraft was performing as it was near impossible to focus on the standby instruments. It was also shortly after this that the internal light on the standby AI flickered (like a standard light bulb blowing) and it remained unilluminated. We descended from 2800 ft to 900 AMSL (approximately 600 AGL) in about a minute and

finally dropped below the cloud base so I could now see the Nowra township lighting. On the way down, some services returned to the aircraft – I had a decent Display Unit again after about one minute and a search light scanning, we also had some comms back and the associated MAYDAY finally went out (we had unserviceable radios and Paddy's ability to transmit out was U/S).

After all of this I was initially going to land us in a paddock; however, as we were no longer on fire from what we could tell and we had also had three weeks of rain in the area, if I crashed entering the paddock in an extremely unstable helicopter with no real external airfield lighting references, no one would be able to reach us. It was at this time that we could see the runway lighting approximately four miles ahead of us (two-to-three minutes away) and we flew safely to Nowra, dodging scattered cloud, and landed.

When we crossed the Threshold of RWY 21, landed safely and exited the aircraft it was a surreal feeling. For a moment I didn't know whether to kiss the ground or run away. It was an experience that will last a lifetime and hopefully no-one will ever encounter again. Always learning is my motto!

How does the Rule of Three play into all of this? The cause of the electrical fire was an incorrectly installed cable which was rubbing on the back of a circuit bus bar. This cable shorted itself to the bus bar and proceeded to catch fire, essentially melting said bus bar while burning or destroying 50 of the 100 wires in that wiring loom. This is what made the aircraft behave in a way it was never meant to perform.

The Rule of Three helped save our lives, giving us the knowledge to make the right decision when things were not going our way. Had we not returned to Nowra when we did, and instead continued with the sortie, it is highly likely that we would have encountered that emergency in a location where we didn't have the local knowledge that afforded us the luxury of a safe and immediate out.

I try not to ponder the 'what ifs'; however, what I do know is on that night a combination of good education, a little good luck and some good decisions made at the right times helped save the life of my crew member and I. Safe flying!

The Rule of Three helped save our lives, giving us the knowledge to make the right decision when things were not going our way.



An accident of history?

By Dr Peter Hobbins,
Department of History,
The University of Sydney
and
Dr Elizabeth Roberts-Pedersen,
Centre for the History of Violence,
The University of Newcastle

DO THE FUNDAMENTALS of aviation safety really change? During World War II, the RAAF suffered hundreds of fatal crashes each year. One response was the development of sophisticated accident reporting and analysis systems. This historical study suggests that the Air Force understood the complex causes of accidents, but struggled with managing human factors.

On April Fool’s Day, 1945, FLTLT Warrick Turner lost his head. Completely out of character, this normally reliable pilot dipped his Curtiss P-40N Kittyhawk toward the Murray River. After completing four practice strafing runs against barges moored near Wentworth, ‘Wak’ Turner proceeded to beat up the range control boat.

Ignoring the authorised minimum altitude of 200 ft, he roared over the vessel at 10 ft, “ruffling the water with his slipstream”. Leading his flight of four Kittyhawks around for another pass, Turner’s second approach was even steeper.

Too steep, unfortunately. During pull out, “the aircraft ‘splurged’ over the crash boat and struck the water”, reported the range safety officer, who watched as the Kittyhawk ricocheted into trees on the river’s northern bank and exploded.

One hand and a foot were recovered for burial in the Mildura War Cemetery. Seven months later, on Armistice Day, Turner’s limbless torso was discovered at the crash site and discreetly added to the coffin. The 26-year-old pilot’s head was never found.

Wartime crash investigations

‘Wak’ Turner’s demise was typical of many wartime accidents in the RAAF. In addition to investigations by the Wentworth Police, the Mildura Police and the Mildura Coroner, his case was formally

reviewed by an Air Force Court of Inquiry. Presided over by SQNLDR Alec Drake, the court heard from nine witnesses, all from 2 Operational Training Unit in Mildura, where Turner served as a fighter instructor.

Informants included the range safety officer and flight control officer, a fellow flight commander and trainee pilot, the unit’s medical and engineering officers, plus a fitter and parachute packer. Although little wreckage was recovered for examination, evidence tendered included the pilot’s log book, the Kittyhawk’s airframe and engine log books, the unit’s standing orders and flight authorisation book, and the daily meteorological report. Given that it was wartime, the deliberations were thorough.

The court found that at the time of the accident, flying conditions were perfect, while Kittyhawk A29-423 and its Allison V-1710-81 engine were properly maintained and fully airworthy. Described just before his death as an “average officer” of “average ability”, Turner had 841 hours of flying experience, nearly 214 on Kittyhawks. Boasting a clean disciplinary record, he was “fit for full flying duties” and not “suffering from fatigue”. So why did his aircraft crash?

“The cause of the accident was that F/Lt TURNER disobeyed instructions”, the Court of Inquiry concluded. “Only F/Lt TURNER was in any way to blame”.

Apportioning responsibility

This decision would not have surprised the Chief of the Air Staff, AVM George

These included not only disobedience of orders, but errors of judgement, poor technique and carelessness. To Jones, they indicated a lack of discipline, irresponsibility and a failure of command – at least at unit level.

On 4 June 1944, engine failure led FSGT Neville Thornley to force-land his Curtiss P-40E Kittyhawk A29-28 near Mildura. Photograph courtesy Anzac Memorial, Sydney.



Jones. As a former Director of Training, and now administrative head of the RAAF, Jones was convinced that the majority of aviation accidents were due to what were later termed human factors. These included not only disobedience of orders, but errors of judgement, poor technique and carelessness. To Jones, they indicated a lack of discipline, irresponsibility and a failure of command – at least at unit level.

Officially, this mentality reflected RAAF policy throughout most of World War II. It was also embodied in the very document used to gather information on aircraft accidents and forced landings – RAAF Form E/E. 24. Introduced in November 1939, this template required officers investigating an accident to specify its circumstances and nature, before apportioning the causes into a pre-specified grid.

Percentage responsibility was cross-referenced between underlying causes – either error of pilot or materiel failures – and immediate causes. The latter

were divided into personnel, materiel and miscellaneous factors, such as airfield conditions and weather. Based on a system devised by the US National Advisory Council on Aeronautics – the forerunner of NASA – it appeared to offer a scientific method of accounting for the complex nature of aviation accidents. In practice; however, investigations were much messier.

Practical considerations

To minimise potential conflicts of interest, RAAF Courts of Inquiry were convened by officers from an unrelated unit. From June 1940, their reports were also scrutinised by an independent Inspectorate of Air Accidents. Air Force leaders; however, perpetuated a culture of presuming aircrew culpable for accidents. In January 1941, for instance, the Air Member for Personnel, AIRCDRE Henry Wrigley, urged that pilots blamed for crashes should be thrown to the media as scapegoats. The policy was rescinded

after the high-profile loss of SQNLDR Keith ‘Bluey’ Truscott on a training sortie in March 1943.

To understand how these systems evolved, we recently published a study which compared wartime RAAF policy, collated accident data and individual inquiries. We explored 10 fatal Kittyhawk accidents in detail – including the losses of Turner and Truscott – while compiling data on 601 preliminary reports on Kittyhawk accidents. The spreadsheet (downloadable at <http://hdl.handle.net/2123/20010>) was based on information in preliminary accident reports (RAAF Form P.T. 81), cross-referenced against aircraft status cards (RAAF Form E/E. 88) and individual personnel files.

Kittyhawks were chosen as their single-seat, single-engine design simplified causation analysis. P-40s were also the RAAF’s most numerous combat aircraft and, at an average of 223 flying hours per accident, they represented the mid-range of crash rates at mid-war. Two of the key findings are summarised in Figures 1 and 2 [page 27], while an interactive visualisation is available online at https://public.tableau.com/profile/chao.sun#!/vizhome/AircraftCrash_O/KittyHawkAccidents. This website allows users to explore RAAF Kittyhawk accidents by nature and cause, as well as by unit, aircraft variant, time of day, operational status, and the pilot’s rank, flying hours and ability.

A culture of blaming personnel

We found that the RAAF entered the war with a culture that primarily blamed human factors. However, accidents attributed to personnel fell from 66.2 per cent in late 1941 to approximately 50 per cent by 1945, remaining at that level throughout the 1950s. Indeed, Turner’s death in April 1945 coincided with the replacement of the Inspectorate of Air Accidents by a new Directorate of Flying Safety (DFS) – a direct precursor of today’s Defence Flight Safety Bureau. Its mission, in the words of its first Director, GPCAPT John Lerew, was to





“eliminate many of those accidents for which pilots have been blamed in the past”.

A key target for RAAF accident prevention policy in 1944-45 was single-seat fighters, with Kittyhawk squadrons singled out for “special attention”. Yet our data showed that in Kittyhawk units, the proportion of accidents blamed on personnel was just 28.5 per cent – nearly half the wartime average for both the RAAF and Australian civil aviation (52.6 per cent). Why?

In-depth analysis

In-depth analysis of individual Courts of Inquiry and personnel files suggests that accident investigators and witnesses often took into account the complexity of environmental, organisational, technological and personal factors. They acknowledged not only the limited nature of wartime training and the demands of flying high-performance fighter aircraft, but also the intricacies of differing Kittyhawk variants and challenging forward environments. Seldom were conclusions as blunt as in Turner’s case. Rather, consideration was given to personality, flying ability, fatigue, operational experience and ‘accident-prone’ periods in a pilot’s career.

Such concerns rarely fitted neatly into a grid mentality, as encouraged by RAAF Form – E/E. 24. Nevertheless, aided by early punched-card computing technology, both the DFS and the RAAF’s Operational Research Section sought to rigorously evaluate accident data. Importantly, they continued to correspond with training and operational units in order to understand what the collated numbers actually meant. The result was a series of surprisingly sophisticated reports which both highlighted systemic problems and suggested practical strategies for preventing future accidents.

Perhaps a shift in emphasis on understanding – rather than blaming – human factors might have saved ‘Wak’ Turner. Largely missing out on operational experience with 457SQN in both Britain and Northern Australia, by April 1945 this fighter pilot had spent 18 months in ferrying and training roles. Whether out of boredom, frustration or on a whim, his fatally rash act might have been averted by a more responsive system. Sadly his reasons – and the blame for their consequences – remain with him alone.

Note

References for the archival files from which the data and quotations above are drawn can be found in Peter Hobbins and Elizabeth Roberts-Pedersen, ‘Accident conscious: accounting for flying accidents in the Royal Australian Air Force during the Second World War’, *War in History*.

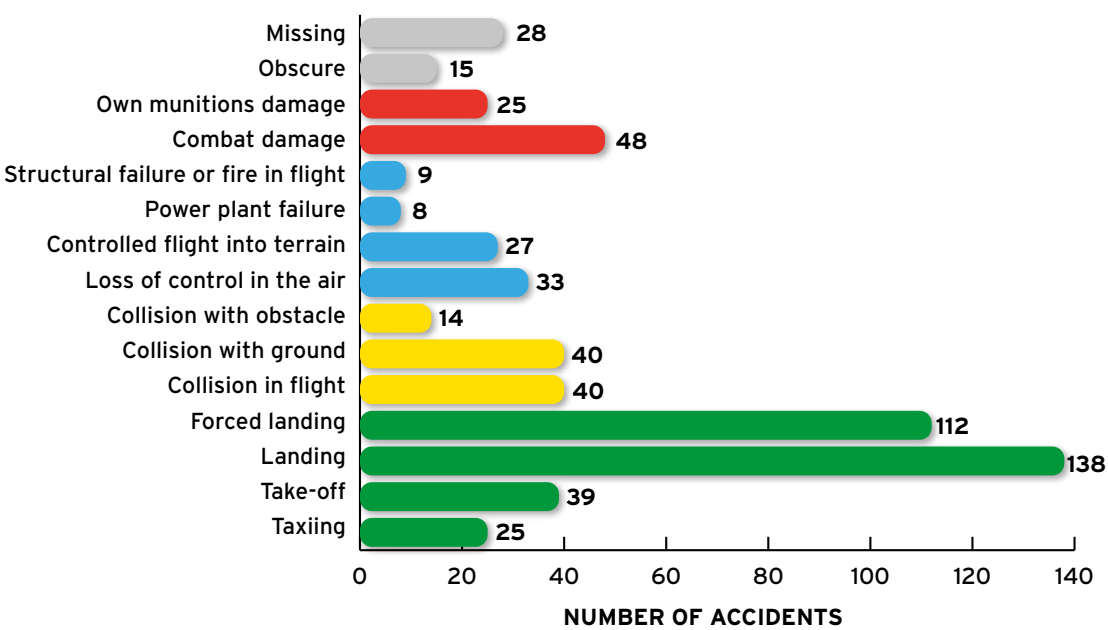


Figure 1. Nature of RAAF Kittyhawk accidents as outlined in RAAF preliminary accident reports, 1942-46 (n = 601).

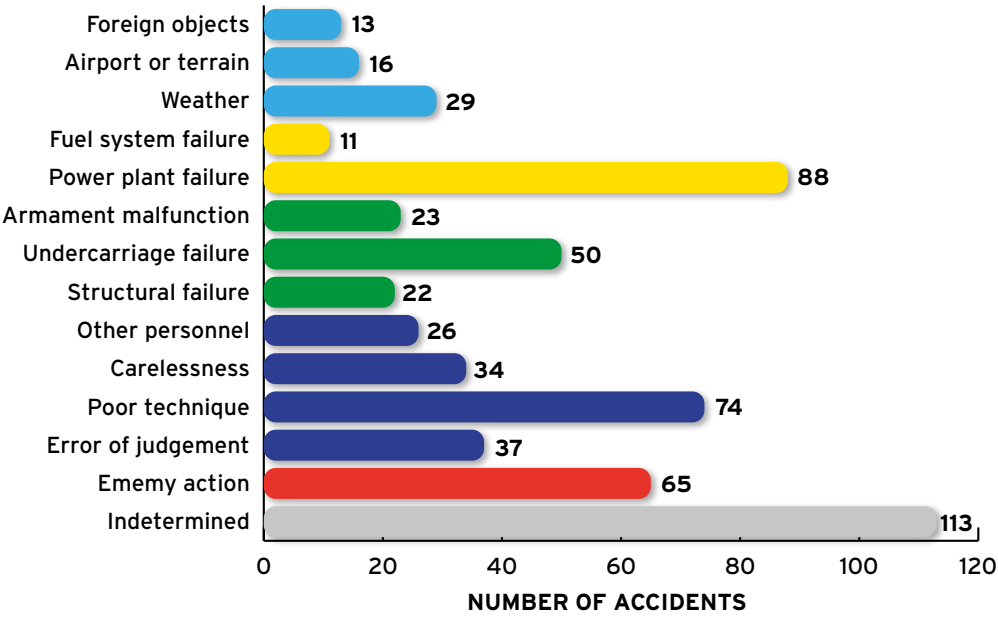


Figure 2. Cause of RAAF Kittyhawk accidents as outlined in RAAF preliminary accident reports, 1942-46 (n = 601).



Collaborative approach to safety garners award

By SQNLDR Brendan Smith

ARMY CAPTAIN ANTHONY ERWIN'S tenacity and commitment to improving aviation safety at 723 Squadron and HMAS Albatross saw him presented with the Royal Aeronautical Society (RAeS) Australian Division Award for 2018.

While 723 Squadron's inaugural Aviation Safety Officer (ASO), CAPT Erwin used a collaborative approach to establish the squadron's Safety Management System (SMS) ensuring all organisations were represented, heard and had buy-in. He consistently engaged with all parties and external agencies in a manner

that developed harmonious and productive relationships.

The squadron transitioned, in January 2018, to a combined Navy, Army, Australian Public Service (APS), and contractor workforce – each bringing its own safety culture and expectations.

CAPT Erwin developed a robust system across the breadth of 723 Squadron personnel hailing from disparate organisations, with a healthy approach to safety as an everyday enabler to operations and capability.

During the presentation of the award earlier this year, Deputy Commander Fleet Air Arm (DCOMFAA) CAPT Grant O'Loughlan commented

on the significance of CAPT Erwin's achievement as a sign of the integration of Defence and industry, in that an Army officer in a Navy squadron, supported by APS and Defence Industry, was presented with an award signed by the Chief of Air Force and sponsored by a civilian organisation. CAPT Erwin says "making a contribution to aviation safety is a positive experience, and while I am not big on the recognition personally, I do believe it enforces the culture to junior aircrew about the importance of aviation safety".

CAPT Erwin drove the development and improvement of risk management assessments for all EC135 flying operations, including regular updates of hazards and treatments learnt during the first year of flying operations and student training courses. This activity ensured all aircrew have the latest information available in order to reduce risk and achieve their training missions safely. The demonstration of this resolve reinforced the importance of debriefing all activities and capturing lessons learned by all aircrew, thereby instilling a generative safety culture.

CAPT Erwin grew both the role of 723 Squadron ASO and the SMS using a building-block approach and provided continuous improvement across the safety cell. This was complicated with the existence of the contractors' Environmental, Health and Safety (EHS) obligations. He researched the Work Health Safety (WHS) obligations of the Commonwealth, and concluded that the contractor EHS met all the intents of the Commonwealth WHS requirements. CAPT Erwin engaged with the Fleet Air Arm WHS cell and Navy Safety & Environment Policy Co-ordination, which helped ensure compliance by Defence and the contractor while reducing duplication of effort.

He also developed an outstanding unit emergency plan which clearly articulates the responses and expectations of all responders. 723 Squadron did not previously have a plan that articulated requirements at this level.

In a bid to further enhance aviation safety across the squadron and HMAS Albatross, CAPT Erwin developed and implemented a series of education and training programs. His efforts played a major role in improving the aviation



Robin Stannier from the RAeS and Deputy Commander FAA CAPT Grant O'Loughlan (RAN) presents CAPT Anthony Erwin (Army) with the society's award.

safety culture and practices on the base. This is particularly important in an ab-initio flying training school, as developing appropriate safety behaviours in new aircrew at the first instance is vital to promoting an ongoing safety culture within a new organisation. Further, the training has eased the transition to Sentinel for aviation safety reporting.

CAPT Erwin's collaborative approach resulted in strong safety networks at HMAS Albatross. It also influenced reporting policy via Sentinel through engagement with Navy Safety & Environment Policy Co-ordination. This initiative has ensured that Defence, Boeing, Raytheon and Thales are able to manage risks and hazards in the best systems available while also capturing lessons and outcomes learned in each of the hazard tracking and management systems.

In a recent Safety Audit of 723 Squadron, the SMS Auditor provided the following comments that best articulate CAPT Erwin's efforts and achievements: "... It was very pleasing to observe the harmonious and mature SMS in place noting the disparate variety of the Navy, Army and civilian workforce." "Even though the Helicopter Aircrew Training System is a developing training



2019 NOMINATIONS

Nominations are open for the 2019 Royal Aeronautical Society (RAeS) Dr Rob Lee Defence Flight Safety Award.

The award recognises individual or collective contributions that have enhanced Defence aviation safety; and sees the winner presented with a trophy and framed certificate from the RAeS–Australian Division.

In judging the award, DFSB and RAeS will consider the following:

- commitment demonstrated to improving aviation safety
- resilience in overcoming barriers in addressing aviation safety issues
- impact/outcomes resulting from the aviation safety initiative
- engagement with staff and stakeholders in making the contribution.

Members of Defence aviation, including foreign exchange and loan personnel, Defence civilians and contractors are invited to submit nominations. This includes commanders, supervising staff, peers and colleagues within ADF squadrons, ground support units and other agencies that support flying operations, however remotely.

Nomination forms are available from the DFSB intranet site.

Members are encouraged to submit their nomination through their chain of command to DFSB: dfsb.registry@defence.gov.au; however, chain-of-command endorsement is not mandatory for the nomination to be considered.

Nominations must be submitted to DFSB by 30 September 2019.

system, the squadron construct and SMS in particular is strong and well placed to meet future challenges.”

CAPT Erwin is a Category-B Qualified Flying Instructor (QFI) at 723 Squadron, with previous experience at the Army Helicopter School. He served in 6 AVn Regiment, flying the S-70A-9 Blackhawk helicopter in a special operations support role and was the inaugural ASO in 723 Squadron Joint Helicopter School (JHS) until commencing employment with Boeing Defence Australia (BDA) in August 2018.

RAeS Defence Aviation Safety Award finalist

Mr Jacob Rowe, Safety Management System Co-ordinator of RUAG Australia has also been acknowledged for his outstanding commitment to safety, named 2018 RAeS Defence Aviation Safety Award finalist.

RUAG Australia is a support contractor primarily for the Royal Australian Air Force focusing on aircraft components maintenance, repair and overhaul (of landing gear, flight controls, and mechanical systems), precision engineering and manufacturing (of actuators and landing gear), engineering design, and metal finishing (processing, non-destructive testing, and paint).

The company-wide safety policies and procedures lacked a consistent approach to protecting products, with different sites using different methods for product hazard identification and the rectification and resolution of the hazards. Most sites did not report product hazards using a standardised process, carrying a higher risk that the hazard would eventuate into an incident.

Investigations also lacked consistency of process, with the root cause not necessarily determined at their conclusion.

Mr Rowe’s approach was to develop a SMS that built on the existing processes, while clarifying and conforming many procedures and scenarios that were unclear or unspecified prior. By building

from the limited procedures that existed, the day-to-day changes within the workforce were less pronounced. These small changes not only proved highly effective, but were also accepted within the organisation and became part of an improved safety culture.

Upon the implementation of Mr Rowe’s changes, it was possible to conduct detailed gap analysis for the systems, and analyse the effectiveness of the changes. This allowed for further development of training of employees in human factors for hazard identification to be increased and secondary methods of identification to be developed. These changes have culminated in a system that is working effectively across five sites around Australia with an increased focus on safety and safety-related incidents.

The award

Each year the Royal Aeronautical Society’s (RAeS) Australian Division, in collaboration with the Defence Flight Safety Bureau (DFSB), awards the RAeS Aviation Safety Award to recognise an individual or collective effort that enhances aviation safety in the ADF.

The RAeS Aviation Safety Award is open to all members of the ADF, including foreign exchange and loan personnel, Defence civilians, Defence contractors, and Australian Air Force Cadets.

The award covers a broad range of aviation safety initiatives, ranging from a single act that may have prevented an aircraft accident or event, to broad or long-term aviation safety initiatives and programs.

In judging the award, the DFSB, and the RAeS consider criteria including the commitment demonstrated to improving aviation safety, resilience and overcoming barriers in addressing safety issues, the impact or outcomes resulting from the initiative, and engagement with staff and stakeholders in making the contribution.

A joint-service approach better prepares aircrew

723 SQUADRON, LOCATED at HMAS Albatross in Nowra NSW, is responsible for initial helicopter conversion training for all Navy and Army aircrew. The squadron utilises a comprehensive training design that includes elements of live, synthetic, and classroom training. The 15 EC135 T2+ helicopters used by the squadron are complemented with flight simulators, synthetic training devices and a new flight-deck equipped seagoing training vessel to deliver training.

The EC135 T2+ is a member of the Airbus Helicopter H135 family of light twin-engine helicopters. The helicopter includes modern glass-cockpit avionics, enhanced external visibility, a multi-axis autopilot, modern navigation systems, the performance and safety of a twin-engine helicopter, and other advanced technologies.

The helicopter has sufficient performance to enable the various helicopter aircrew specialisations to train together and develop crew co-ordination, communications and management skills. This includes pilots, aviation warfare officers, aircrew men and women, and sensor operators.

The integration of simulators, part-task trainers, virtual reality and other synthetic training devices into the training design improves safety while also exposing the aircrew to a wider range of training scenarios than can be achieved in the aircraft.

Simulation training is used to respond to aircraft malfunctions, extreme weather conditions, and to operate sensor and



mission systems including radar, sonar and weapons in combat-like scenarios. This can all be achieved in reduced time and without the expense of duplicating these conditions in the real world.

The training program better prepares aircrew for further training, and reduces the overall training required when the aircrew progress to conversion onto advanced operational helicopter types.

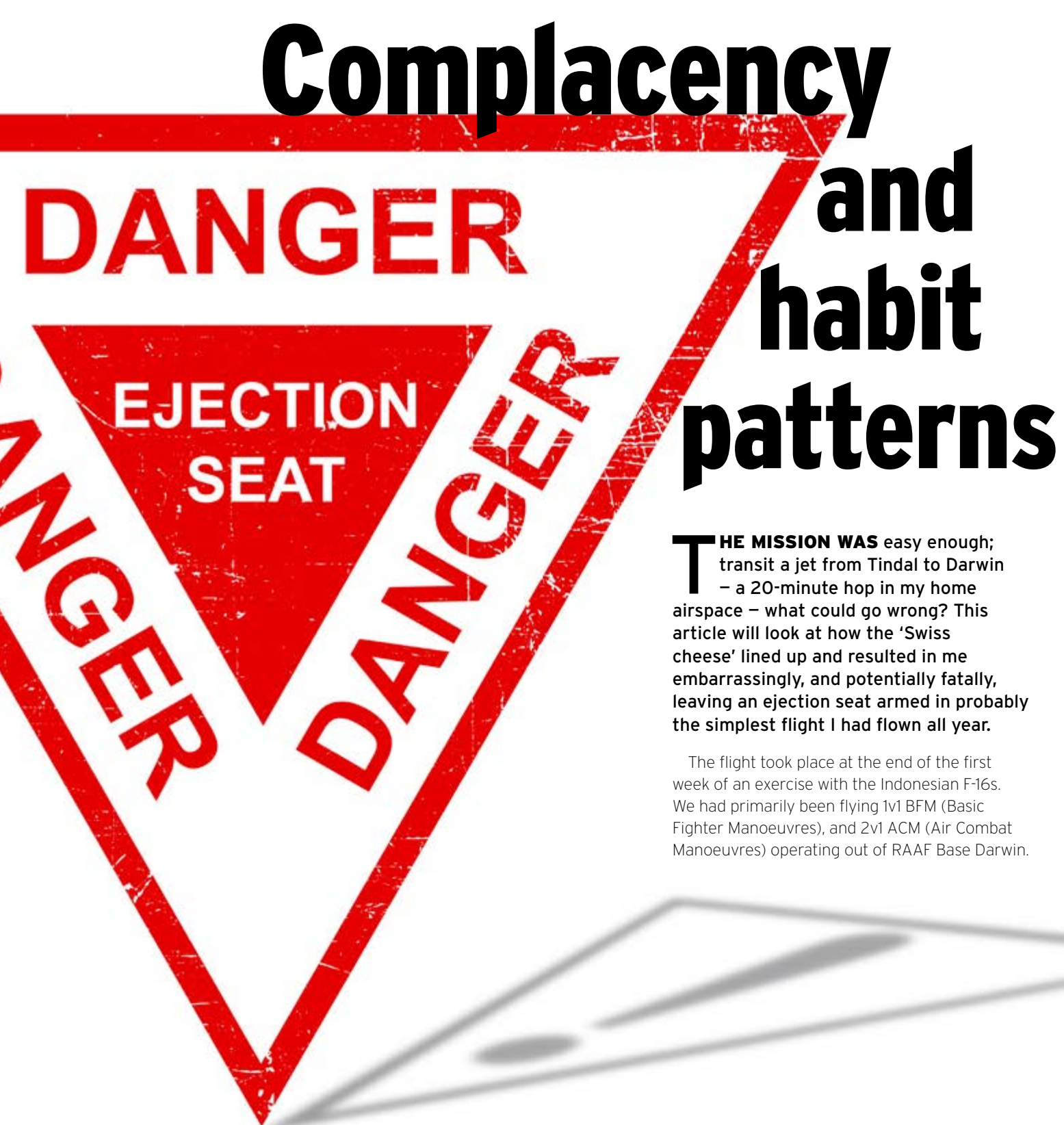
The joint-service approach between the Navy and Army benefits the ADF by lowering the training burden on operational aircraft and enhancing Navy and Army operations for the new amphibious ships.

The training courses require the aircrew to operate the helicopter day and night in all weather conditions. By day, the aircraft is flown in advanced manoeuvres such as turns with high angle of bank and at low level, often to outcrops of rocks and cliffs or into small clearings in the bushland to the west of Nowra. Often this is also

completed in formation with another helicopter. The aircrew also undertakes ship deck landing procedures and stores support operations to the training support ship MV *Sycamore*. All of these manoeuvres are later repeated at night, while utilising night vision devices.

Aircrew members are required to demonstrate technical knowledge and crew resource management skills in order to understand and react to emergency situations and overcome these while working as a crew.

The graduation standard is achieved at night and includes winching operations and carriage of external loads into some of the more challenging training areas available. The standard requires aircrew to demonstrate the leadership, teamwork and communication skills necessary for success in their training onto the operational helicopter types of the Navy and Army.



Complacency and habit patterns

THE MISSION WAS easy enough; transit a jet from Tindal to Darwin – a 20-minute hop in my home airspace – what could go wrong? This article will look at how the ‘Swiss cheese’ lined up and resulted in me embarrassingly, and potentially fatally, leaving an ejection seat armed in probably the simplest flight I had flown all year.

The flight took place at the end of the first week of an exercise with the Indonesian F-16s. We had primarily been flying 1v1 BFM (Basic Fighter Manoeuvres), and 2v1 ACM (Air Combat Manoeuvres) operating out of RAAF Base Darwin.

On the day in question I had two flights, the first one I would take-off out of Darwin, conduct ACM against two Indonesian F-16s and land in Tindal for a jet swap. The second flight was simply a transit to Darwin.

There was a stark contrast between the two flights, the first being exciting, physical, and adrenaline pumping and the second was a boring A-to-B hop counting the miles down before I could land and tell the guys in the Squadron how the 2v1 went.

This, I believe, is the root cause for leaving the seat armed. I had become too relaxed about the transit, and complacency had started to creep in. I'd been flying the Hornet for about 18 months and was starting to feel reasonably confident in it. Without knowing it I had started to let my guard down.

The next hole in the ‘Swiss cheese’ to line up was a simple check I missed while starting the jet. When the Hornet gets weight on wheels again after a flight it will automatically try to erase the classified data it has stored from the mission unless you have overridden this by telling the jet to hold the data; a check usually done while starting up, the check I'd missed.

Why did I miss it?

I put it down to a breakdown in habit patterns. I wasn't setting the jet up to fight like I usually do, I was simply getting it running without getting all the systems online so I could get back to Darwin as soon as possible. This was my first habit-pattern breakdown.

Now I'm staring down the barrel of complacency, and rushing... oh dear. The

flight from this point was uneventful until after landing.

With the weight on wheels again, the Hornets' computer was trying to erase that classified data I'd forgotten to tell it to hold onto. Not a big deal if it does erase it all but I'd become distracted as my right-hand display was now showing a countdown – the first time I've seen this countdown since briefly during Ground School at 20CU 18 months earlier.

My usual habit pattern for safing the ejection seat is as I leave the runway; however, I'd let the erase countdown distract me to the point where I missed this check. Second habit-pattern break down. Now we have complacency, rushing, and distraction coming together.

For those familiar with the Darwin OLAs you will know that it is only a short taxi of 100 or so metres from taxiway Bravo to the OLAs. I believed I was parking in one of the far OLAs; however, as I pulled onto taxiway Romeo one of the flightline troops waved me into OLA 6, the first OLA. This is where my habit pattern broke down for a third time.

On every flight I re-check that I have made my seat safe prior to taxiing under any shelter – a habit I'd had since I first began flying ejection-seat aircraft in 2014, but due to being waved into an unexpected OLA and rushing to finish my after-landing checks I had now missed my 'glove-save' seat check.

My final opportunity to find my error was after shut-down. When I hop out of the aircraft I always stand on the LEX and look back into the cockpit to check from a different perspective that I left the seat safe and all the switches in the correct position. My habit pattern is always safety-

critical switches first, ejection seat in the safe position, master arm safe et cetera, then the rest of the switches.

I completed these checks, or at least I stood on the LEX and looked back into the cockpit, clearly not thoroughly enough though because as I walked around the outside of the aircraft the flightline troop called out: 'Hey Sir! Your seat is still armed.'

How did I miss it in that last catch all check?

Complacency again. How many hundreds of times had I stood on the wing of an aircraft, looked back into the cockpit and seen a safe ejection seat? Thankfully the flightline troop was all over it on this occasion and caught my error before anyone else was put in danger.

On the day of this flight I wasn't fatigued, I wasn't stressed, I was well prepared and yet I still committed the cardinal sin of flying ejection-seat aircraft: leaving it armed.

What did I learn from this?

Well lots of things, but my main lessons were, no matter how simple the mission is, and how comfortable I am with the jet, there is always potential for a mistake to be made that can put my life, or the life of others, at risk.

I've learned to always be critical of my own comfort with a flight, and ensure I'm not paying lip-service to checklist items. Finally I've learned to be particularly cautious whenever there is a breakdown in my habit patterns no matter how minor they appear to be.

Author's name withheld by request.

Should we tell the crew?

WE STUDY AIRCRAFT flight manuals and aim to know everything we can about the aircraft we fly and we conduct pre- and post-flight inspections to check airworthiness. But what if someone didn't tell you something about the state of your aircraft? What situation could possibly exist for someone to withhold that critical information?

I was one of two Category-D Kiowa helicopter pilots on a reconnaissance task flying out of Oakey. The task was simple enough; we had to fly the 40 minutes to Enoggera, take some pictures of a medical field setup and fly back to Oakey.

An hour-and-a-half later, we had successfully completed our task and were approaching Oakey airspace. Listening to ATIS we heard all of the standard information; wind, cloud, runways, when suddenly we hear, "All Kiowa aircraft must remain grounded unless specifically authorised by CO AHS." Our first thought was, "what have we done?" followed by, "what did someone else do?!"

We contacted Oakey approach, were passed to tower and then we landed and shutdown without incident or any idea why the fleet had been grounded. It wasn't until we were signing the aircraft back in that maintenance was able to tell us what had happened.

While we were flying over Enoggera a student conducting a pre-flight walk around discovered that one of the pitch control links, connecting the flight controls to the rotor head, had a crack through it.

Being a flight-critical component, flying was temporarily suspended to give maintenance a chance to receive engineering advice and conduct an inspection on the fleet.

I immediately wondered why nobody told us.

A number of questions had to be answered for those deciding whether to inform us. Was it just the one aircraft that was affected, or was maintenance finding others? Where were we at the time of the grounding and how easy would it be to pass a sufficiently detailed message? If we were informed, would we make a dangerous and ultimately unnecessary immediate landing that could expose us to an even higher level of risk?

When sitting down with our authorising officer after the flight and discussing the reasons why we were not informed, the decision began to make sense. Only one aircraft was found with the defect and there was no easy way to accurately communicate with us; therefore, the decision was made not to tell us. I was also confident that our safety had not been compromised in any way.

As with any aviation safety incident requiring quick answers, an immediate risk assessment was conducted to quickly identify the hazards and the likelihood of their outcome. This was instrumental in guiding the decision-making process and afforded those making a difficult decision the confidence that all relevant details had been considered.

Aviation is a risky business and at times we will need to make difficult decisions regarding the safety of both the aircraft and the crew.

With a solid aviation risk management process, we can use the information we currently have on hand in order to help us make the best decision at the time.

Author's name withheld by request.





Hazard Recognition

When is it time to stop the job and reassess?

By FLTLT Hugh McQuire

“THERE IS A DRILL BIT STUCK IN HIS HAND”, was the first information I received from the member’s Sergeant. You’re probably asking “how does a drill bit get stuck in someone’s hand?”, as I surely did. Of course, our first priority was the member’s safety and welfare, and he was treated at medical. But upon his return to the workplace the next day, with a bandaged hand and an x-ray showing a 2 mm wide, 15 mm long drill bit stuck in his palm, we began our investigation.

Working through the Incident, Cause, Analysis Method (ICAM) for investigations, I inspected the work area where the event happened and gathered the witnesses. The victim explained that while drilling a small sheet of 6 mm steel plate, his left hand (non-master hand) slipped off the top of the drill and his master hand with finger on the trigger, kicked to the side and the drill bit snapped, leaving half in the drill and half in the steel plate. Then, as his left hand hit the plate, it did so with force, straight on the broken drill bit which penetrated his skin. He quickly moved his left hand off the plate and subsequently broke the drill bit off, leaving a quarter of the drill bit in the steel, and the other quarter still in his hand. It seemed

straight forward but there were still many questions unanswered. Through witness interviews, I learned that this was the 15th drill bit broken over the past few weeks during this job. I continued asking the ‘Five Whys’. Why had there been so many broken drill bits? As was determined, the member kept snapping drill bits. He was applying a lot of downward pressure on the drill trying to get through the material. This explained why his hand slipped off the drill with such force and penetrated the broken drill bit. But it did not explain why so many drill bits had been broken. A quick check of the Wurth drill bits box, showed the drill material and minimum operating speed for effective drilling, to be 3000 rpm. I then inspected the drill and determined its maximum rpm was 1500 rpm. This explained why so many drill bits had broken, as they were not turning fast enough to perform the cut, and the user was applying the excessive force. So why would the member not check this? At what stage, or number of broken drill bits, would you stop and ask yourself ‘why’? Does a broken drill bit pose a risk? Why was an immediate risk assessment not conducted after ‘x’ amount of broken drill bits? Why did other members not recognise the hazard and say something? Why could the job not have been conducted on a pedestal drill? Unfortunately, these questions were not asked and the member was injured; only slightly, and he recovered in full shortly after. Even with training on how to operate tools, and managements’ perception that members understand hazards and risks, incidents can still occur. Hopefully we can learn from the unfortunate mistakes of others, and better recognise when it is time to stop and raise the issue as a risk.



Wirestrike and collision with terrain

A T ABOUT 1728 Central Standard Time,¹ on 3 July 2018, a Cessna 172RG aircraft, registered VH-LCZ, commenced circuit operations at Parafield Airport, South Australia (SA) with the pilot as the sole occupant. The flight commenced in day conditions and transitioned to operation under the night VFR² after last light, which occurred at 1743. There were no identified aircraft defects and it was fully refuelled immediately before the flight. The pilot reported that he had conducted a post-

refuel drain and that there was nothing abnormal in any of the fuel samples. At about 1748, the pilot performed a touch and go landing, and departed the runway for the sixth, and intended final, circuit. The pilot recalled that the engine ‘coughed’ once as the aircraft accelerated along the runway. He noted no other abnormalities and continued the take-off normally. About 10 minutes later, the pilot received air traffic control (ATC) clearance to land. He turned the aircraft onto final at an altitude of about 500 ft approximately 1500 m from the runway threshold, and configured it for landing (full flap and landing gear extended).



Figure 1: Aircraft wreckage (note power line fouling the nose wheel). Source: SA Police.

On descent through 450 ft, the pilot observed the propeller speed reduce from 1800 to 1300 rpm. He selected the carburettor heat, increased the throttle and changed the position of the fuel selector from BOTH to LEFT. The pilot reported that, with the exception of this troubleshooting, he did not apply carburettor heat during any of the previous circuits. The engine did not respond to the pilot's carburettor nor fuel selection inputs and the propeller speed remained constant at 1300 rpm. The pilot then deselected the carburettor heat and moved the fuel selector back to its original position. A short time later, he assessed that the aircraft did not have sufficient altitude to reach the runway and that a forced landing would be necessary.

At about 1758, the pilot declared a PAN³ and informed ATC that he was unable to make the runway. The pilot recalled that he had sighted an unlit area ahead, which he assumed to be an open space. He turned the aircraft towards that area and pitched the nose down to achieve the airspeed associated with the maximum glide distance. The pilot reported that, as the aircraft approached the open space, he heard the fuselage hitting treetops. Seconds later, the aircraft stopped abruptly as the nose wheel struck a power line and it then collided with the ground (Figure 1).

After the collision, the pilot attempted to switch off the master switch but was unable to do so due to distortion of the instrument panels. He then

swiftly exited the aircraft through the co-pilot's side window and moved away from the wreckage. Emergency services attended the scene shortly after. The pilot sustained minor injuries and the aircraft was substantially damaged.

Carburettor icing

Induction icing, often referred to as carburettor icing, is the accumulation of ice within the induction system of an engine fitted with a carburettor. This ice forms as the decreasing air pressure and introduction of fuel reduces the temperature within the system. The temperature may reduce sufficiently for moisture within the air to freeze and accumulate. This build-up of ice restricts airflow to the engine, leading to a reduction in engine performance and possible engine failure. Environmental conditions influence the likelihood of carburettor ice forming.

Weather observations recorded by the Bureau of Meteorology at Parafield Airport indicated a temperature of 12.2° C and a dew point⁴ of -0.6° C at the time of the accident. Figure 2 (see annotation in yellow) shows that these meteorological conditions presented a risk of moderate icing when using cruise power and serious icing when using descent power. At the time of the power loss, the engine was operating at descent power.

The Cessna 172RG pilot operating handbook (POH) provided the following guidance for carburettor icing:

- before landing, switch carburettor heat to ON to prevent ice formation
- in the event of a rough engine running or loss of power – an unexplained drop in manifold pressure and eventual engine roughness may result from the formation of carburettor ice. To clear the ice, apply full throttle and pull the carburettor heat knob out until the engine runs smoothly; then remove carburettor heat and re-adjust the throttle.

Safety analysis

A post-accident examination of the engine was not conducted and therefore the possibility that a mechanical defect contributed to the accident could not be ruled out. However, the ATSB assessed the evidence with respect to some common known causes for an engine power loss.

The evidence indicated that fuel contamination, fuel exhaustion and aircraft maintenance issues were unlikely.

Contrary to the guidance in the POH, the pilot reported that he did not apply carburettor heat while descending to the runway during any of the circuits. This combined with weather conditions conducive to severe carburettor icing at descent power made it likely that the power loss was due to the accumulation of carburettor ice.

The POH listed carburettor icing as a cause of the engine running rough or losing power. The actions listed in the POH to clear carburettor ice; however, do not clear ice immediately as it takes some time for the heat to take effect. The pilot first observed a reduction in propeller speed just after the turn onto final. Although he responded by applying carburettor heat, the short time

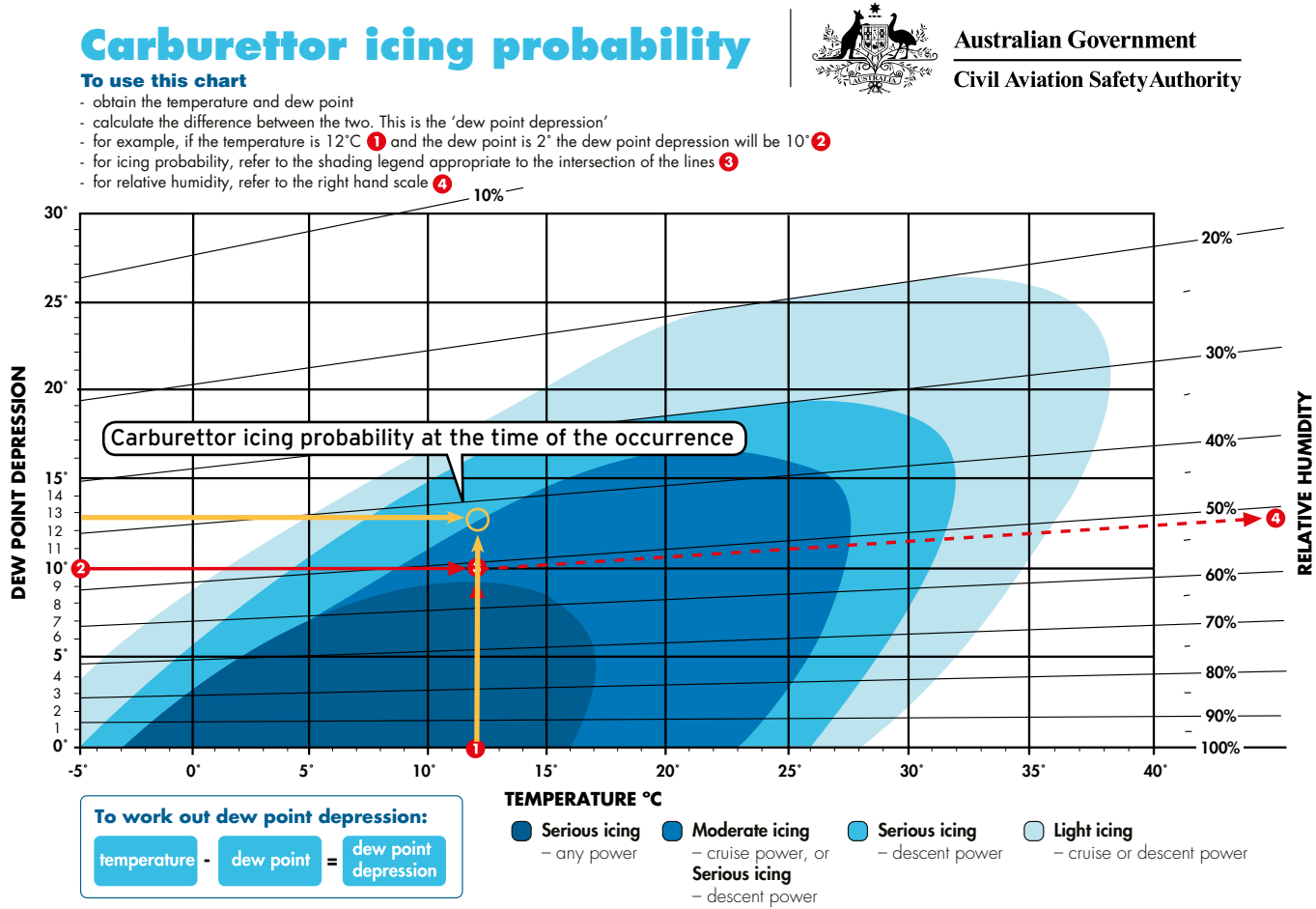


Figure 2: Carburettor icing probability.

Source: CASA, annotated by the ATSB.

The temperature may reduce sufficiently for moisture within the air to freeze and accumulate. This build-up of ice restricts airflow to the engine, leading to a reduction in engine performance and possible engine failure.

between troubleshooting the engine power loss and conducting the forced landing meant there was probably insufficient time to clear enough ice for the engine to recover.

The pilot completed the turn onto final at an altitude of about 500 ft approximately 1500 m from the runway threshold, which is within the normal profile for a powered approach. After troubleshooting the engine issues, the aircraft had already descended to about 450 ft. The POH indicated that, in ideal conditions, a maximum glide distance of about 1500m could be achieved from an altitude of 500 ft. However, a turn onto the final approach at that position is unlikely to permit an aircraft configured for landing to glide to the runway in the event of a power loss.

Consideration of a flight profile that balances the requirement for a stable approach while increasing the likelihood of being able to reach the runway in the event of a power loss is particularly important when flying in night VFR conditions. Selection of a suitable unprepared landing site is more difficult at night due to reduced visual discrimination. In this instance, the selected large unlit area was assumed to be clear but obstructions, such as the power lines, were not discernible.

Following the partial engine failure, the pilot resisted the temptation to lift the nose of the aircraft in an attempt to stretch the glide to the runway. That decision, to follow his training and pitch the nose of the aircraft down to establish the optimum glide speed, enabled him to maintain control of the aircraft. That action likely prevented a low altitude stall and uncontrolled collision with terrain.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- On final approach, the engine of VH-LCZ failed, likely due to carburettor icing.
- The engine failed at a position during the final approach that did not permit the aircraft to glide to the runway and afforded limited alternative landing area options.
- While descending during the forced landing at night, the aircraft struck a power line and then

collided with terrain, resulting in minor injury to the pilot and substantial damage to the aircraft.

Safety message

Engine failure during single-engine aircraft operations is by far the most serious night time emergency. The Civil Aviation Safety Authority (CASA) advisory circular, *Night VFR Rating*, provides useful recommendations for minimising risk during night visual flight rules (VFR) operations, including:

- planning to fly at a higher altitude will increase the options available
- planning the descent onto the base leg so that the aircraft is positioned to start the turn onto final at about 600 ft to 700 ft above ground level.

The routine application of carburettor heat during the period between the base turn point and late in the final approach will significantly reduce the potential for an ice-related power loss. More information regarding carburettor icing can be found in the ATSB report, *The ongoing danger of carburettor icing*.

While a successful landing was not achieved in this instance, the pilot’s actions after realising he would not reach the runway closely followed the guidance in the Federal Aviation Authority pilot’s handbook, *Airplane Flying Handbook*. Flying in a controlled manner, wings level and at the recommended glide speed has a better survivability outcome than when control of the aircraft is lost. The pilot’s actions in maintaining control of the aircraft maximised the likelihood of a successful forced landing.

Notes

- Central Standard Time (CST): Universal Coordinated Time (UTC) + 9.5 hours.
- Visual flight rules (VFR): a set of regulations that permit a pilot to operate an aircraft only in weather conditions generally clear enough to allow the pilot to see where the aircraft is going
- PAN PAN: an internationally recognised radio call announcing an urgency condition, which concerns the safety of an aircraft or its occupants but where the flight crew does not require immediate assistance.
- Dewpoint is the temperature at which water vapour in the air starts to condense as the air cools. It is used among other things to monitor the risk of aircraft carburettor icing or likelihood of fog at an aerodrome.

Source: ATSB AO-2018-050 Wirestrike and collision with terrain involving Cessna 172RG, VH-LCZ.



ON 27 SEPTEMBER 2016, a Pulse Aerospace Vapor 55¹ remotely piloted aircraft (RPA), was operating a test flight at Lighthouse Beach, Ballina, New South Wales (Figure 1).

According to telemetry data² recorded on the remotely piloted aircraft system’s ground control station (GCS), at about 0910 Eastern Standard Time (EST), the RPA lifted off from its start position in front of the surf clubhouse (Figure 2). About 30 seconds later, when the RPA was at an altitude of about 36 ft, it entered

‘manual’ flight mode. The RPA then tracked according to manual inputs from the pilot for about 7 minutes, at which time (when at 124 ft altitude) the data-link signal was lost. Thirty seconds later, the RPA entered the ‘home’ flight mode, and commenced tracking to the programmed home position at an altitude of 154 ft. The last position of the RPA recorded by the GCS was about 165 m NNE of the start position, and about 4 km SE of Ballina/Byron Gateway Airport.

In the home flight mode, the RPA did not respond to the flight control inputs made



Figure 1:
 Photo of a (different) Vapor 55 RPA.
 Source: www.skylineuav.com.au.

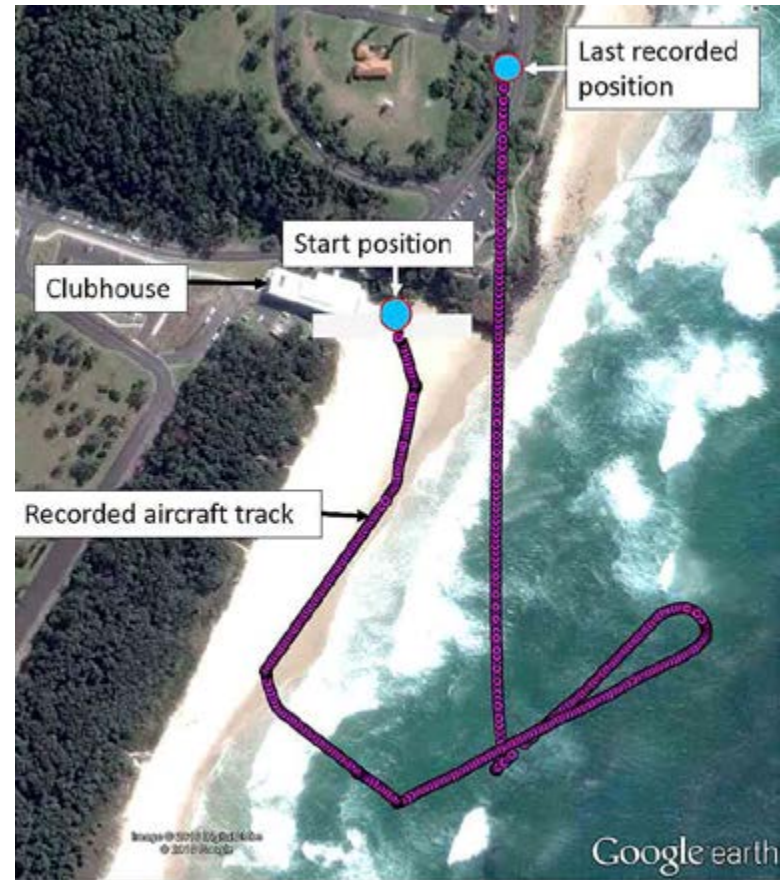


Figure 2: Recorded RPA track. Source: Google earth and remotely piloted aircraft system operator, annotated by ATSB.



Figure 3: Planned operating area defined using NW and SE markers. Source: Google earth, annotated by ATSB.

by the pilot and the pilot subsequently lost sight of the RPA. The RPA was not found despite an extensive search.

Mission planning

Prior to the flight, the pilot's preparation for the planned mission involved using Google earth on a computer (not the GCS), and selecting a north-western and a south-eastern reference point. These markers defined an outer rectangle, within which the flight was to take place (Figure 3).

The pilot then transferred an image of the google earth map for the area onto the GCS using a USB stick, and uploaded it to create the 'Lighthouse Beach' mission. To georeference³ the image, the pilot then overlaid the markers in the image with a point icon on the controller, and entered the latitude and longitude of two positions into the dialogue box on the GCS. The north-western GCS marker is visible in the top left corner of Figure 4, but the latitude and longitude values visible are image text only.

Once the image had been georeferenced, the pilot then used the graphical interface to place the start and home icons and any intervening waypoints for the planned mission (Figure 4).

Incorrect georeference

The remote pilot reported that both they and an observer checked each waypoint before the flight, verifying latitude, longitude, altitude and height. However, the GCS data shows that during the planning phase, while the north-western marker was correctly assigned, the south-eastern marker was incorrectly assigned to a georeference point with a latitude in the northern hemisphere. This resulted in all of the waypoints and home location being incorrect, as they were created by dragging icons on the georeferenced image. Waypoints 2, 3, 6 and 7 had latitudes in the northern hemisphere, and the home position was assigned to 17.222395° S and 153.591582° E. That location was in the Coral Sea Islands about 1200 km north of the start position (Figure 5).

The RPA's start position was correct as it was obtained using the RPA's GPS. As the aircraft entered manual

mode after take-off and the pilot did not initiate the automatic mode to fly the programmed mission, it was only when the RPA lost the datalink, stopped responding to the pilot's manual control inputs and commenced tracking for the programmed home position, that it left the planned operating area. The pilot can also manually give the 'home' command. In all home and automatic modes, the handheld controller is ignored unless the pilot gives the 'manual' command via the GCS application and manually takes control of the RPA.

The GCS has a 'flight plan' tab, which shows the planned distance and time (among other items) for the mission, which could have alerted the pilot to the incorrect latitude references. However, a check of the flight plan tab had not been included in the operator's pre-flight procedures. In addition, the flight plan tab includes a measure tool that can be used to check that the map size is correct.

The manufacturer advised that the following steps are included in their pre-flight procedure specified in the aircraft flight manual:

- verify flight plans
- verify lost communication home waypoint.

The operator stated that there was no further detail of the verification process in the manual.

The default hemisphere was north (N) in the GCS for entering positions. The manufacturer stated that there was no feature that would change the default (to south (S)). The manufacturer assessed that changing the default could lead to issues with the conduct of appropriate pre-flight checks.

The operator reported that information about the default setting to north was not provided in the Aircraft Flight Manual.

Loss of data-link signal

The RPA system commands homing after 10 seconds of data link loss when



Figure 4: Image uploaded onto GCS with planned mission overlaid. Source: Remotely piloted aircraft system operator, annotated by ATSB.

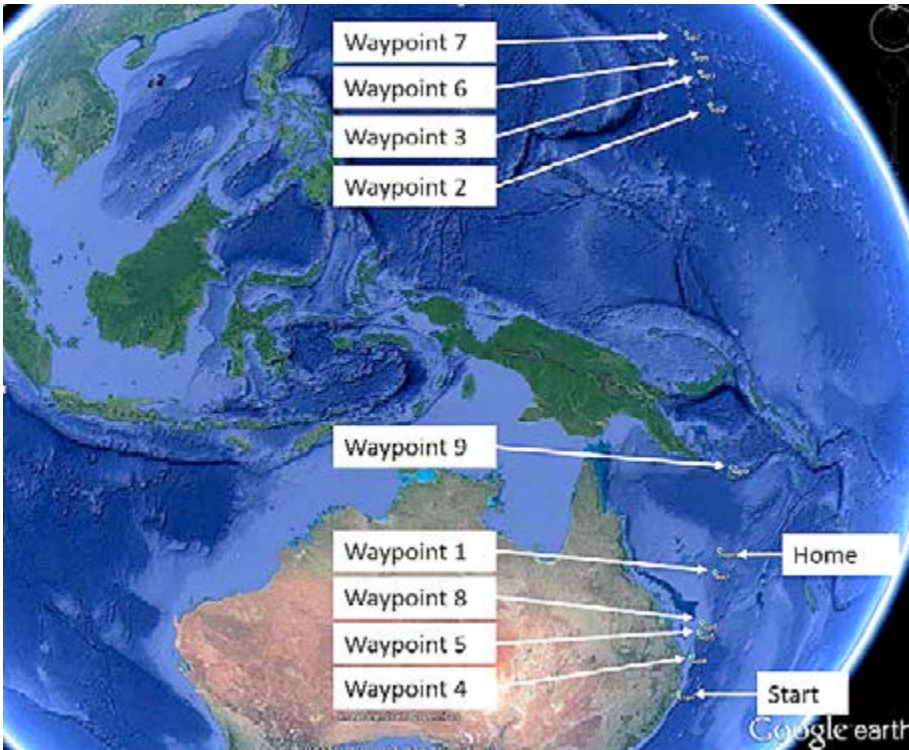


Figure 5: Actual location of home position and waypoints from the GCS. Source: Google earth annotated by ATSB.

The careful application of operational controls and procedures, underpinned by robust risk assessment, will become increasingly important as relevant technologies develop further and new RPA applications continue to emerge...

in automatic mode and 2 seconds if in manual mode. In this incident, as the RPA was in manual mode, it initiated homing after 2 seconds.

The cause of the lost signal could not be determined. The operator thought that there may have been interference from a media outside broadcast unit located about 30 m from the GCS. However, the media personnel advised the operator that they were using a satellite communications link and therefore should not cause interference.

Appropriate action

The manufacturer advised that once the aircraft commenced tracking to an incorrect home location, the appropriate action would have been to use the ‘hold’ or ‘manual’ command so that the joystick flight control could be used.

The remote pilot advised that they had attempted to use the ‘hold’ command, as they were shown in their training, but the RPA did not respond. No evidence of this was recorded in the GCS data.

Safety analysis

Although the pilot reported having completed the pre-flight preparations and associated checks, the data stored on the GCS showed that the incorrect (northern) hemisphere was assigned to the south-eastern georeference marker at the time the map image was created. This led to the home position being assigned a location in the Coral Sea Islands, so when the RPA lost signal and tracked for home, it headed north and was not recovered.

The same outcome would have occurred if the pilot had selected the RPA to fly home, even with a continuous data-link signal. While all of the intermediate waypoints were also incorrect, as the GCS remained in manual mode, the RPA did not attempt to track to any of those waypoints.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The south-eastern point used to georeference the image on the ground control station map was selected to a northern hemisphere latitude, which resulted in incorrect waypoints and home position for the mission.
- The RPA data-link signal to the ground control station was lost, so it commenced tracking to the programmed home position, which was in the Coral Sea Islands at a latitude 17.22° S, about 1200 km north of the start position.

Safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following safety action in response to this occurrence.

Manufacturer

As a result of this occurrence, the RPAS manufacturer has advised the ATSB that they are taking the following safety actions:

- Audit of training curriculum to ensure that pilots understand how to verify GPS co-ordinates, interpret their values and signs. The training course will continue to train pilots on the tools available to them within, and outside of the GCS software.
- Share this incident with operator trainers so that new operators can learn from the events of this incident.
- Continued education and outreach discussions with RPAS operators pertaining to decreased mishap rates through training and currency policies.

Remotely piloted aircraft system operator

As a result of this occurrence, the remotely piloted aircraft system operator has advised the ATSB that they are taking the following safety actions:

- The pre-launch checklists have been modified to include additional and enhanced procedures to verify data input and flight plans.
- Investigate the fitting of either GPS or cellular tracking devices to remotely piloted aircraft.
- Update the risk assessment form to include location of external broadcast stations such as television outside broadcast units.
- Brief all company pilots on the event for safety and education purposes.
- Continue liaison with the manufacturer.

Safety message

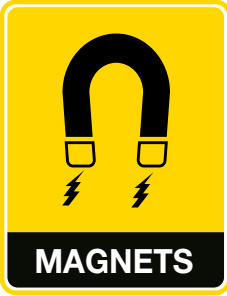
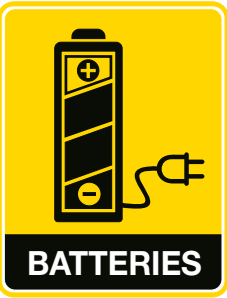
Incorrect reference data can have potentially serious consequences in remotely piloted and manned aircraft. It is imperative that remotely piloted aircraft systems incorporate means of minimising the opportunity for errors to occur and also for detecting and correcting errors that do occur. The careful application of operational controls and procedures, underpinned by robust risk assessment, will become increasingly important as relevant technologies develop further and new RPA applications continue to emerge. RPA operators should expect data loss events and prepare for these appropriately.

Notes

1. The Pulse Aerospace Vapor 55 is a helicopter, gross weight 25 kg, with a maximum cruise endurance of 60 minutes, controlled via a laptop computer operating the ground control station and flight controls (joystick).
2. The telemetry data is sent from the RPA to the ground station and stored.
3. Georeferencing means to assign a physical location (co-ordinates) with a position in an image.

Source: ATSB report on the loss of remotely piloted aircraft Pulse Aerospace Vapor 55, 27 September 2016 involving Cessna 172RG, VH-LCZ.

DECLARE ALL DANGEROUS GOODS



Always check with movements staff or flight crew

Failure to declare Dangerous Goods is an offence under the Defence Force Discipline Act



Dangerous goods are a risk to health, safety, property or the environment.

These include obvious things, such as: explosives, radioactive materials, flammable liquids, dangerous or volatile chemicals, strong acids, compressed gases, poisons and aerosols. Everyday items that can cause problems include toiletries, aerosols, tools and lithium batteries. **REMEMBER – IF IN DOUBT, ASK!**

Tossed by a thunderstorm

Regional jet plummeted 4000 ft in severe turbulence and icing before the pilots regained control.

By Mark Lacagnina

A LINE OF THUNDERSTORMS associated with a cold front and topping out above 52,000 ft was moving east over southern Ontario, Canada, the afternoon of 5 September, 2014. An air traffic control ground hold due to the severe weather in effect at the airport in Grand Rapids, Michigan, U.S., providing time for the flight crew of an Embraer 145LR to take another look at the convective activity on their cellphone weather apps and plot a viable route to their destination: Newark (New Jersey, U.S.) Liberty International Airport.

“The flight crew decided that the line of thunderstorms appeared to be fragmented enough, with sufficient openings, to allow them to deviate from their planned route around the weather system,” says the report by the Transportation Safety Board of Canada (TSB).

The aircraft, operated as ExpressJet Airlines Flight 4538, departed from Grand Rapids at 1845 local time carrying 26 passengers, a flight attendant and the two pilots. The captain was the pilot flying. He had about 10,000 flight hours, including 7000 hours in type and 5000 hours as pilot-in-command. “A company check airman, the captain had been employed by the operator for 10 years and had completed his most recent recurrent aircraft type training in April 2014,” the report says.



The first officer had about 3400 flight hours, including 2200 hours on type, was employed by the operator for three years and had completed recurrent aircraft type training in July 2014.

Under the original flight plan, the Embraer was to head southeast after departure. However, following the route they devised to avoid the severe weather, the flight crew initially deviated 50 nm (93 km) north-northeast after departing from Grand Rapids. “After its initial deviation, the aircraft turned east, paralleling a line of thunderstorms south of its position,” the report says. “The aircraft was in visual meteorological conditions (VMC).”

‘Gaps closing quickly’

The Embraer encountered light turbulence while climbing to Flight Level (FL) 370 (approximately 37,000 ft), which is the aircraft’s maximum operating altitude. Soon after the aircraft reached FL370, the turbulence began to intensify. The crew established a cruise speed of 0.63 Mach, the recommended airspeed for turbulence penetration.

“While flying eastbound, the crew used the onboard weather radar system to see the weather system ahead,” the report says.

“As the aircraft was in VMC, the flight crew also visually identified openings between the thunderstorms ahead. As the flight progressed, the crew observed the thunderstorms billowing, closing the gaps in the route ahead.”

The pilots were in radio communication with Toronto Area Control Centre, which approved their request to deviate as necessary to avoid the severe weather. “As the aircraft continued eastward, the flight crew could not locate an opening that would enable them to continue flying

toward their destination,” the report says. “At 1908, the flight crew communicated with the company dispatch [office] via the aircraft communication and recording system to request a route through the weather system, stating that they needed help picking their way through the storms and that the gaps between storm cells were closing quickly.”

At the time, the aircraft was eastbound and nearing the lower west shore of Lake Huron. The dispatcher studied his flight-following and weather display, and

suggested that the flight crew turn south and proceed to Sarnia, Ontario, which is on the south shore of Lake Huron, and then to proceed east-southeast toward Erie, Pennsylvania, U.S., on the southern shore of Lake Erie.

Turbulence intensifies

Following the dispatcher’s suggestion, the flight crew turned south toward Sarnia. Data from ground-based radar show that the Embraer soon entered a solid line of severe convective activity. Turbulence increased substantially. The aircraft’s flight data recorder (FDR) captured initial peak vertical accelerations of 0.49 g (that is, 0.49 times standard gravitational acceleration) and 1.42 g.

The crew adjusted the thrust setting several times during the next few seconds. Airspeed eventually increased to 0.79 Mach, which is above the aircraft’s maximum operating Mach number of 0.78. “The turbulence became more intense, with peak values of 0.41 g and 1.7 g,” the report said. “The roll attitude became unsteady, with the aircraft banking at angles ranging between 45 degrees left and 14 degrees right.”

The autopilot automatically disengaged, and the aircraft began to climb, likely due to strong thunderstorm updrafts. The crew re-engaged the autopilot, but it disengaged again seconds later as the turbulence intensified even more. The aircraft was in a slight (1.7 degree) nose-down pitch attitude as angle-of-attack changed from 3.8 degrees to minus 9.9 degrees and airspeed decreased through 0.68 Mach. The Embraer continued to climb.

At 1916, the aircraft reached a peak altitude of 37,600 ft – 600 ft above its maximum operating altitude. “At this point, the uncommanded right bank angle reached 45 degrees, and the turbulence momentary peak values were 0.44 g and 1.6 g,” the report says. “No significant elevator and trim deflections that would have contributed to the climb were commanded.”

Flight path (dashed line), weather, and aircraft location at 1916. The weather depiction was generated by a composite reflectivity radar source, using the maximum reflectivity from all of the multiple elevation angles.

Contrary control inputs

After reaching 37,600 ft, the aircraft stalled, pitched 11 degrees nose-down, rolled 30 degrees right and began a rapid descent. “The flight crew increased the thrust ... and, using flight control inputs, commanded an additional right roll,” the report says. “The roll inputs by the flight crew during the uncommanded descent were contrary to known aircraft upset-recovery techniques. The correct technique is to roll the aircraft in the shortest direction to wings-level.”

The crew’s roll inputs contributed to the aircraft reaching a right bank angle of 63 degrees. “The pitch attitude increased to 13 degrees nose-down, and the aircraft reached a descent rate of 3100 feet per minute (fpm),” the report said. “The crew briefly applied left roll inputs, and the right bank angle decreased from 63 degrees to 33 degrees.”

The Embraer encountered severe icing conditions during the upset, and the wing, stabilizer and engine anti-ice systems automatically activated. The aircraft was in a 42-degree right bank as it descended through 36,800 ft at 4400 fpm. The crew again applied right roll inputs, and the bank angle increased to 77 degrees. “The pitch attitude increased to 17 degrees nose-down,” the report says “The aircraft’s speed was accelerating through 0.76 Mach, and the severe turbulence persisted.”

The crew then applied left roll inputs, reducing the right bank angle to 26 degrees. At this point, the descent rate was 7500 fpm and the pitch attitude was 24 degrees nose-down. The crew reduced thrust as the aircraft descended through 36,400 ft. “Over a period of 6 seconds ... the aircraft’s pitch attitude decreased to 5 degrees nose-down and the descent rate decreased to 6900 fpm,” the report

says. The turbulence subsided somewhat, from severe to moderate.

Control recovered

The flight crew recovered control at 33,600 ft, after the aircraft had plummeted 4000 ft. “During the period of loss of control, the aircraft had sustained an average turn rate of 200 degrees per minute, which had changed its heading from 180 degrees magnetic (M) to 240 degrees M, and had reached a peak descent rate of 9300 fpm,” the report says. “Severe turbulence had persisted throughout this period of upset and loss of control.”

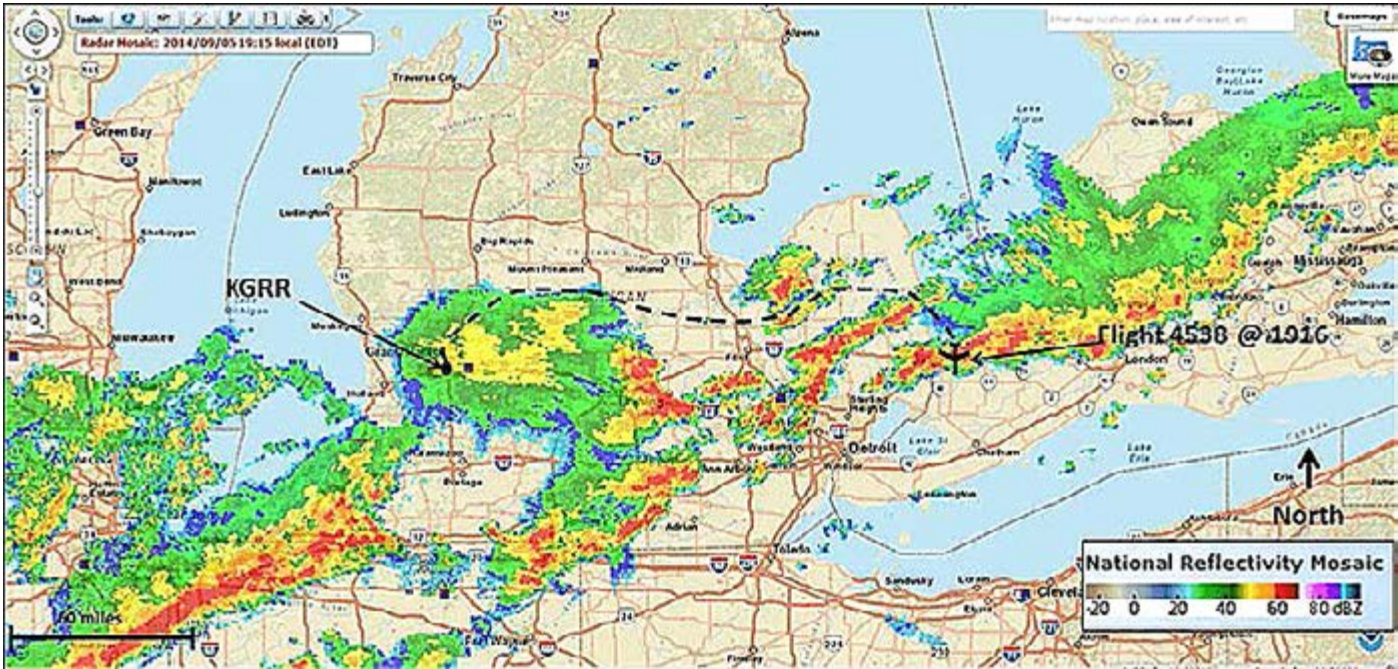
Toronto Centre had repeatedly tried to hail the crew. “The flight crew’s only response was ‘stand by’, but this was said with a tone and volume that suggested that something of an urgent nature was occurring,” the report says.

While the crew climbed back to their assigned altitude, FL370, the aircraft encountered light to moderate turbulence and icing conditions. The Embraer was still on a heading of 240 degrees when the crew asked Toronto Centre for a heading that would take them out of the weather system. “Again the tone of voice and volume suggested urgency,” the report says. “Toronto [Centre] suggested a southbound heading; the aircraft turned southbound and shortly afterward exited the weather system.”

The crew then turned east, toward Newark, and subsequently landed the aircraft without further incident. None of the occupants had been hurt during the upset. The crew reported a severe-turbulence encounter to ExpressJet.

“As a result, maintenance [technicians] performed a severe turbulence inspection on the aircraft and downloaded the [FDR data] in accordance with the EMB-145 aircraft maintenance manual,” the report says. “There was no damage reported or discrepancies noted. The aircraft was released back into service.”

TSB investigators also analyzed the FDR data and found that overspeed conditions



(exceedances of the maximum Mach number) had occurred just before and during the upset and might have caused structural damage to the aircraft.

“As a result, the TSB notified the operator, which subsequently performed an overspeed inspection,” the report says. Apparently, no damage was found during the overspeed inspection.

Training, equipment limitations

Both pilots held U.S. Federal Aviation Administration (FAA) certificates. FAA regulations did not require formal upset-prevention and recovery training when the incident occurred, and such training was not provided by ExpressJet.

The report says; however, that the company’s flight-simulator training did include two scenarios involving recoveries from nose-high and nose-low pitch attitudes and bank angles selected by the instructors.

“Although the flight crew had been previously exposed to upset-recovery training, the occurrence was their first exposure to an event involving an upset with turbulence of this degree,” the report says. “Because of current fidelity limitation inherent in full-motion flight simulators and because training scenarios involve some level of expectation, it is difficult to replicate an aircraft

upset with turbulence of the severity encountered by the occurrence flight crew.”

The upset-recovery training that the pilots had received at ExpressJet had not prepared them for the magnitude of the turbulence they encountered. They “were not proficient in recovering from an upset of this nature”, the report says. “During the loss of control, the flight crew momentarily applied flight control inputs that exacerbated the roll attitude of the aircraft. As a result, the altitude loss and recovery time were increased.”

The crew had reduced airspeed to the recommended turbulence-penetration speed when the turbulence increased. Shortly thereafter; however, they increased thrust, which consequently increased airspeed. “Although the turbulence-penetration speed is a recommendation, not a limitation, if flight crews operate aircraft outside of manufacturer recommendations, the risk of encountering an adverse consequence is increased,” the report says.

A question of reflectivity

ExpressJet used WSI Fusion software for flight following and weather monitoring. Although the route that the dispatcher suggested to the pilots appeared to be feasible, based on what he was

Above: Flight path (dashed line), weather, and aircraft location at 1916. The weather depiction was generated by a composite reflectivity radar source, using the maximum reflectivity from all of the multiple elevation angles.



Above: Dispatcher’s view of the aircraft’s flight track at approximately 1915, showing the actual flight path (blue line) and weather. The weather depiction was generated by a base reflectivity radar source, using the lowest of the reflectivity angles.

seeing on his display, U.S. National Oceanic and Atmospheric Administration (NOAA) ground radar was showing a large and unbroken line of thunderstorms on the route. “The difference in the two depictions was due in part to radar reflectivity types,” the report says. “The dispatcher’s display is a base reflectivity product, which uses the lowest reflectivity angle, while the NOAA display shows a composite radar return, which uses the maximum reflectivity from all of the multiple [ground radar] elevation angles.”

Dispatcher’s view of the aircraft’s flight track at approximately 1915, showing the actual flight path (blue line) and weather. The weather depiction was generated by a base reflectivity radar source, using the lowest of the reflectivity angles.

Moreover, the flight-following software that the dispatcher was using is a weather-avoidance tool. When the flight crew requested assistance, they were already in the convective activity and attempting to navigate between storm cells. “As a result, the flight-following software was not used as intended (that is, as a proactive tool to avoid weather) but rather as a reactive response to a thunderstorm encounter,” the report says. “Had the flight crew requested dispatch assistance earlier, a suggestion to help them avoid the weather system completely may have been provided.”

The weather radar system aboard the Embraer was a Honeywell Primus 660. “The weather radar system can see rain, wet snow, wet hail and dry hail (depending on its diameter),” the report says. “It cannot see water vapour, ice crystals or

small, dry hail.” Among the limitations of airborne radar systems is attenuation, in which heavy precipitation can effectively block the radar signal. “The greater the intensity of the precipitation, the shorter the distance the radar can see when looking into and through a storm,” the report says. Grease, dirt and cracks on the aircraft’s radome also can impair the transmission of the radar signal, as can a film of water that might form on the radome at certain altitudes and airspeeds.

Correct management of range, tilt and gain settings also is critical to the effective use of weather radar. Investigators were unable to determine how the crew was using their system. “As the FDR does not record parameters from the weather radar unit, it could not be determined with certainty which settings the flight crew were using,” the report says.

The TSB issued no formal recommendations based on the findings of its investigation. The report noted; however, that ExpressJet conducted an internal assessment of its flight operations and took action to improve how dispatchers use its flight-following software. The company also developed a pilot training module on the use of weather radar systems.

Sources

This article is based on Transportation Safety Board of Canada Aviation Investigation Report A1400165: Loss of Control; ExpressJet Airlines; Embraer EMB-145LR, N16954; London, Ontario, 52 NM W; 05 September 2014.

Flight path at 1918: U.S. National Oceanic and Atmospheric Administration, National Weather Service, with Transportation Safety Board of Canada annotations.

Dispatcher’s view: ExpressJet, with Transportation Safety Board of Canada annotations.

2019 Courses

Aviation Safety Training

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 provides theory and practical exercises in the broad topics of the Defence Aviation Safety Management System, risk management, human factors, the Defence 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 a 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. Includes participation in a practical emergency response component.

NTS

Aviation 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

COURSE AIM:

To develop members with the skills to conduct aviation incident-level investigations in support of their ASOs.

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.

COURSE NAME /NUMBER	DATES	LOCATION	NOMINATIONS CLOSE
1/19 ASO Initial	19 to 28 Feb	Nowra	18 Jan
2/19 ASO Initial	26 Mar to 04 Apr	Canberra	1 Mar
3/19 ASO Initial	30 Apr to 09 May	Canberra	29 Mar
4/19 ASO Initial	30 Jul to 08 Aug	Canberra	28 Jun
1/19 AvnNTS	18 to 22 Mar	Canberra	22 Feb
2/19 AvnNTS	20 to 24 May	Canberra	11 Apr
3/19 AvnNTS	09 to 13 Sep	Canberra	05 Aug
1/19 ASO Advanced	20 to 24 May	Edinburgh	18 Apr
2/19 ASO Advanced	16 to 20 Sep	Amberley	16 Aug
5/19 ASO Initial	27 Aug to 05 Sep	Canberra	26 Jul
6/19 ASO Initial	15 to 24 Oct	Canberra	13 Sep
7/19 ASO Initial	12 to 21 Nov	Canberra	11 Oct

COURSE NAME /NUMBER	DATES	LOCATION
1/19 AIIC	15 Apr	Darwin
2/19 AIIC	16 Apr	Tindal
3/19 AIIC	15 May	Pearce
4/19 AIIC	29 to 31 May	Richmond
5/19 AIIC	4 to 6 Jun	Amberley
6/19 AIIC	14 Jun	Holsworthy
7/19 AIIC	18 to 20 Jun	Williamtown
8/19 AIIC	14 Aug (TBC)	Robertson
9/19 AIIC	23 Aug (TBC)	Townsville
10/19 AIIC	TBA	East Sale
11/19 AIIC	TBA	HMAS Albatross

All courses are generally oversubscribed, dates provided are for planning purposes and are subject to change due to operational requirements, nominations from individual units or candidates will not be excepted, nominations are to be forwarded with Commanding Officers endorsement to:

- **Air Force:** the relevant Wing Aviation Safety Officer, or for CSG, Staff Officer Safety HQCSG
- **Navy:** the Fleet Aviation Safety Officer and



For further details regarding the above courses visit the Dfsb intranet site or email

Dfsb.setcourses@defence.gov.au



Defence Aviation Safety Award

The Royal Aeronautical Society (RAeS) Aviation Safety Award recognises individual or collective efforts that have enhanced Defence aviation safety.

Nominations for the RAeS Aviation 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 aviation 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 2019 award please visit the DFSB Intranet site.

