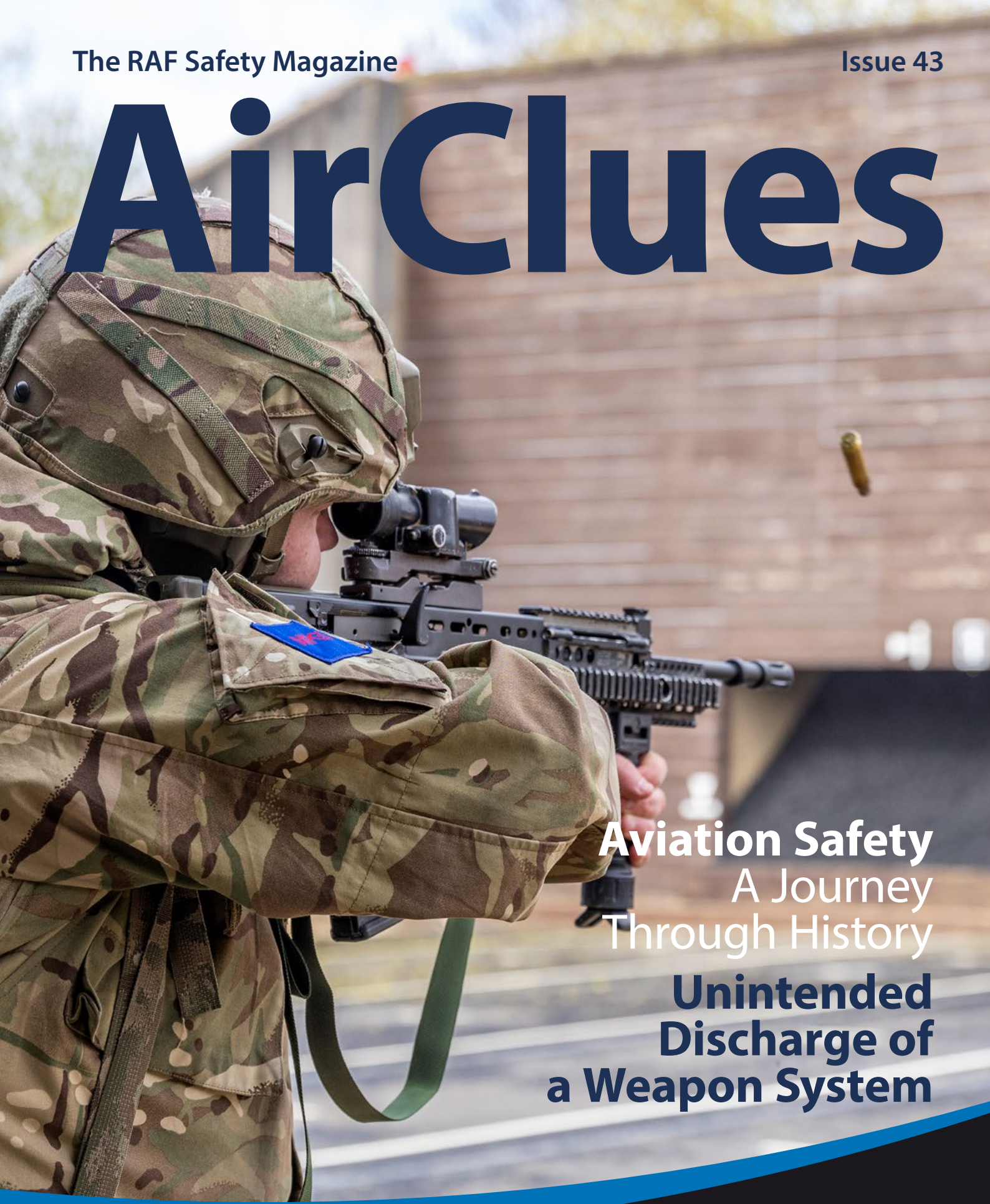
The RAF Safety Magazine

Issue 43

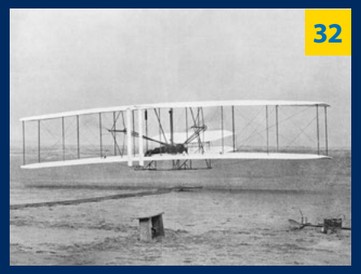
AirClues



Aviation Safety
A Journey Through History

Unintended Discharge of a Weapon System

ROYAL AIR FORCE
Safety Centre



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Inspector of Safety (RAF)
Air Cdre Sam Sansome
sam.sansome136@mod.gov.uk

Inspector of Flight Safety (IFS)
Gp Capt Andrew Keith
andrew.keith626@mod.gov.uk

CESO
Lizzy Kijewski
elizabeth.kijewski100@mod.gov.uk

For enquiries to other departments in the Safety Centre – email **Air-SafetyCtre-WgCdrSpry@mod.gov.uk**

More Information:
Additional information can be found in the following locations:

RAF Safety Centre SharePoint Site:
https://modgovuk.sharepoint.com/teams/23116

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https://www.raf.mod.uk/our-organisation/units/raf-safety-centre/

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Air-SafetyCtre-WgCdrSpry@mod.gov.uk

March 2024
Produced by Air Media Centre, HQ Air Command. 4589_23WP
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Foreword

By Air Cdre Sam Sansome, Inspector of Safety (RAF)

Air Commodore Sam Sansome

Welcome to Air Clues 43. I'm sure that you don't need me to remind you how important a good reporting culture is to the safety culture of an organisation, but it isn't just important to report things, it's also necessary to investigate, learn what lessons you can and put in place suitable barriers to make sure that incidents don't happen again – if practicable!
One of the fundamental building blocks in making this happen successfully is clearly a Just Culture and a feeling that you can raise concerns and record incidents safely; 'psychological safety' is one of the more common terms you'll hear about open reporting systems and what is needed to make them work.
Perhaps something even more important – fundamental even – is a means by which to report.

Having learnt how useful it is to have a good reporting system in the Air Safety world (ASIMS), for many years the RAF tried to get the rest of Defence interested in a single system on which we could report incidents and near-misses that happened outside the Air Safety domain. Eventually, we could not wait any longer and we created our own – FSIMS. Since FSIMS opened its doors in October 2020, it has provided us with a great insight into our safety occurrences off aircraft but it will soon be time to call time on our stop-gap measure. Predictably, soon after we got FSIMS up and running the Centre started looking at a centralised system of reporting for Defence – some of you may even have heard of it or used it. The Defence Unified Reporting and Lessons System – DURALS. The project that started in the Army has now been taken up by Defence Safety and Defence Digital and will be rolled out across the other TLBs this year (Army and UK StratCom have acted as the guinea pigs). With the change of ownership comes a change of name, DURALS is being rebranded to MySafety – a one-stop-shop for all non-Air related Safety and Environmental incidents and accidents. MySafety will be supported by a dedicated team and will continue to develop and improve. It already allows anyone in Defence to start a report from their personal device (mobile phone , tablet) so that important information can be captured immediately – so you won't need an account or a desktop. MySafety will allow us to identify trends and lessons from across Defence – so we can hopefully learn once between us. Keep your eyes open for more information on timescales, training and more – and in the meantime keep reporting the information and learning will not be lost!

We need your 'I learned about flying/engineering/air traffic from that' articles. Please write to Wg Cdr Spry with your open and honest stories.

Safety Awards

Lieutenant Clark RN – RAF Marham – Green Endorsement

On 26 May 23, whilst returning to RAF Marham from Exercise NORTHERN EDGE, Alaska, and on the final leg of the return trail from Lajes, Lieutenant Clark was flying No.3 of a formation of six Lightning aircraft in company with a Voyager. Following a successful second refuel bracket at FL250, the initial Integrated Caution Advisory Warning (ICAW) enunciated in the cockpit. Lieutenant Clark was flying on back-up oxygen and had to descend to 16,000ft MSL with his wingman in formation. During this descent the list of ICAWS grew to 10 and the fault was identified as a failure of one of the Vehicle Management Computers (VMC). The IPP remained failed leading to multiple mission and flight control systems overheating with no onboard cooling and reliance on back-up oxygen.

During the lengthy transit the back-up oxygen supply depleted and Lieutenant Clark was forced to further descend to 9,500ft to ensure he mitigated any effects of hypoxia. This descent now put his aircraft below the desired parameters to assist in cooling mission and flight control systems. During the 48-minute transit to the diversion, with multiple systems now off or failed, flight controls overheating with a steady increase in cockpit temperature, Lieutenant Clark completed his pre-meditated ejection drills in anticipation of loss of aircraft control due to failed flight critical systems. Lieutenant Clark and his wingman were on emergency squawk flying as a pair.
After considering the multiple system failures, aircraft performance and diversion airfield specifics they concluded a Slow Land was required. Having acknowledged the additional warnings and notes in the PCL, Lieutenant Clark was aware converting the aircraft from conventional to Short Take Off Vertical Landing (STOVL) mode may require multiple pilot overrides to configure the aircraft correctly. Upon initial selection to STOVL mode a CONV HALT enunciated, as expected, and Lieutenant Clark attempted to complete a manual override. Three pilot overrides were attempted and, although the expected STOVL doors manoeuvred into position, the lift fan did not engage. Due to the close proximity to touchdown and to avoid additional time airborne, Lieutenant Clark attempted to revert the aircraft back to conventional mode but which was unsuccessful.
He modified his approach to reduce AOA and approach angle to avoid the possibility of any still open STOVL doors contacting the runway surface, landing safely.

Air Specialist Class 1 (Technician) Burniston – RAF Odiham – Good Show

Whilst deployed from RAF Odiham, and on only his third shift, Air Specialist Class 1 (Technician) Burniston was conducting an aircraft rotor blade tape repair to a Chinook aircraft.
He noticed damage to the leading edge of the main rotor blade, and promptly informed the mechanical trade desk. After conducting a full examination of the rotor blade, it was deemed unserviceable. The following day, while carrying out rotor blade track and balance adjustments, he also noticed extensive scoring to the No.1 synchronisation shaft.

Corporal Buck – RAF Odiham – Well Done

Corporal Buck conducted a routine flush of fuel with a newly delivered Large Capacity Aircraft Refueler (LCAR) when she discovered that the Hose End Pressure Coupling was leaking fuel. She reacted quickly and efficiently to reconnect the hose to prevent a spill.

Sergeant Houston – RAF Odiham – Well Done

Following Corporal Buck's fuel spill intervention, Sergeant Houston followed up this issue; further investigation was instructed by A4 into the LCAR variant. This led to a discovery at factory level of an initial design fault which was not highlighted until the LCAR was used for operations by RAF Odiham ASMT.

Captain Nicholas Heard – 57 Sqn RAFC Cranwell – Well Done

Captain Heard was the QFI in a Prefect TMk1 aircraft coming to the end of an Elementary Flying Training sortie in the vicinity of RAFC Cranwell. He carried out a normal circuit to land on runway 19R, which included a demonstration of the use of maximum reverse power. The approach and touch-down were both uneventful. However, upon the selection of full reverse, a major airframe vibration rapidly ensued. Initially diagnosing a potentially catastrophic engine/propellor or wheel failure, Captain Heard immediately reselected flight idle power and brought the aircraft under control.

Flight Sergeant Ball – 3FTS Mil CAMO – Commendation

In January 2023, during the Military Airworthiness Review on a Texan aircraft, an error was noted in the Weight and Balance data for this aircraft. Flight Sergeant Ball, through exemplary diligence over a significant period, has ensured that the Weight and Balance of the Texan fleet is now managed by the Maintenance Organization to an acceptable standard. It is also noteworthy that the UK Civil Aviation Authority, which also oversees the maintenance on the Texan fleet on behalf of the Military Continuing Airworthiness Management Organization, praised his Task Audit for its detail and best-practice analysis technique.

Corporal Wright was conducting a routine role equipment change on a Puma HC2 helicopter of 230 Squadron, located at Rimba Air Base, Brunei. This activity consisted of transferring seat lap-straps to facilitate a different seat configuration on the aircraft. He quickly noticed that the serial number tag was missing from one of the lap-straps; on further investigation he found that 10 of the 32 individual straps he checked were missing their serial number tag label. He then inspected the other 230 Sqn aircraft based in Brunei and found the same issue. He identified the root cause as being increased removal and re-fit activity due to insufficient number of lap-straps being held in country.

Corporal Wright – 230 Sqn BFB Brunei – Good Show

While working at Medicina Lines, Brunei, Air Specialist Class 1 (Technician) Wilson was acting as the safety supervisor for the first engine start of a Puma HC2 helicopter, following major maintenance. He was positioned to the front of the aircraft, ensuring the safe start of the right-hand engine, when he noticed a large amount of hydraulic oil flowing, under pressure, from the highest point of the tail. The leak was later confirmed to have been from the Tail Rotor Servo Control Unit.
The aircraft was operating in an area of Special Scientific Interest, with a high-water table and in immediate proximity to virgin rainforest. With this in mind, AS1(T) Wilson also contacted all required personnel and led a comprehensive clean-up, ensuring that no ground or water contamination occurred post the incident.

Air Specialist Class 1 (Technician) Wilson – 230 Sqn BFB Brunei – Good Show

Squadron Leader Leyman submitted a Defence Air Safety Occurrence Report for an error which he found in the Aircraft Technical Log for Prefect TMk1 aircraft he was about to fly. He identified that details about a forthcoming maintenance task on the engine, due in 2 days, were not present on the Maintenance Forecast sheet in the Aircraft Technical Log. Whilst a pilot may be expected to identify an error in information that is presented to them, identifying information that is missing entirely is much more difficult and a particular challenge.

Squadron Leader Leyman – 57 Sqn RAFC Cranwell – Well Done

During the towing of an RAF Shawbury Juno helicopter at the end of the day's flying, Miss Brownson was acting as a 'wing walker' to ensure appropriate clearances were being maintained between the aircraft and anything else.
Miss Brownson spotted that a quarter turn Camlok stud fastener on the forward lower access panel of the helicopter was undone. She brought it to the attention of a suitably qualified engineer and highlighted what she had found, which indeed was a loose panel, and corrective action was taken.

Miss Katie Brownson – AHUK RAF Shawbury – Well Done

Mr Allan Trenholme and Mr David Davidson have demonstrated an enduring and outstanding attitude towards Flight Safety. Their contribution to Foreign Object Debris (FOD) management and reduction at RAF Leeming has been commendable and is an example to the Whole Force.
For eight years, a part of each working day has been dedicated to conducting FOD sweeps of the Technical Site adjacent to the airfield, an area deemed to be a moderate risk to aircraft. They have done this outside their terms of reference, understanding the potential impact FOD has on wider station and defence outputs. It has been recognised that they have often conducted FOD sweeps in the early morning before going on leave.

Mr Alan Trenholme (L) and Mr David Davidson (R) – RAF Leeming – Commendation

Captain Hodgson was conducting a Prefect training sortie at RAF Cranwell. Part of the start-up and taxi procedure is to conduct a propeller overspeed governor check to confirm the oil system is governing the propellor speed within its normal range. This was executed at the runway hold point and during the initial check, an unusual sound was heard. Captain Hodgson elected to conduct a second check which was within limits and successful, however the oil temperature was observed to be slightly higher than normal and so he elected to terminate the sortie. He taxied the aircraft clear of the taxiway to allow a further two aircraft to pass and whilst holding at this location, the oil temperature continued to rise. This was exacerbated by the position of the aircraft out of wind and inability to manoeuvre due to the proximity of other traffic. It became apparent that an ATC clearance to taxi back to dispersal was not going to be forthcoming and so he decided to shut the engine down to prevent any damage as a precaution against exceeding the oil limitations.

Captain Hodgson – RAFC Cranwell – DDH Air Safety Award

Sergeant Gallagher – Leuchars Diversion Airfield – Good Show

On 17 August 2023, Leuchars Diversion Airfield (LDA) MT took receipt of Large Capacity Aircraft Refueller (LCAR) following upgrade and modification through the Life Extension Programme. It was the first vehicle to be returned to the unit following the Life Extension upgrade. Test samples following initial flushing and draining indicated some large metallic fragments akin to swarf which were large enough to cause problems with aircraft fuel and engine systems.
This was initially expected; however, after topping the fuel up to 20,000 ltrs and subsequently flushing some 200,000 ltrs of fuel through the system, a more excessive amount of metallic fragments became evident. The test samples technically passed the testing procedure, however Sergeant Gallagher sensed that there were still contaminants in the fuel beyond the last point of issue, which could present a significant Air Safety Risk and immediately suspended the use of the LCAR. His suspicions were subsequently validated.

Corporal Yeudall & Air Specialist (Class 1) McNaught – RAF Lossiemouth – Well Done

Corporal Yeudall was training Air Specialist (Class 1) McNaught in the Truck Runway Control at RAF Lossiemouth. Whilst conducting last look checks on a departing P8-Poseidon aircraft they both noticed that there appeared to be something unusual with the handle on the left-hand door. They passed a message to the aircraft via ATC which allowed the crew to check the door in flight. Although there appeared to be nothing amiss, it was realised following landing that the handle was in an unusual position.

Corporal Brown – RAF Lossiemouth – Well Done

IX(B) Squadron at RAF Lossiemouth was preparing four aircraft to take part in a high-profile Exercise and Corporal Brown was part of the line team. Whilst in the cockpit operating brakes for an aircraft tow, Corporal Brown identified an unusual mark on a console panel which initially appeared to be dirt. However, on closer inspection he suspected it could be scorching. He immediately consulted his chain of command, and it was confirmed that the panel had been subjected to excessive heat from an unknown source. The aircraft was subsequently taken off the flying programme and the console panel was removed for industry investigation. The finding prevented the very serious airworthiness risk of having smoke or fire in the cockpit.

Acting Corporal Marsland – RAF Lossiemouth – Well Done

On 16 June 2023, at RAF Lossiemouth, Acting Corporal Marsland, a Weapons Technician, was working on a Typhoon aircraft. Prior to entering the cockpit, he carried out a check of all Aircraft Assisted Escape System safety devices. It was during these checks that he noticed something unusual with the Digital Video Voice Recorder (DVVR), identifying a 'red band' on the asset. Acting Corporal Marsland recalled a *'General Awareness Feedback'* form regarding red banded components, noting that this indicates it is for 'ground use only' and should not be fitted to an aircraft for flight.

Flight Sergeant Hall – RAF Odiham – Well Done

Flight Sergeant Hall was tasked with conducting a Chinook air test as No.2 crewman whilst deployed at the Naval Air Facility El Centro, USA. The aircraft had recently undergone significant engineering work and, although it had completed a rotors-turning ground run, it hadn't flown since. After start, and once ready to begin the air test, the aircraft was taxied to the runway. Flight Sergeant Hall noticed that a latch, designed to attach the forward transmission work platform, had become insecure. He immediately informed the captain, preventing the aircraft from becoming airborne. The crew elected to taxy back, shut down and have the latch inspected and re-secured.

Sergeant Blay – RAF Odiham – Well Done

Sergeant Blay was operating as the No.1 crewman for a Chinook sortie from RAF Odiham. The crew had already completed the first hour of the sortie, a passenger move, and had shut down for a short break before the last section of the flight was due to commence. Shortly after the aircraft had been fully restarted, Sergeant Blay conducted an additional inspection of the engines. He noticed a very small piece of blue paper towel, roughly 2cm in diameter, visible through the inspection panel within the engine bay. A further larger piece dislodged and became noticeable within the same area. Sergeant Blay informed the captain who elected to shut down for engineering assistance. Following a thorough investigation around the engine bay, multiple fragments of paper towel were discovered. Had this remained undetected, there is a possibility that the towel could have interacted with the engine components causing either a failure or fire.

Boscombe Down VAS – Team Commendation

From left to right; Mr David Eells, Mr Mark Brady, Mr Grahame Clarke, Mr Tom Cottrell, Mr Andy Doyle, Sqn Ldr Slaughter.

On 17 August 2023 the Visiting Aircraft Section (VAS) at MOD Boscombe Down was preparing to accept and ground handle 2 F-35 Lightning II aircraft from 207 Sqn based at RAF Marham as part of support to an on-going exercise. This was the first time this aircraft type had been handled by the team.

Despite some concerns by the team, a planned way forward was formulated and agreed following discussion amongst the VAS team to enable them to operate safely. This consisted of each aircraft being handled in series rather than parallel, with the team leader conducting the physical checks outside and underneath the aircraft footprint, inclusive of hand signals to the aircrew and with the team conducting their normal duties of Marshalling and brakes. All with a view to the team gaining experience on Fast Jet handling whilst keeping to activities they were comfortable in conducting. Following shutdown, the team further liaised with the aircrew to increase their knowledge of handling the aircraft and fuelling activities. The VAS team and aircrew walked through the crib sheets to manage both parties' expectations regarding dispatch and see-off activities. In addition to the careful coordination put in place by the team, from the office window overlooking the Main Dispersal, Mr Andy Doyle noticed a clear fluid emanating from the rear LH side of the aircraft; it was dripping at a considerable rate and both aircraft were displaying similar symptoms. This was noted by the ground crew and monitored. This was a highly unusual task for the team, made difficult by the technical spec of the aircraft type.

Corporal Baker – RAF Coningsby – Well Done

Corporal Baker was conducting line training from an aircraft environmental shelter on the main Aircraft Servicing Platform at RAF Coningsby. He had positioned himself alongside the aircraft marshaller and successfully supervised the see-off of his student's aircraft. After dispatch, the aircraft from the adjacent shelter began to taxi; at this point Corporal Baker noticed that the aircraft's hand pump handle was still fitted with its access panel still open. He signalled to the aircraft captain and took control of the aircraft, bringing it to a stop. Commanding that the aircraft brakes be applied, he signalled to the pilot that a further panel and leak check must be carried out. He then stowed the hand pump handle, closed the panel, and carried out a comprehensive check of the aircraft before releasing it to carry out its sortie.

Air Specialist Class 1 (Technician) Brown – RAF Coningsby– Well Done

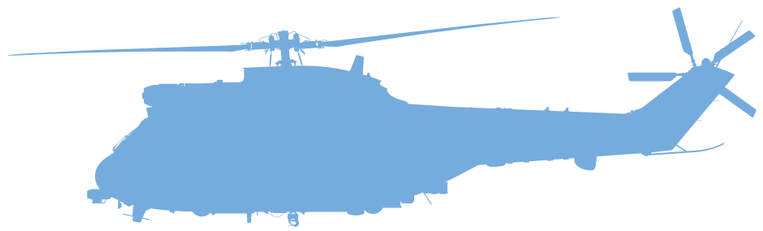
While deployed with 12 Squadron, Air Specialist Class 1 (Technician) Brown was a leader with regards to Foreign Object Damage (FOD) awareness and prevention. Conditions were challenging, and the FOD risk was high, occasionally extreme, due to the large-scale building work being carried out at the deployed location. On one occasion during the transit to the flight line, AS1(T) Brown noticed a significant amount of FOD being blown across the ASP towards the 12 Squadron Typhoon aircraft that were being prepared for flight. He instructed the driver to stop the vehicle, alighted and chased the high-risk FOD on foot across the ASP, successfully retrieving it and ensuring the debris posed no danger to aircraft.

Air Specialist Class 1 (Technician) Darnell – RAF Coningsby – Commendation

Deployed with 12 Squadron in late 2022, Air Specialist Class 1 (Technician) Darnell was dealing with a high-risk Foreign Object Damage (FOD) situation on an airbase still under construction. AS1(T) Darnell submitted more reports and personally catalogued more FOD than any other individual; the material collected by Darnell was turned into displays and used to demonstrate the level and type of FOD being collected to senior ranks of both RAF and Host Nation forces. The example set by AS1(T) Darnell was picked up and adopted by his peers and, in turn, led to a robust FOD awareness and reporting culture on 12 Squadron.
The normally very high standards that were applied to FOD management in the UK were increased exponentially to enact a virtually impenetrable net of FOD Control. This culture, spearheaded by AS1(T) Darnell, and thriving amongst all Sqn Personnel, was critical to the continued airworthiness of the Squadron and translated into a very successful, high-profile deployment with Zero FOD rejections - a remarkable feat considering the operating environment.

Puma Depth Servicing Hub – RAF Benson – Commendation

Squadron Leader Polden (OC PDSH) receives an RAF Safety Centre Commendation from Wg Cdr Tostevin (Acting Stn Cdr) for their submission to the RAF Safety Centre Safety Trophy competion in which PDSH were one of the runners-up.



Lieutenant Commander Huxtable – RAF Marham – Good Show

On 12 October 2023 a student pilot was returning to RAF Marham as number two in a formation of 2 Lightning II aircraft. The weather at Marham was significantly worse than forecast but reported conditions were adequate for the student to attempt an instrument approach using his white instrument rating. Whilst the green-rated formation lead successfully completed the approach, the student was not visual at his higher minima and initiated a missed approach to fly to the promulgated station diversion airfield.
During outbound conversion from Short Take-Off Vertical Landing mode, a 'Conversion Halt' caution enunciated. This meant that the aircraft was stuck at a much higher fuel burn than the diversion fuel assumptions and would likely flameout before reaching the diversion airfield. The student called the 207 Squadron duty pilot, Lieutenant Commander Huxtable, to assist with the inflight emergency. While the aircraft re-established in the Marham instrument pattern, Lieutenant Commander Huxtable was able to quickly assess the situation and calmly guided the student through the conversion halt procedure. The procedure forced the aircraft back to a known configuration, albeit still at a much higher burn rate. Rapidly considering all factors, Lieutenant Commander Huxtable directed a further attempt to convert to conventional mode, which was successful. Although now well below diversion fuel, this provided a safer fuel margin to attempt a further approach at Marham. Presented with the fuel emergency, Lieutenant Commander Huxtable directed the student to use green instrument rating minima if required, which resulted in a successful recovery.

Air Specialist Class 1 (Technician) Byrne – RAF Coningsby – Well Done

On 1st December 23 at RAF Coningsby Air Specialist Class 1 (Technician) Byrne was part of the Human Interface Team (HIT) for a Typhoon see off. As a third aircraft in the formation cleared its slot and turned right towards the HIT vehicle, AS1(T) Byrne noticed that the pre-cooler bypass blank was still fitted at the base of the fin. He brought the aircraft to a stop, ensuring it did not carry on with its take off with the blank still fitted.

Flight Lieutenant Smith – 6FTS – Good Show

On 9th June 2023, Flight Lieutenant Smith was flying a Combined Cadet Force RAF Air Cadet on their first Air Experience Flight to the North of Glasgow Airport in a Grob Tutor. Whilst levelling off at 3500ft and accelerating to cruise speed, Flight Lieutenant Smith noticed contamination appearing on the right-hand side of the forward windscreen, directly in his field of view. The contamination spread quickly until he had almost no forward visibility. Dismissing the possibility of ice due to the outside air temperature and the light brown colour of the contaminant, he correctly identified the fluid as engine oil. Aware of the gravity of the emergency, Flight Lieutenant Smith actioned the oil loss drill, declared a PAN and requested direct track to the overhead of Glasgow Airport through the Class D Airspace of the Control Zone, With extremely limited forward visibility, he used the Glasgow navigational beacon and side visibility to route towards the airfield whilst simultaneously climbing to 4000ft altitude and avoiding built-up areas as best he could.
On reaching the Glasgow Airport overhead, Flight Lieutenant Smith descended the aircraft to 1500ft downwind on a left-hand glide circuit to Runway 05 as this afforded him the best visibility, albeit still very poor. On rolling out on the final approach, he could only discern the runway as it was a dark shape flanked by green on either side. Using his tail-dragger experience from the Chipmunk aircraft on which he is current, Flight Lieutenant Smith used sideslip and his peripheral visibility out of the canopy sides to maintain the runway centreline and descend until he assessed he was in a position to flare the aircraft. He then idled the engine and, after a slightly prolonged flare, landed the aircraft smoothly. Flight Lieutenant Smith opened the canopy and taxied off the runway with his head outside of the cockpit to allow forward visibility, shutting the aircraft down once clear. Throughout the emergency, transit and landing, he kept the cadet informed of the situation and successfully reassured him as to his safety.

2023 L G Groves Awards Ceremony

Presented annually since 1946, the L G Groves Awards Ceremony was established in memory of Sergeant Louis Grimble Groves, RAFVR, 517 Sqn Coastal Command, who lost his life while flying on a meteorological sortie on 10 Sep 45. The 2023 awards were presented by Air Cdre Sam Sansome, the Inspector of Safety RAF, at the L G Groves Awards ceremony which took place at the Met Office Headquarters on 09 Sep 23.

Image – the crew lost on 10 Sep 1945.

Aiming to encourage the study of Air Safety and to stimulate research in the science of aviation meteorology, whilst also recognizing the work of personnel engaged in meteorological observer duties; the awards are open to personnel from all 3 services, the Met Office and civilian support staff.

The prizes and awards offered are a £1000 Air Safety Prize, which this year went to the Sqn Ldr Lance Levin from HQ 1 Group Air Safety for his outstanding contribution to fatigue management across the Air Mobility Force. Recognising a trend in Defence Air Safety Occurrence Reports, Sqn Ldr Levin established an evidence base to successfully support his business case for a new Fatigue Avoidance Scheduling Tool (FAST). FAST will improve awareness of fatigue and enable the Aviation Duty Holder chain to better identify and manage mission profile risk caused by fatigue. His professional approach and determination to improve fatigue management through innovation and resourcefulness alongside with his tenacity to pursue solutions through to delivery made him a worthy winner.

The £500 Ground Safety Award was won by the RAF Valley Fire Section for their consistent delivery of critical support and exceptional contribution to station safety. During a busy year, the section performed above and beyond both contract and reasonable expectation to assist with a number of lifesaving incidents. In doing so, their actions potentially saved three lives and spread good practice and morale across the station. The Ground Safety Award was collected by Mr John Bagwell, the Capita Group Manager.

Dr Jacob Cheung of the Met Office was awarded the £1000 Meteorology Prize for his fundamental role in leading the scientific and technical upgrades to the World Area Forecast Service (WAFS) to improve global aviation safety. Highlights of his contribution include the implementation of the automated turbulence forecast system (known as Graphical Turbulence Guidance), providing a more reliable prediction in terms aligned to those directly measured by aircraft.

Mr Mike Kendon was awarded the £500 Meteorological Observer Award. Mr Kendon has led every one of the very successful and widely-used State of the UK Climate reports since their inception in 2015. This year, Mr Kendon included a summary of future projections of the UK's climate, to enable readers to understand how future projections to 2100 compare against observations back to the 19th century. The report emphasises the need for both adaptation to and mitigation of human induced climate change.

Nominations for the 2024 awards are now under way and Unit Flight Safety representatives are encouraged to identify suitable candidates as per the guidelines laid out in AP 8000 and 2023DIN06-026.

2023 L G Groves Meteorology Prize and Meteorological Observer Award Winners.

Left to Right: Mr Mike Kendon, Mr Anthony Groves, Mrs Penny Endersby (Met Office CEO), Mr Stephen Belcher, Dr Jacob Cheung.

2023 L G Groves Air and Ground Safety Winners

Left to Right: Mr John Bagwell, Mr Anthony Groves, Air Cdre Sansome, Sqn Ldr Lance Levin.

Safety Centre Trophy 2023

By the RAF Safety Centre

The RAF Safety Centre Safety Trophy is a singular annual award, made by the Safety Centre, which is awarded to: "The RAF Station, team or individual that has demonstrated an outstanding or enduring achievement, or cumulative set of achievements, that has significantly enhanced safety on the unit and/or across the wider RAF."

In 2023, 12 submissions were received and the overall winner was the FPCAT Inspection Team at RAF Honington.

Left-Right: Wg Cdr Tony Field – SO1 FPCAT, Sqn Ldr Lee Wood – SO2 Safety and Inspection, Air Cdre Sam Sansome Inspector of Safety (RAF), Flt Lt Justin Christoforou-Hazelwood – SO3 Safety Inspections, WO Paul Groombridge – WO Safety Inspections. Absent: Sgt Gerard Brew-Butler – Sgt Safety Inspections.

The RAF FPCAT Inspection Team has been employed to provide Land Environment Safety inspection activity across the RAF since their inception in 2017. The Team is dedicated to providing FP Safety Assurance through effective Inspection and Continuous Improvement to ensure delivery of Operational Land Environment Capability in a safe, efficient, and effective manner. This assurance is completed via a mixture of Notice and No-Notice Inspections across Force Protection Training Flights, the Combat and Resilience Force, the Aviation Security Force and the Military Provost Guard Service (MPGS) organisations, on behalf of the dedicated TRA and TDAs. In addition, the Team complete compliance inspections of the SST and SSW, as documented in Defence and sS publications, on all Land Environment activity.

Runners up were RAF Shawbury's Ops Team and RAF Henlow's Fire Safety Team, although the panel were impressed with all of the submissions received. So much so that the Secretary of the L G Groves Memorial award asked to consider the non-winners for that competition.

Stn Cdrs & HoEs are encouraged to send in submissions for the 2024 Competition to:
Air-SafetyCtre-WgCdrSpry@mod.gov.uk
no later than 1 Sep 24. Submission forms are available on the SC Comms Page at:
https://modgovuk.sharepoint.com/teams/23116

Civil Insights From the UK Flight Safety Committee

Why Standards and Supervision Matter

By Air Cdre Dai Whittingham (Retd), Chief Executive

This year started with 2 accidents, closely separated by time but on opposite sides of the world when viewed from the UK. The media interest was intense and sensationalist, and it would be understandable if the average consumer believed commercial aviation was inherently unsafe. You can perhaps forgive editors concentrating on the very dramatic footage of a blazing A350, the flames enhanced by the night sky, but not for some of the accompanying hype.

Then came the Alaska B737 MAX door loss and rapid decompression. Again, it's not a surprise the event was newsworthy – there can be few of us who have not seen some Hollywood spectacular where the bad guy leaves via a small window, courtesy of a gunshot or an explosion that leads to a decompression that goes on for a full minute. The event was made more newsworthy by the earlier MAX accidents and the idea that Boeing might in some way be at fault again; sadly, it seems from the recently issued NTSB interim report that this may indeed be the case.

So, is the industry unsafe? Approximately 35 million commercial flights operated during 2023 and there was only a single fatal accident, an ATR-72 crash at a new airport in Nepal that killed 72 people after the training captain feathered both engines during a circling approach. You can do the maths for yourself – you are at more risk crossing the road at the airport. In the same time frame, there were also a couple of ramp fatalities from engine ingestion and several from collisions with vehicles; the ramp can be a dangerous place, especially if you are inexperienced. True, there have been some injuries, mainly from turbulence encounters but also from emergency evacuations following runway excursions or other events – any captain making an evacuation decision does so in the knowledge that minor injuries (bruises, friction burns) and sometimes major ones (broken bones) are inevitable. Turbulence injuries are largely avoidable, the vast majority being prevented by the simple expedient of having your seatbelt fastened when you are in your seat. Refusing to wear one is Darwin territory: there was a very serious turbulence accident in India in 2022, with several passengers sustaining major injuries. Of the injured, one sustained catastrophic spinal injuries and another a similarly devastating head injury; one subsequently died, although as their death was outside the 30-day ICAO definition, it does not appear in the statistics.

Standards and supervision run through all the events mentioned so far. The Hanada runway collision investigation has already determined that the presence of the Coastguard Dash-8 on the runway was not detected by the ATCO or the A350 crew, but it also highlighted the fact that the radio phraseology, albeit the norm at Hanada, was non-standard and open to confusion. Changes have already been made.

Also on the phraseology theme, the Alaska decompression crew responded to that event with "we are declaring an emergency", which is the norm in the USA. The ICAO Recommended Standard and Practice is to call MAYDAY or PAN. The USA does not do that, though making such a call will get you the relevant system response. All ICAO signatory nations can file a 'Difference' from the ICAO standards (the UK does so, for example our Rules of the Air differ) but the problem comes when home-based procedures conflict with national procedures when you are away from home.

Image by: Mark Bess, CC BY-SA 2.0 <https://creativecommons.org/licenses/by-sa/2.0>, via Wikimedia Commons.

If we throw startle and surprise into the mix, you can see that a US-trained pilot whose aircraft has just had a rapid decompression over London, Paris or Frankfurt might well 'declare an emergency' because they are reverting to their training. That 'emergency' call will prompt addition traffic while the controller works out what level of priority and protection should be afforded to the aircraft in question. In the Alaska event, several questions were required before the ground environment understood what was required and how they could help.

As a further example, the transcript of a close-call event in New York (JFK) showed non-standard phraseology was rife. The transcript is not as illuminating as the recording available online because you can read text at your own speed. Radio traffic at JFK is delivered at enormous pace and is riddled with slang and informal abbreviations. It causes problems for native English speakers, but it is part of the JFK culture because the supervision has never considered enforcement of ICAO standards. "It's how we do it here…". Anyone who has ever operated out of Nellis AFB or any other high-density US installation will recognise the issue with pace, acknowledging that military controllers necessarily work in a different environment.

It's not only the USA: colleagues in an operational safety meeting in London were shocked to learn from a Spanish pilot that his airline required crews to conduct a threat and error management brief covering the difficulties caused by language in the London TMA. Yes, British controllers and aircrew using non-standard phraseology and slang, delivered at a pace that make it hard for non-native English speakers to cope with. Who would have thought it? Work is in hand via ICAO to address RTF delivery, but it

will be a long road to any meaningful change. For now, we can but try to ensure the ATC and flying communities appreciate that the difference in this area between 'work as imagined' and 'work as done' can cause real difficulties, but it is adherence to standards that is at the root of the problem.

Flight data monitoring (FDM) is working its way steadily into the military aviation system but has been a requirement in heavy commercial aviation for some years. FDM provided, for the first time, a means by which pilot performance and, especially, adherence to SOPs could be viewed directly. It has provided management – or the chain of command – with the ability to supervise and to detect procedural drift. But there is no FDM in the hangar, on the ramp, or in manufacturing facilities. Instead, consistent adherence to standards and processes relies on compliance monitoring and physical checks.

Checking and supervising is not a skill you simply absorb, and the RAF system is blessed by the breadth of training people receive as they move up through the rank structure. If you need to supervise, you are trained in how to approach the job. By contrast, training in supervision or management in the civil sector is notable for its almost complete absence. An informal straw poll at a ground handling safety meeting last year was very revealing: of the 60+ people in the room, all had been promoted to a managerial or supervisory role. When I asked them to raise their hands if they had received any training for the role, there was just one hand to be seen, which belonged to an RAF Warrant Officer. You could expect to see a similar result in most maintenance organisations.

This is not to say the people in civilian supervisory roles are not up to the job, just that we should not be surprised if the system occasionally fails, as seems to have happened in the complex 737 MAX manufacturing process. Even if you have properly trained supervisors, backed up with a solid QA process, there will always be leakage.

A very long time ago I was programmed to conduct a post-minor air-test on a Phantom. I was a first-tourist with about 600 hrs on type and hadn't flown a full air-test before. After the usual preamble I climbed into the front seat but was unsettled to the point where I thought I must have missed something, so I repeated the walk-round. Nothing seen, but I was still convinced all was not well. Back in the cockpit, I connected the PEC and leg restraint lanyards before realising that the QRF looked unusual (the source of my doubts). That was not a surprise, because it had been fitted upside down on the negative-G strap and it was physically impossible to strap in. End of air-test. That faulty harness assembly had made its way through the Martin-Baker manufacturing QA system, through the supply system, had been fitted to the seat by a highly trained armourer and been subject to further independent and vital supervisory checks before the aircraft was released for flight. It should not have been possible, but it happened. It was a good reminder that 'oversight' can have two meanings.

Rules, instructions, technical orders, and standards can be a pain, but they have normally been written in blood and we ignore them at our peril. Holding people to account for compliance can also be a painful process but, if you allow professional standards to slip, the risk will start to creep up and you eventually begin to do the enemy's job for him.

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Unintended Discharge of a Weapon System

By Sqn Ldr Lee Wood, SO2 Safety, Force Protection Safety Team

Weapon Safety – Unintended Discharge (UD) - Don't be afraid to put your hand up and ask for assistance!

The operation of a weapon system is one of the top Risk to Life activities that are conducted within the RAF and everybody in the RAF has a responsibility to ensure they are not a danger to themselves or others whilst conducting live firing activities or duties that require the carriage of a loaded weapon system. The UD of a weapon system can have devastating consequences, with each occurrence harbouring the potential to cause significant injury or death.

What is an Unintended Discharge?
A UD of a weapon system is defined in Pamphlet No. 21, The Training Regulations for Armoured Fighting Vehicles, Infantry Weapon Systems and Pyrotechnics, as:

'A weapon or pyrotechnic discharge, considered by the Conducting Officer or chain of command, to contravene the approved drills or procedures and contrary to the provisions in King's Regulations.'

This was formerly known as a Negligent Discharge (ND), which incorrectly apportioned immediate blame on the person operating the weapon system, prior to any formal investigation being conducted. UDs can occur for a variety of reasons, including, but not limited to:

Weapon malfunction – As with any mechanical object faults can and do occur.

Error in drill – When the endorsed drill, as per regulation and policy, is incorrect; however, these occasions are extremely rare.

Error of drill – When the weapon system or ammunition has not been operated in accordance with the user pamphlet. This is the most common cause for a UD.

Lack of awareness - A substantial portion of UDs occur where the Service Person (SP) handling the weapon system loses track of their progress during weapon drills or live

firing practices. This can lead directly to an error of drill and ultimately a UD.

Complacency – Handling weapon systems on a regular basis does not necessarily mean that a UD will be prevented. Prolonged use can increase the opportunity for a UD to occur, if an SP becomes complacent during the operation of the weapon system.

Inadequate or lack of Supervision – Whether on guard duty, conducting range activity or on operations, all weapon drills must be supervised correctly and conducted in a recognised location. The ratio of Safety Supervisors to SP conducting authorised weapon system drills must be sufficient to the task being conducted, thus ensuring safety is maintained.

Physiological factors – Things such as fatigue and body temperature can negatively influence cognitive function and fine motor skills, both having the ability to lead a UD.

Recklessness – Whilst there is no intent to do harm to others, recklessness implies that an individual has knowingly ignored the potential consequences of their actions. This is definitely an area where sanctions may be applied.

Examples of the circumstances that have led to UDs include:
In 2013 a soldier on operations was conducting unsupervised weapon drills inside a sanger. Whilst applying the safety catch on a Light Machine Gun, they inadvertently depressed the trigger, firing a burst of rounds. This is an example of complacency, whereby personnel carrying out routine tasks that they have conducted many times before without incident, result in a UD.

In 2014 during an exercise, an SP wasn't entirely sure of the state of their weapon system, so decided to pull the working parts to the rear to check. Observing no round in the chamber, they released the working parts forward and operated the trigger, resulting in a round being fired. A lack of awareness had prevented them from realising that a full magazine was still fitted to their weapon, therefore releasing the working parts, 'chambered' a round, resulting in a UD when the trigger was depressed.

In 2021 during routine firing activity on a 25m barrack range, whilst observing firers unload, a Safety Supervisor noticed that one of the firers had not removed the magazine from their weapon system, however they failed to intervene, the result of which was a UD. This demonstrated not only a lack of awareness from the firer, but also a lack of appropriate supervision from the Safety Staff.

These events highlight some of the reasons that UDs occur, it also demonstrates that they can occur in all settings, from exercises, static ranges and even on operations.

What to do in the event of a UD occurrence
All personnel should remain calm and remember that weapon safety is paramount. All firers should be instructed to stop what they are doing and listen for further instructions. The Range Conducting Officer will take charge of the situation and follow the instructions contained within Pamphlet No 21, Chapter 2 Planning, Section 3, Accident Procedures, and the guidance contained within AP 8000 Safety and Environmental

Total RAF Unintended Discharges reported between 1 Jan 20 – 29 Jan 24 = 70

(All 70 reports were analysed by the RAF Small Arms School Corp (SASC) SO3, who determined the suspected cause (in the absence of a LI) and phase/drill in which the UD occurred. In addition, please note that one report may have generated multiple suspected causes).

Suspected Cause of UD	Phase/Drill in which the UD occurred	Total
Error of Drill	Unload	21
	Ready Drill (Change Lever)	2
	Stoppage Drill (obstruction)	6
	Function Test	2
	Make Safe	5
	Magazine Change	3
	Make Ready	2
Error in Drill	N/A	0
Lack of Awareness	N/A	20
Complacency	N/A	16
Inadequate or lack of Supervision identified	Unload	14
	Stoppage Drill	3
	Function Test	1
	Making Safe	2
	Magazine Change	1
	Ready	1
Weapon Malfunction	N/A	1
Insufficient detail within Functional Safety Occurrence Report (FSOR)	N/A	32
Recklessness	Firer	6
	Conducting Staff	1

Protection Policy, Leaflet 8552 Unintended Discharge Investigation and Reporting procedure.

Mandated UD reporting
To ensure that all UD occurrences are captured and exploited correctly to highlight any potential trends, it is mandatory for Units to report incidents to the Munitions Incident Database (MID) Cell and the local Ammunition Technical Officer (ATO), via the Range Conducting Officer (RCO) / Supervising Staff. RAF reporting procedures also mandate that UD occurrences are reported via a Functional Safety Occurrence Report (FSOR) on the Functional Safety Information Management System (FSIMS). Station Health and Safety Advisors (SHSA) will be able to assist units with the correct completion of an FSOR.

Mandated UD Local Investigation (LI)
Following a UD occurrence, it is mandatory that a Local Investigation is conducted in order to provide a qualified and objective assessment to determine cause/s and identify any resultant recommendations, thus supporting the development of a Just Culture.

RAF UD Occurrence trending
This table reveals a few key issues surrounding UD occurrences within the RAF, as follows:

- Evidence suggests that mandated occurrence reporting and LIs are not being conducted as directed in policy. Far too many of the reports lacked detail or the findings from an investigation, therefore preventing in-depth analysis of the causal factors of the incident. It is vital that occurrence reporting, and investigations are completed in a timely manner and to the required level in order to promote learning and prevent similar occurrences. The CoC have a responsibility to ensure that all occurrence reporting is completed correctly.

- Lack of awareness was considered a suspected cause in almost a third of all UD occurrence reports, which may be due to the limited exposure that some SP have to weapons during the conduct of their Service careers, and possibly exacerbated by the discovery of a Phase 1 training gap. The Inspector of Land Safety (RAF) Annual

Assurance Report 2022-23 highlighted that under Operational Shooting Policy (OSP) 19, RAF personnel completing Ph1 training had not passed initial weapon training to the Tri-Service standards (Basic Close Combat), until they have completed IRT Module 4 (high threat training). In addition, a recent review of shoots undertaken during Station Security Force (SSF) training had demonstrated that only five of the sixteen mandatory shoots were undertaken. These factors may have further compounded the perceived lack of 'hands-on' access and overall confidence that an individual has in conducting weapon handling and utilisation, a potential link to a UD occurrence in the first instance.

- Although the list of the suspected causes of a UD is considerable, this table demonstrates that the majority of UD incidents occurred during the unload drill. This factor should arm those delegated with the responsibility to supervise weapon drills, the knowledge to pay particular focus on this element of weapon handling and / or provide additional mitigations during this drill.

- This table demonstrates that inadequate, or lack of supervision may have been accountable for over a third of the UD occurrences experienced by the RAF in the timeframe annotated. Supervision of live firing activity and the carriage of weapon systems is mandated within CAS Arming and Guarding directive, therefore any reduction in the standard of supervision provided to individuals, (who may already have a lack of confidence in the operation of the weapon system), may directly lead to a UD incident.

What simple actions can YOU conduct, to prevent a UD?
Treat **ALL** weapon systems as if they were loaded, until such times as proven otherwise by means of conducting Normal Safety Precautions (NSP).

ONLY conduct weapon drills when authorised to do so and only when correctly supervised.

ENSURE that you understand weapon functions tests and what they are designed to do.

ALWAYS utilise a recognised loading and unloading facility and remember to conduct a thorough check of the chamber **AFTER** removing magazines.

ALWAYS point your weapon system in a safe direction and keep your finger off the trigger unless ordered to fire.

Always Remember
If you are ever unsure what to do whilst operating a weapon system, **don't be afraid to put your hand up and ask for assistance!**

Advice on UDs, Weapon Systems, Pyrotechnics, Live Fire Marksmanship Training (LFMT) or Live Fire Tactical Training (LFTT) can be sought from the RAF SASC SO3 (Air-SafetyCtre-SO3 SASC).

Near Troops? Think Drone!

By Sqn Ldr Rebecca Rowlands, SO2 Flight Safety (RW)

The employment of Uncrewed Aircraft Systems (UAS) by the Army used to be reserved as a specialist role, and for larger platforms, such as Watchkeeper and AV Puma, it still is. However, the Field Army will soon be widely distributing, down to section level, UAS below 25kg (small UAS, sUAS). That means there are going to be many drones of different sizes and capabilities operated by the Army, from sections and platoons up to battlegroups and divisions.

What does this mean for you?
The issue arises when there is interaction between troops and aviation, for example a Support Helicopter (SH) pick up, a Fast Jet show of force (FJ SoF), or even a Tactical Air Transport (TAC AT) drop of some description. All of these activities take place in the same height band (0-400ft agl) as any supporting drone or drones. Without full situational awareness of both the ground troops and the aircrew activity, a mid-air collision (MAC) could occur. This could mean a potentially catastrophic outcome for the aircrew or, at the very least, a loss in capability for the ground troops.

Traditional barriers to MAC include (to name just a few) Air Traffic Service (ATS), Electronic Conspicuity (EC) and Warning Systems and See-and-Avoid principles. The sUAS are not required to be in receipt of an ATS, are not mandated to be equipped with EC, will be very difficult to spot from the air and hence avoidance of MAC falls primarily to the sUAS operator. If an sUAS operator hears and/or sees an aircraft approaching, SOPs dictate that the sUAS is landed.

The RA1600 series Remotely Piloted Air Systems and RA 2320 Role Specific Remotely Piloted Air Systems (RPAS) direct that RPAS (incl. sUAS) are operated in a manner that keeps the Risk to Life ALARP (As Low As Reasonably Practicable) and tolerable. In order to comply with the Regulatory Articles, sUAS are to be operated by appropriately qualified personnel and authorised by a Responsible Officer. Some flights will be in segregated airspace which is a useful, albeit not 100% effective, mitigation against MAC. A range of measures are to be implemented to reduce the likelihood of loss of safe separation of an sUAS with other air users.

Whilst regulations and SOPs are in place to minimise risk of fratricide, proactive engagement between the crewed and uncrewed aviation communities is always mutually beneficial to understanding TTPs (Tactics, Techniques and Procedures), constraints and limitations of the other's operations. Ultimately it will assist in reducing any risk of MAC.

For the aircrew reading this, next time you are working with troops on the ground, or involved in planning deliberate ops, it is vital to consider sUAS use by the troops; ask the Ground Force Commander about their TTPs. Negotiate a deconfliction plan that all elements involved (ground and air) are aware of and happy with.

For UAS operators: when planning and working with crewed platforms, be forthcoming with how you employ sUAS as part of your TTPs. Ensure that some deconfliction plan is agreed. Be aware that, even with prior awareness, your sUAS will be difficult, if not impossible, for the aircrew to spot. Without a prearranged deconfliction plan it has to be assumed the aircrew will not see your drone to avoid it. It is incumbent on you to land your drone or keep it out of the way to remove the MAC risk.

Near troops? Think drone!

Doc's Corner:
When it Doesn't Quite Fit –
Helmet specialist measurements

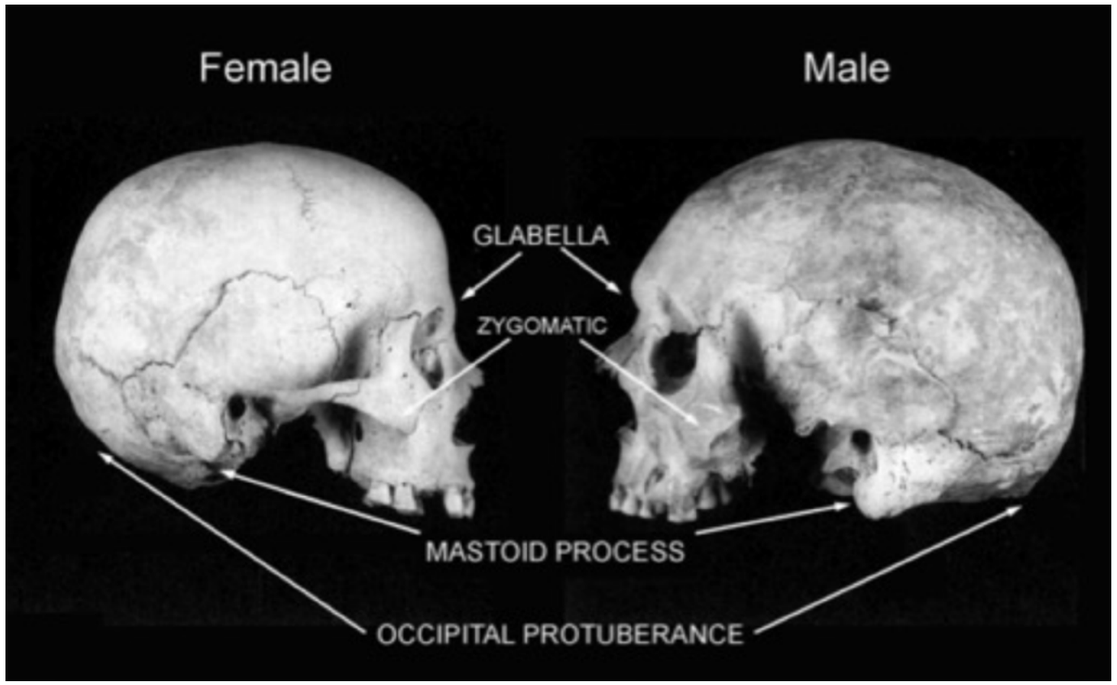
By Wg Cdr Phil Lucas, SO1 AvMed, RAFCAM and Sgt Paul McCree RAFCAM AMW AEIG

For aircrew who wear the traditional 'bone dome' or Mk 4/Mk 10 series helmet, you will be very familiar with the measurement and fitting process that comes with the issuing of the helmet. After the initial sizing, regular checks are required to ensure the fit is still effective. I'm sure at some point, all users have felt that perhaps the head is meant to deform to fit in the helmet, rather than the other way around!

What we ideally like from a helmet is a piece of equipment that is as light as possible, while retaining its protective properties. It is just as important that the helmet is as comfortable as possible. An uncomfortable and poorly sized helmet can not only compromise safety, but will cause discomfort which fatigues and distracts the aircrew.

While adequate safety protection and comfort can be achieved with fitting, it doesn't mean that everyone will be 'comfortable' in Mk4 and Mk10 series helmets. Not everyone has a standard NATO-approved head shape, and there will always be outliers who struggle to get a decent fit. In some situations, safety is obtained at the cost of comfort but we strive for both safety and comfort which can be a tricky balance to achieve. This is where the SE Techs at the Centre of Aviation Medicine can help. They can customise the fit for those aircrew who struggle with the bone dome.

Aircrew tend to suffer in silence and CAM knows of cases where people have gone for years with uncomfortable fits thinking it there was no alternative or have just accepted discomfort was a part of flying. That is not the case. SES can support the fitting process by adding custom modifications. SES at CAM see 10-15 aircrew a year who require some



solution. We believe that there are more aircrew out there who could benefit from this process.

What to do
If you are struggling with your helmet fit, go and see your local SES team in the first instance. If they cannot rectify the issue then ask them for a referral to CAM, this can be done in two ways:

1. Through SES or

2. Through the Med Centre when you have your annual check with the Medical Officer (MO). If you decide to get referral via med centre, please make your SE section know as well as CAM SES. SES don't have access to medical records, so would need to be briefed to understand the problem.

Once the SE Section at CAM receive your referral, a visit to CAM will be arranged where they start discuss you and your helmet issues. The SE Tech will confirm the size and type of helmet you are using, and then help find you a solution. The appointment at RAF CAM could potentially take all day, depending on the issue you have, but in most cases, it should only take a few hours.

The solution is in the manufacturing and placement of custom-made foam pads into the helmet cradle to reduce gaps or pressure points. Once a solution is found, an MO confirms the modification and it is "signed off" with a report kept on file so SES know how to adjust your helmet in the future. If you ever need replacement pads in the future your SE Team will contact SES at CAM for a new set, as per your helmet record.

Potential helmet issues
There are a few common issues related to your skull shape and size, which can lead to poor fit or discomfort:

- Small heads. A small skull, either globally or in a specific parameter can be adjusted for with extra padding to improve grip. Female skulls tend to be generally smaller than male skulls with female foreheads more vertical than the male sloping forehead. Additionally there is a less prominent bony occiput or 'bump' at the back of the skull which can help prevent the helmet rolling forward. Both the size and shape differences can make fitting a helmet for a female more challenging

- Large heads. Padding can be trimmed, or there is a special XL size helmet only issued from CAM SES which may be a more comfortable fit.

- Lumps and bumps. If you have an uneven head shape, especially on the crown or forehead where the shape impacts the helmet liner, it can generate hot-spots and discomfort. SES can modify the helmet padding to reduce the pressure over certain parts of the head.

- Lots of hair. For those blessed with luxuriant hair, hair acts as a lubricant between head and helmet. The best solution with long hair is to wear the hair tied in a low ponytail to avoid any possibility of snagging and reduces the hair bulk at the back of the skull. The biggest issue is that long hair can prevent helmet gripping the nape of the neck, this is particularly problematic when wearing NVGs, as a helmet with poor grip will pitch forward with additional weight of the goggles.

A few case studies.
A trainee WSOp writes:
"As a baby Aviator undergoing phase three flying training, I was still getting used to my Survival Equipment. I was aware that my helmet had a slight tendency to rotate backwards and forwards. This was within limits, and I was content to continue, but it was during a Secondary Roles Winchman sortie that one of the helmet ties came lose, causing my helmet to slip forward over my eyes, at the bottom of the wire. Whilst this was due to a tie coming loose, it re-highlighted my previous slip issue and it was one neither the local SEs, or myself, were willing to accept.

I was pointed in the direction of SEMB, RAF CAM. Given I was at a crucial stage of flying training, continuity was key, and SEMB were able to expedite my appointment, fitting, creation and subsequent delivery of the solution. On arrival at SEMB, we tried a couple of Mk4 variants and we were not content with the fit, so then we moved onto the 10RW. Working with various pad sizes and types, we were able to achieve a satisfactory fit. At this stage, I was content to accept the helmet but the SEMB team, knowing this is a fully customisable helmet, really wanted to ensure it was the perfect fit. I was suffering a minor hotspot at the point where the spine meets the skull, and we came up with a solution to still support the helmet, but without putting undue pressure on the head.

I then sat wearing the helmet for the required period of time, where I was checked on regularly and supplied with many wets along the way. After this time period, I received a check from the RAF CAM Doc, who was briefed on what the SEMB team had done and confirmed he was content with my fit. Having received the medical sign off, the day at RAF CAM was complete.

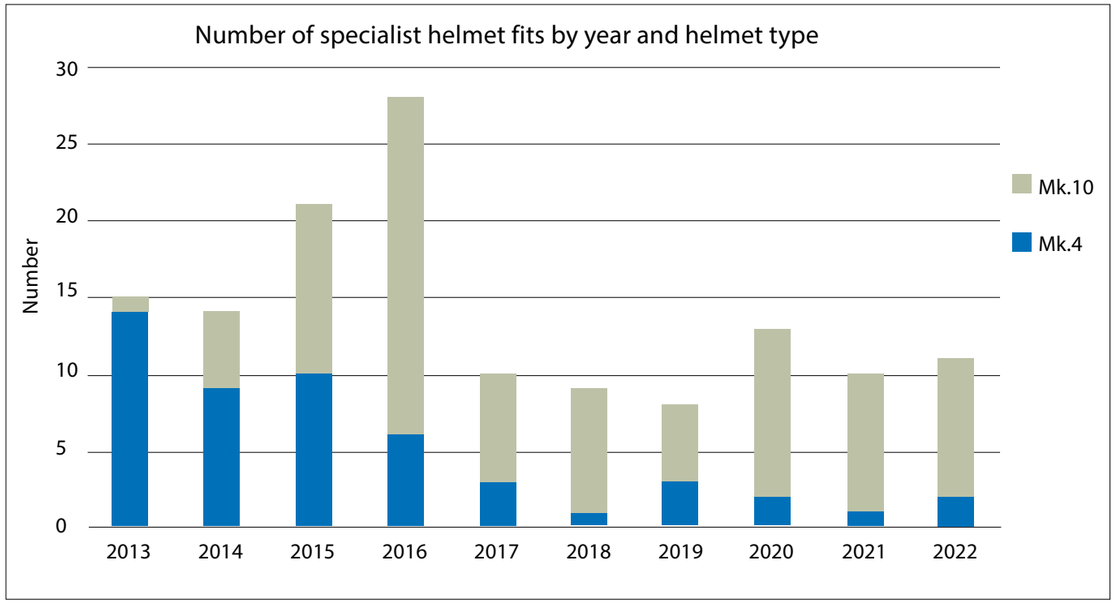
Just a few weeks later, my local SE section received my new helmet and pads and I was able to continue flying. I was, and still am, very happy with my fit, having tried it in various sortie configurations.

A QHI writes:
I suffered for years with a helmet which just didn't fit right. I would have a pressure/pain across the front of my head, and always felt like I had to be pushing the helmet from the rear to release the pressure. I got referred to RAFCAM for a Spec Measure and I haven't looked back since. I spent all day at RAFCAM with the SE Tech's Initially listening to all of my issues, how my legacy helmet fitted and I then got remeasured. I fall exactly on the line between 2 sizes, so the helmet felt either too tight, or absolutely massive.

We spent a few hours looking at varying degree of modifications to the internal fittings of my helmet, until we found the perfect fit. No detail was ignored, and even the smallest tweak made a difference. I can't fault the SE Tech's for their professionalism and determination, not accepting less than perfect of the end product they wish you to leave with.

A QFI writes:
During my initial helmet fitting at RAFC Cranwell it was decided that the standard medium sized helmet was too large and required an Above Neck Spec Measure referral to RAFCAM. With a compressed course timeline, RAFCAM were proactive going out of their way to accommodate me at very short notice. I was hosted by a SQEP SE Technician and made to feel as if it were a routine appointment.

Over the course of one afternoon by trialling various combinations of material, marks of helmet, padding sizes and at each stage seeking my input on the comfort of each trial helmet, we succeeded in finding a suitable helmet fit. Having now worn the helmet for over a year, it has never caused me any issues or discomfort and passed all routine Helmet 'check fits'. A credit to the expeditious and attentive RAFCAM team.



Out of Sight Out of Mind

Lessons learned from a Mobile Air Operations Team

(Originally Published in JHC Digest Nov 23)

In April 2023 a Mobile Air Operations Team (MAOT) from Joint Helicopter Support Squadron (JHSS) journeyed 'across the pond' to support Ex NOCTEM WARRIOR 23. Based out of Naval Air Facility El Centro, Southern California, the exercise pits Chinook crews in the heart of the Sonoran Desert to attain environmental operating currency. Training involves a multitude of sorties focussing on Low Ambient Light Ops (LALO), dust landings and pairs flying in searing 40 ^{0}C heat. Throughout NW23 the MAOT provided Helicopter Landing Site (HLS) assurance and designation services alongside underslung load (USL) capability, enabling the movement of training cargo from location to location. It is on the USL capability that this article will focus, specifically, the improper management and use of Helicopter Underslung Load Equipment (HUSLE).

Two teams deployed on NW23, MAOT 1 deployed from Apr-Jun before handing over to MAOT 2 for Jun-Aug. This offered invaluable training opportunity in a new environment that many had not previously operated in; accruing experience in operating for extended periods on the ground in remote locations. It was during MAOT 1's time that a serious HUSLE mismanagement DASOR (asor/Benson-RAF\BEN-JHSS\No Aircraft\23\6586) was raised by the incoming team. Needless to say it marked a profound bout of embarrassment both for the unit and the team, featuring several issues that necessitated swift remedial action.

So what happened? In the year prior, out of date [Annual Inspection] HUSLE was dispatched to NW22, necessitating the despatch of a Helicopter Load Slinging Equipment Inspector (HLSEI) for servicing before start-of-play. Frustratingly, incident recurred on NW23, despite acknowledging these prior lessons to this deployment. On review it quickly became apparent that insufficient workforce resource was available to despatch the HUSLE. Had a qualified Helicopter Load Slinging Equipment Inspector (HLSEI) been on MAOT 1, this issue could have been remedied at the outset of the det. Compounding the issue, MAOT 1 failed to recognise the CH Sqns they were supporting had HLSEI's within their ranks that could have provided the required checks prior to StartEx.

This inefficiency was exacerbated by the failure to interpret guidance from JHSS on the correct servicing procedures of HUSLE in-Th. The use of WhatsApp contributed to this mis-interpretation. This ultimately resulted in the use of non-airworthy HUSLE, jeopardising the safety of aircrew and MAOT 1 personnel using the equipment, military personnel operating out of NAFEC and the general public.

To round off these glaring errors, the cherry on top was that before and after use inspections (BUI/AUI's) were not recorded on any of the HUSLE paperwork. This is considered a 'bread and butter' routine for JHSS personnel and is somewhat anomalous when considering other USL incidents. In accordance with regulations contained within the DAP 101A-1105-1A usage checks should be carried out prior and no later than 7 days following use. These inspections should then be recorded on respective HUSLE log cards. Inspections should include physical and thorough checks of the nets and all equipment that will and has been used. The log cards were held in a storage container that was not included in routine work patterns, staying 'out of sight, out of mind'.

Had the MAOT Leader performed routine managerial checks of the log cards, rectification of incomplete cards could have been undertaken within the 7-day timeframe. In the same vein, by holding the responsible Landing Point Commanders in charge of HUSLE to account, the log cards would have been centrally administrated and not overlooked or incorrectly stored. From both leadership and colleague perspectives, this lends credence to the adage 'rely, but verify', ensuring trust in professionalism isn't eroded whilst assuring quality in output.

Personal reflections from the team include the obvious requirement for maintaining professional standards and doing right by their team by maintaining awareness of individual roles and responsibilities. Back on the Sqn not enough support was given to the HUSLE store despite repeated calls for direction on the issue of out-of-date HUSLE requirements. During a period where there was a limited supply of nets available, the HUSLE store had assumed a HLSEI would deploy to cover off inspection requirements. Had MAOT 1 been on hand during this process they would have spotted the risk and ensured annual inspections were carried out, avoiding the issue from the outset.

Further consideration is now given to the leadership experience and abilities of those being considered for the Landing Point Commander (LPC) qualification. Command of, and responsibilities for HUSLE and USL ops should be accompanied by an individual's confidence and ability to raise issues appropriately. This ability is integral to ensuring the Team Leader and others are sufficiently informed of issues and problems. Other OSI recommendations already being implemented include a review of the LPC qualification requisites, MAOTL Order creation, HUSLE Storeman orders and the introduction of a HUSLE order form, designed to provide enough detail and notice to get the correct kit out of the door in order to sustain USL operations for as longer period as possible.

The incident, though embarrassing, had highlighted administrative adjustments required on the Sqn to bring about greater efficiencies, working practices, and to avoid potential future incidents that could have graver consequences. Many of these changes were quickly adopted and the incident has brought into focus the importance of careful team, equipment, and individual selection, including team management when operating alongside aviation. JHSS considers itself an integral part of JHC's delivery of RW aviation LIFT capability; continuous improvements such as those mentioned in this article will ensure that it continues to be so, albeit more efficient and safer.

Wg Cdr Spry's Comments:

An open and honest account highlighting themes that will be common to other teams and have the potential to catch out any one of us: poor communication; assumptions; inexperience; stretched workforce and busy op tempo, to name a few. It also highlights lessons learnt vs lessons identified; when a lesson is identified, do something about it and implement the solution, ensuring it is communicated to everyone. This example should serve as a reminder to us all, whether in leader or team positions: set and maintain standards, call out deviations within your team but support others to achieve a healthy air safety culture. ■

AirClues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DANGER-JET INTAKE
DANGER
JET
INTAKE DANGER
DANGER-FAN EXHAUST
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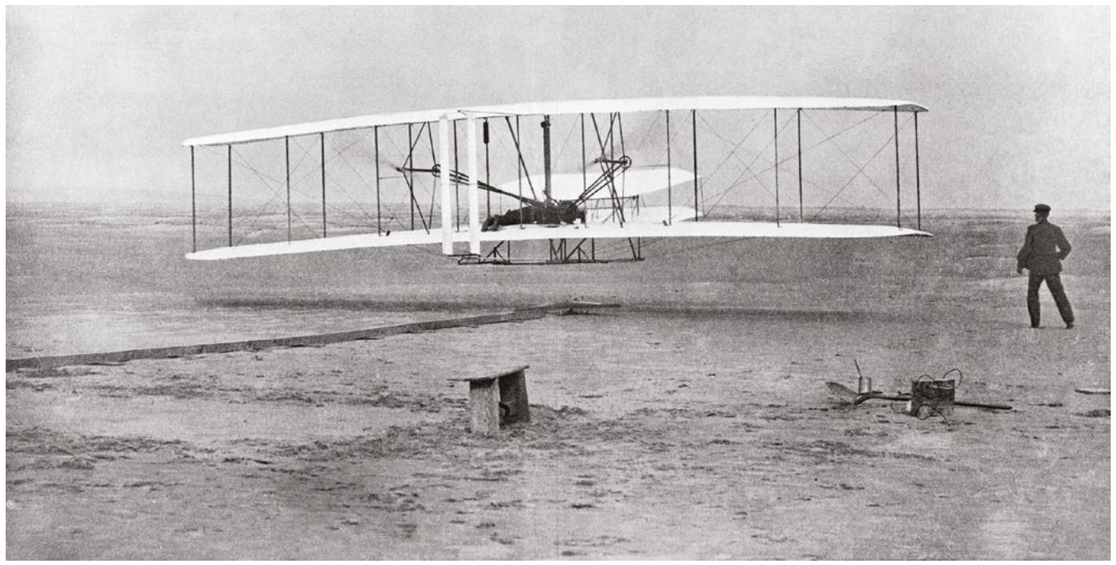
Aviation Safety –
A Journey Through History

By Pete Hibbert, Senior Consultant at Baines Simmons



Wright 1903. Image by Adobe stock.File #: 162271427.

Aviation's approach to safety has been evolving for over 100 years, but what led us to our current regulations and Safety Management Systems (SMS), where every organisation looks to proactively understand their risks, mitigate them, and report them up the chain to create a worldwide aviation risk picture?

Whilst the first national law specifically applicable to aviation was introduced one year after the first hot air balloon flight by the Montgolfier brothers, we need to look at the 20th century to plot our safety history route.

On a September morning in 1908 at Fort Meyer in Virginia, Orville Wright was demonstrating the Wright Flyer to the US Army. Lieutenant Thomas Selfridge was flying as a passenger with Orville when one of the two propellers fractured leading to a wire supporting the tailplane being severed. Orville was attempting to land when he lost control at a height of 75ft and the aircraft went vertically into the ground. Whilst Orville survived, sustaining a fractured thigh and several broken ribs, Selfridge wasn't so lucky, as he fractured his skull and perished a few hours later; he hadn't been wearing a helmet.

This accident occurred five years after the beginning of powered flight and directly led to one of the first written regulations that we know of. It was one year later that the Signal Corps purchased a Wright machine for $30,000 and mandated the use of helmets for its aviators.

After this, lessons continued to be learnt from accidents but it took the formation of the International Civil Aviation Organisation (ICAO) to start to consolidate a worldwide approach to aviation safety. Whilst many accidents shaped ICAO's thinking, there are some that moved the goalposts and introduced new eras in our safety journey. The first of these being the **technical era**, which is widely acknowledged to have been started by two high-profile losses of the world's first jet airliner, the de Havilland Comet.

British designed and built with unmatched speed and passenger comfort, due to a pressurised passenger cabin, it had airlines queuing up to buy it having set a number of commercial airliner firsts:

- Turbojet engines.
- Totally hydraulically actuated controls.
- Highly pressurised cabin (8.25 psi).
- High pressure refuelling.
- Glued skin panels.

On the morning of 10 January 1954, BOAC Flight 781, enroute from Rome to Heathrow, suffered from an explosive decompression at 27,000ft over the Mediterranean Sea off the coast of Italy; there were 35 people, including 10 children on board. Then, three months later, South African Airways Flight 201, another Comet, travelling from Rome to Cairo, suffered an explosive decompression south of Naples; there were 25 people on board.

Both aircraft had failed due to major design defects, in that the large square windows, designed to allow the passengers a view, failed, despite extensive testing in the design stage. The repeated pressurisation and subsequent depressurisation of the fuselage had caused cracks and fissures around the corners of some of the passenger windows, leading to fatigue failure and an almost instant failure of the airframe.

The aircraft was pushing technological barriers and it set many records and firsts. The tragic accidents were no different and they shaped the way air accident investigations are carried out by pioneering the first use of:

- Medical forensics in an aviation accident.
- Underwater cameras to locate aircraft wreckage.
- Using the aircraft remains to make a large-scale reconstruction.
- A water tank to encase and test a whole aircraft.

The lessons from these accidents led to a much greater awareness of fatigue life, mandatory full-scale fatigue tests and the introduction of the fail-safe design philosophy enabled by multiple load paths.

The need for a safe technical design didn't just pop into being in the 1950s, but it was during this time that aviation was making huge safety gains around technical regulations, and we are still making gains today.

In 2013, the United States Federal Aviation Administration (FAA) ordered the grounding of Boeing's new 787 Dreamliner as several aircraft had suffered from electrical system problems stemming from its Lithium-ion batteries.
The thermal runaway of this new type of high-energy battery was not well understood, and therefore poorly regulated, causing the introduction of new regulations to deal with these emerging threats, as well as many others, such as drones.

Going back to our safety journey, as our technical and design regulations continued to evolve during the 60s and 70s, accident rates had significantly declined. But when British European Airways (BEA) Flight 548, an airworthy Trident aircraft, crashed in a field next to a housing estate in Staines just south of Heathrow on 18 June 1972, and with the loss of 118 lives, it caused another shift in our safety thinking. The problems humans brought to aviation had been talked about when the Wright Brothers first flew; new laws had been proposed in the 1920s for dealing with human error in aviation; and in the 1940s, aircraft designs took account of ergonomics in cockpit design, but it took the Staines disaster to open the door on the **human era** of safety.

Less than two minutes after take-off, with the airspeed just over 160kts at 1,772ft, one of the crew selected the droop leading edge high lift devices in, even though the minimum droop retraction speed was 225kts. This action was committed 1,300ft too low, and 63kts too early. The Trident instantly entered a stall and although the stick shaker stall warning and the stick pusher activated, the crew turned off the stall recovery system; we will never know why.

What we do know is that there were no major mechanical malfunctions, and the Accident Investigation Branch concluded the disaster was caused by pilot error. Their report made a number of recommendations around pilot training changes, as well as how the Civil Aviation Authority (CAA) operated, and that the carrying of cockpit voice recorders should be a mandatory requirement on all British civil passenger-carrying aircraft.

Until the Lockerbie disaster, the loss of BEA Flight 548 was the UK's worst aviation accident. The next event that shaped our safety journey remains the world's worst aviation catastrophe. On the 27 March 1977, a KLM Airlines Boeing 747 commenced its take-off run in poor visibility whilst a Pan Am 747 was still on the runway; the subsequent collision resulted in 583 fatalities.

Gran Canaria Airport had been closed due to a terrorist attack and all incoming flights had been diverted to Los Rodeos, a smaller regional airport on Tenerife, that was not equipped to handle large airliners. This led to aircraft parking on the only taxiway resulting in aircraft having to backtrack the length of the only runway, before turning round to take off.

The KLM 747 was cleared to taxi down the runway and a short while later the Pan Am aircraft was cleared to follow

Flight BEA 548 Memorial. Image: Pete Hibbert, Reproduced by Kind Permission

but was told to exit at the third taxiway to make room for the KLM aircraft to take off. The visibility at the time was varying between 900 and 100m, and on board the Pan Am 747 there was some confusion in the cockpit as to which taxiway they were supposed to use to vacate the runway. This was not helped by the lack of ground radar, the air traffic controller's strong Spanish accent, use of non-standard Air Traffic Control (ATC) terminology, and the poor visibility and signage; all these factors meant that the crew didn't see taxiway 3 and continued down the runway.

The KLM aircraft had now turned around at the end of the runway and its captain, Jacob van Zanten advanced the throttles. Van Zanten was KLM's chief flight instructor, he often appeared in the airline's advertising campaigns and was widely regarded as the most respected pilot working for the airline, yet when he was challenged by the first officer about trying to take off without clearance his answer was, 'No, I know that, go ahead, ask', and he brought the aircraft to a halt. Even before the tower had finished reading the KLM aircraft's departure instructions (this was not take-off clearance), Captain van Zanten said 'We're Gaan' (we're going) and released the aircraft brakes. Whilst there were further transmissions from both the tower and the Pan Am aircraft, most of these were inaudible due to them being made simultaneously, thereby blocking each other out, until 25 seconds before the aircraft collided when the KLM crew heard the Pan Am aircraft transmit 'OK, we'll report when clear', causing the KLM flight engineer to say 'is he not clear', this was met with a forceful 'oh yes' from van Zanten.

The Pan Am crew saw the KLM aircraft emerge from the fog, applied full power and turned towards the grass in an attempt to avoid the impending collision, and upon seeing the Pan Am aircraft in front of them the KLM crew hauled the nose up causing a 72ft long tail strike, and whilst they did get airborne, they struck the Pan Am's fuselage.

A series of communication errors in both cockpits, lack of robust challenges to KLM's captain's decision to take off and radio messages getting blocked by simultaneous radio calls led to everyone on board the KLM 747 and 335 people of the 396 on board the Pan Am 747 perishing.

Immediately after the accident, KLM suggested that Captain van Zanten would be the ideal individual to help with the investigation, unaware that he was the captain who had been killed.

As a consequence of the accident, aviation authorities around the world introduced requirements for standard ATC phrases, a greater emphasis on English as a common working language and further training was introduced for crews to play down hierarchical relations with a greater emphasis being placed on decision-making by mutual agreement, communication and leadership. Today, this is known as Crew Resource Management training, and it covers all members of an aircraft crew.

Whilst early aviation human factors tended to focus on crews and individuals, it was recognised in the 1990s that humans in aviation operate in an incredibly complex and dynamic environment, therefore, the safety focus expanded again to take more account of the systems within which humans work. Again, this new organisational era of safety was driven by several accidents.

There can be fewer dramatic aviation photos than that of Boeing 737 N73711, Aloha Flight 243 sitting at Maui Airport with the roof of the cabin completely ripped open – the fact that only a single fatality occurred, a member of cabin crew named Clarabelle (CB) Lansing, the safe landing of the aircraft was a testament to the skill of the aircrew and professionalism of the cabin staff, one of whom dragged herself along the exposed floor, seat leg by seat leg, helping passengers.

Designed for short-hop flights, most of the Boeing 737 fleet averaged flights of between 1 to 2 hours; however, the short 20 minutes in hops between the Hawaiian Islands meant that the Aloha fleet was rapidly accumulating pressurisation cycle fatigue, combined with a humid and salty location, this made for a demanding operating environment and a thorough maintenance inspection programme was required.

The Aloha Airlines maintenance inspection corrosion programme had found many cracks in the aircraft, and it had identified 25 locations where fuselage skin repairs or rework had been performed; however, the condition in which these inspections were carried out was not ideal, with poor lighting and the inspectors even needing ropes attached to the rafters of the hangar to prevent falling when inspecting the fuselage, subsequently much of the damage was missed.

Corrosion was a big problem for these aircraft and during the emergency when the loss of the roof caused the aircraft to flex, it put extra stress on the heavily corroded engine control

Aloah Airlines 737. Image by FAA, Public domain, via Wikimedia Commons

cables and the number 1 engine failed, thankfully the number 2 engine cable held.

The following issues all contributed to the loss of CB Lancing and the terrifying 13-minute flight endured by all on board:

- Failure of the airline's maintenance programme to detect the presence of damage.
- Aloha Airlines approach to carrying out maintenance inspections, including time pressure imposed on maintenance staff, lack of training and carrying out multiple inspections during periods of circadian low.
- Aloha Airlines supervision of its maintenance activities.
- Boeing's approach to the known cabin lap joint bonding problem.
- The FAA failed to properly evaluate the airline's maintenance programme.
- The FAA's approach to issuing and the clarity of Airworthiness Directives.

Another incident that reinforced the lessons the industry was learning from Aloha Flight 243 was on 10 Jun 1990, when British Airways (BA) Flight 5390 was at 17,300ft over Didcot, Oxfordshire when a windscreen blew out.

Captain Tim Lancaster had removed his harness, and when the windscreen went, he was sucked outwards but fortunately, three things saved him. His legs caught between the control column and the flight deck; a steward quickly entered the cockpit and grabbed Capt. Lancaster's belt; and a second steward entered the cockpit, strapped themselves into the jump seat and held the first steward's belt to prevent him from exiting the aircraft along with the captain.

The first officer put the aircraft into a dive and it was only at 3,000ft on approach that the crew realised that Capt. Lancaster was alive as he had been exposed to the equivalent of 345 mph winds and -17°C temperatures. At one point, the stewards had even considered letting him go but quickly rejected this as the Capt. might have entered the Number 1 engine, and the steward holding Capt. Lancaster later stated if they had let him go they would never have been able to face the Captain's family.

After a frantic 22 minutes, the aircraft landed at Southampton with the only injuries being to Capt. Lancaster who had frostbite and several fractures and the steward holding him who also suffered frostbite and had a dislocated shoulder.

The event was caused by a BA engineer fitting the incorrect size bolts to the windscreen, poor engineering practices including lack of supervision, the design of the aircraft and limited CAA oversight. Amongst many other improvements, this incident led directly to the introduction of Abnormal and Emergency Situations (ABES), previously 'TRUCE' (Training for Unusual Circumstances and Emergencies), for air traffic controllers.

Both events and many others led us into the **organisational era of safety**, where we consider organisational culture and policies on the effectiveness of safety risk controls and routinely collect and analyse safety data using reactive and proactive methods to detect emerging safety trends. These enhancements provided the learning and foundation which led to the current SMS approach.

Finally, we enter the last leg of our journey (for now), the **total systems era**.

In the early noughties, many organisations had embraced proactive reporting and risk management, the problem was the majority of safety systems were inward looking with little understanding of how interactions between organisations could still create holes in the safety barriers, and the loss of RAF Nimrod XV230 in Afghanistan in 2006 was a catastrophic example of this.

Library Image of Generic Nimrod by Dale Coleman via Wikimedia Commons

The crash resulted in the loss of all 14 crew members on board, making it the single deadliest incident for British forces in Afghanistan at that time. A fuel leak caused by a design flaw in the aircraft's ageing fuel system led to a fire and subsequent explosion. The ensuing investigation also revealed a systemic failure in the RAF's safety culture, maintenance practices and organisational structures. It identified a lack of focus on safety, inadequate risk assessment and a 'can-do' attitude that prioritised operational demands over safety concerns.

A report by the Rt Hon Lord Justice Haddon-Cave KC, had a significant impact on the management of safety and airworthiness within the Ministry of Defence (MOD). It called for a cultural shift within the MOD to prioritise safety, enhance leadership and accountability, and improve communication and information-sharing practices. The accident in Afghanistan led to the formation of the Military Aviation Authority (MAA), the introduction of SMSs and increased scrutiny of military aviation safety across the UK.

I would also argue that even though the two 737 MAX accidents are largely seen as failings of a single organisation, given the sheer size of that organisation, it is also a total systems accident.

The loss of Lion Air Flight 610 in October 2018 and Ethiopian Airlines Flight 302 in March 2019 were primarily caused by a flaw in the Manoeuvring Characteristics Augmentation System (MCAS), a flight control software unique to the 737 MAX aircraft designed to automatically prevent the aircraft from stalling.

In both accidents, faulty sensor data triggered the MCAS, which repeatedly pushed the nose of the aircraft down, overpowering the pilots' attempts to regain control. The pilots struggled to counteract the automated system, as they were not adequately informed about the existence and operation of MCAS and how to override its commands.

The investigations into the accidents exposed flaws in the aircraft's design, pilot training and organisational culture as well raising critical concerns about regulatory oversight, as it was found that the FAA had delegated some safety assessments to Boeing itself, leading to potential conflicts of interest. The total costs of the accidents are unknown; however, many analysts estimate that the costs to Boeing have been more than $20bn.

As a result of the 737 MAX losses, the industry is working towards greater sharing and transparency of information between aircraft manufacturers, airlines and regulatory agencies.

So, what differentiates the total systems era from the organisation era that preceded it, after all, that is when proactive reporting and risk management were introduced.

Aviation and everything that it entails is now considered as a single system, with each entity, including military aviation, as a sub-system, including the regulators themselves.

Within the era of the total system, ICAO and the individual regulators are now looking for a holistic view of risk as the individual entities, and themselves, strive to understand how the systems interact, i.e., who is bringing a risk to whom. This involves actively managing the interfaces between organisations that you support, and those who support you, to understand and mitigate these risks. Remember, these different organisations aren't always looking to achieve the same goal; some may be profit-driven and others mission-orientated.

Whilst regulations will continue to emerge from accidents, with a joined-up holistic and proactive risk picture, many regulators, including the MAA, are now adopting an approach that the UK CAA calls 'Horizon Scanning'. This involves systematically identifying risks in the system and developing predictive regulations based on the risk picture. Simply put, the aim is to introduce new regulations to stop an accident before it happens.

Epilogue

Of course, things are far more blurred than a neat succession of eras, there has always been a complex mix of technical, human and organisational safety measures, and some individuals were ahead of their time with their thinking. Take Sir Sefton Branker, who talked about introducing regulations to deal with 'Error of Judgment' in his 1922 Royal Aeronautical Society paper entitled 'Various Sources of Danger', or the RAF Sqn Ldr, who having recognised the way the civil aircraft maintenance world was moving, introduced human factors training for engineers at RAF Leeming in 1998, five years before the European Union Aviation Safety Agency (EASA) did.

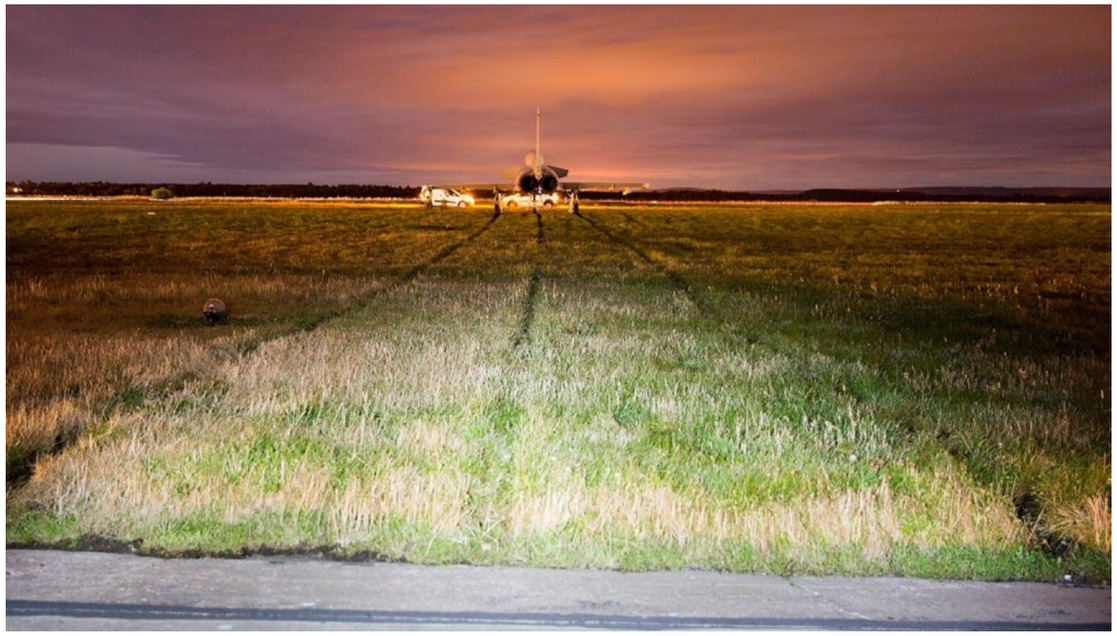
We will never leave any of these eras; we are always pushing the technology boundaries and we continue to understand more about human performance. All these things influence the designs of our platforms and systems to minimise potential harm wherever possible and we now strive to improve communication between our respective systems, the upshot being that air travel is one of the safest forms of transport with fatalities per billion miles being around 0.88, compared to 213 for motorcycles and 7.3 for cars (U.S. Bureau of Transportation Statistics data).

As we enter the mid part of the 2020s, not all organisations in aviation are on the same page, although most have started the total systems chapter in the same aviation safety book. The best organisations now see a safe system of working as a good thing that contributes to completing your goals, whether that's delivering passengers to make a profit or delivering troops into an LZ; being safe helps you achieve it, and some airlines now even think of safety as a profit centre. This is in stark contrast to the old view that safety is something that had to be done as the regulator mandated it and that it often stops you from achieving the mission.

No one knows what the next era of safety will be, maybe it will be the AI era where the safety system takes live data from our flyable platforms, ATC, the met forecast, our currency database, the next day's flying programme, shift/watch rosters, the safety reporting app, engineering database and even our logistics system, and gives a live risk picture to the duty holder/accountable manager. Whatever it is, the UK military hasn't yet finished the total systems chapter, but then again, only a handful of organisations worldwide are past halfway, but I must say from my position in dealing with numerous aviation organisations globally, the UK military is a lot further on in the chapter than a great many, and what you are doing, you are doing rather well.

Slippery When Wet

By Sqn Ldr Pete Geddes, SO2 Flight Safety (FJ), RAF Safety Centre



Do you remember the exact stopping distances in the rain from your driving test? Possibly not, but you might exercise caution as driving accidents tend to spike in these conditions. Exactly how do you exercise caution though? In 2003 a Tornado F3 lost directional control during landing on a flooded runway at Goose Bay in Canada. A Tornado GR1 had a similar incident in 1995, but the lessons from the Tornado GR Force did not adequately reach the F3 Force. Roll forward a few years and we see similarities. In the past ten years there have been incidents where Typhoon or Lightning did not stop in time and left the end of the runway, and in one case, collision was a risk. Rain, snow, and slush was a factor in all but one of them. It is clear we have an ongoing hazard, so this article aims to keep the topic alive and share the lessons. With a shift towards Agile Combat Employment (ACE), deployments to austere airfields where poor weather can prevail may expose crews to these conditions at short notice. Whilst the following stories focus on fast jets, it is equally relevant to other aircraft types too.

Tornado GR1 – 1995 – Goose Bay

As the aircraft touched down, the pilot selected reverse thrust and the aircraft suddenly drifted and yawed right. Thinking that the aircraft was going to leave the edge of the runway, the pilot initiated command ejection. The Board of Inquiry concluded that aquaplaning on a wet runway was the cause of the accident, aggravated by handling of thrust reverse.

Tornado F3 – 2003 – Goose Bay

Shortly after landing, and whilst using reverse thrust to decelerate, the aircraft yawed rapidly. With the aircraft approximately 60° off runway heading and approaching the left side of the runway command ejection was initiated. The Inquiry concluded the cause of the accident was a loss of directional control, due to a lateral control column input whilst operating reverse thrust at a high-power setting. This was aggravated by a runway with poor friction conditions. The Board also found that the deployed Tornado F3 squadron may not have been aware that the runway at Goose Bay was prone to suffer from 'standing water' after even light rain showers, which could significantly affect aircraft landing performance.

So what?

Both types have now retired, but the conditions experienced during those accidents exist today. Knowing your aircraft limits and handling required in the wet is one matter but understanding when you are in those conditions can

Tornado GR1 Goose Bay

be problematic. Typhoon and Lightning II have bags of power to take-off but stopping them during landing or a rejected take-off can potentially be difficult when the runway is slippery. We now have aircraft with cooled ceramic brakes and brake chutes, but the brakes are only effective if the tyres maintain contact with the runway and the brake chute is not 100% dependable!

What has been happening on current aircraft?

Typhoon T3 – 2014 – Poland; Touchdown onto the wet runway was normal. Braking commenced at 155 kts but there was no apparent initial retardation. The aircraft started to slow down when the brakes were re-applied, and the anti-skid system activated. At 120 kts and with 3,000ft of paved surface remaining, the pilot deployed brake chute. The aircraft left the end on the runway at approx. 35kts and rolled for approximately 60m on the firm stop way, coming to a halt just before the lowered barrier. The investigation concluded aquaplaning was the causal factor.

Typhoon FGR4 – 2014 – Lossiemouth: Following a crosswind landing on a slush covered runway, the red ANTI-SKID caption illuminated, and zero aircraft retardation occurred when full braking commenced. An ATC assessment of the runway concluded it was fit at the time of landing. In addition to zero retardation the aircraft drifted left despite right rudder input to maintain the centreline of the runway. At 120 kts and 3,000ft to go (aircraft in the middle of the left half of the runway) the pilot aborted the landing and diverted as he assessed the runway to be too slippery.

In the subsequent investigation the brakes were fully serviceable. Tyre damage from the skid during aquaplaning is evident in the photo below. But there is more to that story….

That same day, a pair of Typhoons were landing shortly after the Typhoon in the above incident, but the information on the state of the runway passed by the previous pilot did not reach them. On approach the second Typhoon in the formation touched down on the centreline with a strong crosswind and a 10kt tailwind component. Immediately the aircraft started to drift to the left. Due to the lack of directional control and the fact the first Typhoon was still occupying the centre of the runway (due to their own

Typhoon Tyre Damage

aquaplaning issues), an aborted landing option was not available. The nose was immediately lowered and braking attempted. This had no effect, and the speed was not abating whilst the aircraft continued to slide in slush at up to 10 degrees off runway track. The second aircraft directed the first to move over. On successful deployment of the brake-chute the aircraft started to straighten up and the hook was lowered to engage the cable at approximately 75kts ground speed, almost colliding with the lead aircraft.

Typhoon FGR4 – 2017 – Czechia: This incident occurred during landing in poor weather associated with thunderstorms. The pilot lowered the nose and braking commenced immediately after touch down. There were no issues with directional control, but there was little response felt from the brakes. No distance to go boards were present, which made the standard acceptable braking assessment of 30kts per 1000ft remaining more difficult to judge. The pilot deployed the brake chute towards the end of the landing roll but overran the runway at approximately 40kts. The overrun area appeared flat, so the pilot remained with the aircraft. Sufficient directional control was available to avoid the approach lights. It came to a stop approximately 180m from the end of the runway; aquaplaning on a flooded runway was assessed as the most probable cause.

Lightning II – 2023 – Marham: The pilot conducted a conventional landing and delayed braking to try and assist the recovery of aircraft behind him. At 500ft to go, the pilot realised that he had insufficient runway remaining and attempted max braking, with associated anti-skid system activation. Determining he would not stop in time; the pilot steered to avoid the approach lights and left the runway at 18 kts ground speed. The runway was wet; braking action was 'good' on the main (grooved) section but 'poor' on the concrete (non-grooved) section where maximum braking was demanded.

Aquaplaning theory

All these incidents have a common factor of directional control and braking problems associated with a wet or slushy (contaminated) runway.

Aquaplaning can occur when a wheel is running in the presence of water; it may also occur in certain circumstances when running in a combination of water and wet snow. Aquaplaning on runway surfaces with normal friction characteristics is unlikely to begin in water depths of 3mm or less. For this reason, a depth of 3mm determines if a runway surface is contaminated with water, to the extent that aircraft performance assumptions are significantly affected. Once aquaplaning has commenced, it can continue over surfaces, and in water depths which would not have led to its initiation.

A simple formula (Horne's formula) exists for calculating the minimum groundspeed for initiation of aquaplaning on a sufficiently wet runway based upon tyre pressure where V = groundspeed in knots and P = tyre inflation pressure in psi:

$$V = 9 \times \sqrt{P}$$

Aquaplaning can be seen at lower speeds than this, and the constant may be closer to 6 or 7 rather than 9, depending on the design of the tyre. For example, in a Typhoon, application of this calculation results in speeds of 120 kts or less, which is lower than the typical landing speed.

How will I know if aquaplaning conditions exist?

ICAO view runway excursions as one of their highest flight safety risks, along with aircraft manufacturers and safety organisations. In November 2021 ICAO published a new 'Global Reporting Format' (GRF) to describe runway surface conditions. Prior to this, runway description was not standardised, and it was potentially confusing. In the Czechia Typhoon incident, the OSI found that the runway conditions were likely to have been outside the aircraft Release to Service restrictions, but this was not clear to the pilot due to communication issues.

RA3272 describes the reporting format and that GRF for Runway Condition Code (RCC) shall be promulgated at military airfields. The criteria are also summarised in the Flight Information Handbook (FIH) as shown in table 1.
This will be on the ATIS and should now leave pilots well informed on the state of the runway. A code describes the condition of each third of the runway e.g. 6-6-6 for a dry runway.

As we know from the theory, 3mm is the depth of water required to create aquaplaning, which explains the minimum depth of water for declaring RCC 2 in table 1. Despite the now standardised terminology, confusion can still occur. RCC 5 can include anything from 'any visible dampness' to water up to 3mm in depth so theoretically aquaplaning could be possible at the top end of this bracket. So how can you mitigate this? If the runway surface appears reflective in RCC 5 it would be wise to assume the water depth is approaching 3mm and exercise caution.

Weather conditions (and associated runway surface conditions) can change rapidly. ATC need to re-assess whenever the conditions change, which takes time and can be subjective. Pilots should assist if they perceive the description to be inaccurate by broadcasting an 'unofficial repot' to ATC. ATC will pass this to other pilots if the conditions are worse than promulgated. With the Typhoon incident at Lossiemouth, the message from the diverting pilot suffering aquaplaning did not reach the following formation as it was not passed directly to ATC. If you experience runway conditions different to those reported, pass this to ATC and you might just prevent an accident behind you!

AirClues

Table 1: Runway Condition Assessment Matrix

Assessment Criteria		Downgrade Assessment Criteria	
Runway Condition Code	Runway Surface Description	Aircraft Deceleration or Direction Control Observation	Pilot Report of Runway Braking Action
6	• DRY	_	_
5	• FROST • WET (The Runway surface is covered by any visible dampness or water up to and including 3mm depth) **Up to and including 3 mm depth** • SLUSH • DRY SNOW • WET SNOW	Braking deceleration is normal for the wheel braking effort applied and direction control is normal	GOOD
4	**- 15ºC and colder OAT** • COMPACTED SNOW	Braking deceleration OR Direction control is between Good and Medium	GOOD to MEDIUM
3	• WET ("slippery wet" Runway) • DRY SNOW or WET SNOW (any depth) ON TOP OF COMPACTED SNOW **More than 3 mm depth:** • DRY SNOW • WET SNOW **Warmer than -15ºC OAT:** • COMPACTED SNOW	Braking decelaration is noticeably reduced for the wheel braking effort applied OR Directional control is noticeably reduced	MEDIUM
2	**- 15ºC and colder OAT** • COMPACTED SNOW	Braking decelaration OR Directional control is between MEDIUM and POOR	MEDIUM to POOR
1	• ICE	Braking decelaration is significantly reduced forthe wheel braking effort applied OR Directional control is significantly reduced	POOR
0	• WET ICE • WATER ON TOP OF COMPACTED SNOW • DRY SNOW or WET SNOW ON TOP OF ICE	Braking decelaration is minimal to non-existant for the wheel braking effort applied OR Directional control is uncertain	LESS THAN POOR

Other Aggravating Factors Linked to Aquaplaning

Some airfields lack a grooved asphalt surface, which means standing water can build-up quickly, and it will be slower to drain. This should be evident during pre-flight planning. Runways made-up from concrete pads in eastern Europe are common and this was the case in Czechia with the Typhoon incident (see photo below). Note that RAF runways may have a concrete section at the end, which will suffer the same effects. For example, a caution exists in the RAF Marham TAPs and En-Route Supplement, that the concrete ends of all runways are 'liable to be slippery when wet.' Rubber build-up can also occur in the touch-down zone which will affect the ability of the runway to drain and will sometimes reduce

Czechia Runway Surface

braking performance; this should be in the airfield NOTAMs when 'de-rubberisation' has not taken place.
As with the Lightning II incident, saving braking to the concrete section of the runway could leave you with reduced braking performance (due to a combination of the above) when you need it most.

What is the handling advice?
As I mentioned at the start this article is attempting is to maintain corporate knowledge given the historic trend of problems associated with slippery runways. Your own aircraft document set will contain handling advice pertinent to the conditions experienced, and clearances for various runway conditions. There is generic advice that would apply to all aircraft types:

Preparation – A mix of handling checks, currencies and assurance processes assess your ability to operate your aircraft safely. Landing in the wet can be difficult to simulate. Know your aircraft limits and keep the discussions going on your Sqn to exercise this knowledge routinely. If you are an ACO, consider throwing these scenarios into handling check profiles where possible.

Planning – Has another Sqn or Air Force operated from the proposed base, and do they have experience they could pass on? If you have taken the often-time-consuming steps to calculate take-off and landing data (TOLD), share it.
Do you know what the runway surface is? This should be published in planning documents but is easily overlooked and is not always available in the TAPs.

Practice - Aircraft frequently have a selection of stopping methods available. Typhoon can deploy the brake chute, use the wheel brakes alone, take a cable in an emergency, and conduct aerodynamic braking. Lightning also employs aerodynamic braking, but matters are complicated further by utilising STOVL capabilities. It is easy to neglect certain areas of this 'library,' but those basic currencies may pay dividends when you are caught-out by weather in unexpected circumstances.

Tailwinds are bad – A statement of the obvious, but do you know how this affects the TOLD calculations on your aircraft? Do you know the max groundspeed limits for your tyres? The effect of the wind strength doubles when switching from a headwind to a tailwind. A 20 kt tailwind might not seem all that much, but when that increases your groundspeed on landing from 160 to 200 kt, the increase in stopping distance is marked. The shape of the graphs in the ODM change dramatically when factoring tailwinds, especially in the wet. In an operational context, approach speed will be higher again if carrying weapons. Something as simple as a failed PAR on the duty runway might require you to complete an ILS 'against the stream' to a runway with a tailwind. A circling approach or conversion to a low-level circuit is an often-neglected option. When did you last practice this in poor weather?

Assess your rate of deceleration – During landing, a rule-of-thumb such as 30 kt per 1000 ft of runway remaining to assess deceleration is useful. These incidents had/should have had an escape option, which was to abort the landing and take-off again to re-assess. Most fleets use the 3,000 ft marker board as a decision point but bear in mind civilian airports do not have these and a geographic feature would need to be pre-briefed.

The show is not over until the aircraft shuts down – It is easy to relax immediately after landing, but even a taxiway, apron or 'piano keys' can be slippery. I have experienced an icy apron and locked the wheels around the parking slot which caught me (and the marshaller) by surprise.

Spry's Comments:

As we look at shifting our operations around the globe, we could find ourselves operating in vastly different conditions at short notice. The bulk of this article has focussed on wet runways; it is rare to encounter snow and ice in the UK as we tend to melt it prior to operating. When flying in another country, that might not be the case. Despite having a clearance for gritted compacted snow surfaces, an experienced Voyager pilot was surprised at Bardufoss in Jan 22. They had experience in similar conditions and were exercising extreme caution. ATC briefed that gritting had taken place, but the taxiway was 'a bit slippery' in places. I quote from the DASOR:

With very few options and little time left available before we slid straight ahead off the taxiway, I minimised braking pressure and instinctively attempted to turn. I tried to get round the corner at least partially and wanted to minimise the excursion. Surprisingly the NWS gave me enough grip and I managed to get two-thirds round the turn before the mainwheels broke traction and we began to drift sideways. Instinctively, I steered into the skid and applied asymmetric outboard power to try and push us straight.

Even a slight variation in slope or camber can magnify the effects of everything discussed in this article and despite thinking you are prepared, the consequences of a momentary loss of control can be unpredictable; be careful! ■

ROYAL AIR FORCE

Heat Illness
Life Saving Rules

I know the signs and symptoms of Heat Illness.

I ensure I am prepared before conducting activity that may invoke Heat Illness.

I will wear the correct kit and clothing appropriate for the activity and weather.

I will drink an adequate amount of safe water.

I will avoid stimulants, caffeine, alcohol and non-prescription drugs.

SC135
Produced by Air Media Centre, HQ Air Command.

The Empire Strikes Back

The effects of climate change upon aviation

By Captain Robin Evans - pilot and member, BALPA Environmental Study Group

At 2019 peak, aviation emitted 915m tonnes of CO_2 - 2.1% of the global, human-emitted 43bn tonne total, accounting for 12% of the transport sector. Though dwarfed by many industries, this remains significant due to forecast industry growth and decarbonising difficulty. Besides contributing to climate change, aviation is also starting to suffer because of it, as revealed by the growing field of climate change impacts *upon* aviation.

'It's very much a two-way interaction,' explains Dr Paul Williams. A Professor of Atmospheric Science at the University of Reading's Department of Meteorology, he's specialised in climate research for over twenty years. 'Most of the scientific work and academic interest so far, hundreds of academic studies, has been on the effect of aviation on our climate. The *opposite* question is relatively new, though a rapidly growing topic and a very important one.'

'When you were learning to fly I was in the university library studying the atmosphere, turbulence and jet streams, all the phenomena in the fluid that aircraft fly through,' says Paul. 'I have recently been applying that knowledge to analyse what the impacts might be of climate change on your sector. Where my job differs slightly from a traditional academic is that I spend a lot of my time engaging directly with industry.' Of the discovery that increased turbulence was on the cards, he's clear: 'To my mind, the defining moment that opened up a whole new field of academic research.' This also resonates most with the travelling public, only just becoming aware. 'Based on the large number of presentations I get invited to deliver at industry conferences, I would say there is a huge appetite for more knowledge of this topic.'

Paul refers to a statement by the World Meteorological Organisation (WMO) after their 2017 Aeronautical Meteorology Conference. *"A changing climate scenario may render some of today's aerodrome, airspace and airframe design and operation standards inadequate in the years or decades to come. Using past climatological records alone as an indicator of future climate at an airport may be insufficient given the rate at which the world's climate is changing."*

He reflects: 'Like all UN agencies the WMO is quite conservative, it doesn't say things lightly. A statement like this is sobering and I think an acknowledgement from the highest echelons that climate change is going to have consequences for the way we fly.'

Image: Pexels.com – Pixabay - 209831.

So what is climate change doing to aviation? 'The answer is quite a lot,' says Paul, identifying five areas…

Flood defence

Airport defence conjures up Tel Aviv's Iron Dome, but the earth has enough ice to raise sea levels 64m through the East Antarctic (52m), West Antarctic (5m) and Greenland (7m) ice sheets. One metre of rise would dramatically redraw the map with profound consequences for millions; the location of many airports also influenced by the 30% of global population living within 100kms of the coast.

The Met Office 2022 State of Climate Report reveals sea levels rising 3-5mms annually, double the rate of early last century. One recent study estimated the sea level rise of 2 °C warming would put 100 airports below sea level. A 2014 assessment identified 13 of the USA's largest airports (including Miami, San Francisco and Newark) with at least one runway within reach of a moderate-high storm surge.

Baseline tide is a key factor: outside high tide, Hurricane Sandy closed La Guardia (5-20' elevation) for three days in 2012, inundating both runways. A 1-in-500 year flood event in pre-industrial times is currently 1-in-25, now believed that Sandy-like New York flooding will become a 1-in-5 year event by mid-Century.

The notoriously flood-prone New Orleans Louis Armstrong (elevation 4') is second only to Amsterdam Schiphol in low elevation. In 2011, Bangkok's Don Mueang Airport (elevation 9') 40kms inland was submerged after heavy monsoon rain, with 747s pictured with landing gear underwater. In 2018, Typhoon Jebi showed that even new, highly engineered airports were vulnerable, inundating Kansai (elevation 17'). Despite the due diligence required in its reclamation from Osaka Bay, floods closed one runway for ten days and one terminal for seventeen.

Density altitude

Every 3 °C of warming is equivalent to a 1% density reduction or raising airport elevation 300'. Recall the flight cancellations due to extreme temperatures (48 °C) in Phoenix, Arizona in 2017; considered America's hottest city, with summer 2020 the hottest and deadliest on record. Cities are particularly prone to the 'heat dome' effect of high pressure keeping a lid on conditions beneath.

A 2016 ICAO report warned of: *"severe consequences for aircraft take-off performance, where high altitudes or short runways limit the payload or even the fuel-carrying capacity."* A 2017 study of ten Greek island airports with an IAE-engine A320 performance model revealed a reduction in takeoff performance over several decades. Chios (15' elevation with a 1511m runway and pre-pandemic 240,000 annual passengers) was most restricted, with an annual MTOM reduction of 133kgs. Since 1988 service entry, the A320 has suffered a four tonne payload reduction here. All others, with MTOM unaffected, saw an annual mean TODR increase in the order of several metres. In opposition to expectations at altitude, a general weakening of surface winds over decades, the 'global stilling' phenomenon has a related effect on takeoff performance.

In the UK, the extremes of July 2022 are only the most recent: of the ten hottest days on record, nine occur since 1990 with the top five in the last decade. Disruption of operating envelopes is typical of the likely effects of climatic aviation shifts. The mitigation of rescheduling for cooler times of day is already common in regions of the world limited by density altitude, if not runway length.

Extreme weather events

Recalling piston engines, the carburettor icing risk initially increases with air temperature, as warmer air holds more moisture. In turn, a warmer atmosphere increases a cloud's generation of electrical fields, lightning considered a tracer for violent winds, hail and heavy rain. 'There's a clear link between temperatures and lightning, so it stands to reason that as we warm the atmosphere we'll see more lightning strikes,' says Paul.

More lightning has historically occurred by day than night, over the Tropics than Poles and in summer than winter. This is now understood to be changing. A 2021 study of Arctic lightning strike data revealed summer strikes have increased from 18,000 (2010) to 150,000 (2020) with temperatures above 65°N latitude increasing by an average 0.3 °C over the same period. Meanwhile, studies focusing on the continental US indicated that every degree of warming would equate to an increase in annual lightning activity of 12% (Romps et al, University of California, 2014) and 10% (Price, Tel Aviv University, 2012) respectively.

Separate from jet streams, 'atmospheric rivers' are long bands of atmospheric moisture, extending between tropics and higher latitudes. Releasing large water volumes, they are linked to dramatic weather events, expected to be more intense in a warming climate.

One such river, the 'Pineapple Express' funnels water vapour from Hawaii to the US: the source of the November 2021 storms along the Pacific Northwest and into Canada. Months before, the region had experienced wildfires and the heat dome effect. Together, the phenomena match the scientific expectation for hotter, drier summers and wetter winters; and although single events can't be categorically pinned upon climate change, studies confirm such events are more likely.

Modifying wind patterns

Paul's focus is particularly upon jet stream and windshear effects; there is consensus from climate models that wind speeds at altitude will increase in future. The temperature differential between the Tropics and Arctic is what drives the North Atlantic jet stream. Amplified warming in the tropical upper troposphere, plus the Arctic now warming four times faster than anywhere else on earth due to the albedo (reflectivity) change of sea ice loss, is brought to bear on cruise altitudes.

Paul's work has shown that when modelling flight time against probability, a doubled CO_2 scenario pushes eastbound crossings towards the fastest end of the distribution; and westbound towards the slowest. In this scenario, the likelihood of a sub 5h20m eastbound transatlantic flight more than doubles from 3.5% to 8.1%, with the westbound likelihood of exceeding 7hrs nearly doubling from 8.6% to 15.3%. 'Our studies have shown that twice as many flights will experience very fast eastbound crossings in the years to come,' he reveals.

Subsonic eastbound records are getting faster: JFK-LHR 5h16m (Jan 2015) 5h13m (Jan 2018) and 4h 56m (Feb 2020). In the third case, the strong jet stream was also responsible for powering Storm Ciara, two other transatlantic flights exceeding the previous record. Says Paul: 'I'm not saying climate change has necessarily caused these records to be broken, but it is certainly consistent with what we expect.' Whilst westbound crossings experience an opposing effect, the headwind penalty exceeds the corresponding eastbound tailwind. Extrapolated to all transatlantic traffic (600 daily crossings) gives an extra 2,000 hours airborne annually.

Paul's work also helped motivate the 2022 NATS policy change on removing the North Atlantic Organised Track Structure (OTS) at and below FL330. One study of the original setup showed aircraft were forced to fly hundreds of unnecessary kilometres. Another airline-sponsored study demonstrated that every minute saved over the ocean equated to £51. 'Our quantification of the possible savings certainly helped to build a strong case,' says Paul.

CAT out of the bag

All crossings can expect more turbulence, studies revealing the North Atlantic jet stream at cruising altitudes has become 15% more sheared since satellites began observations in the 1970s. A 2017 study in the Advances in Atmospheric Sciences Journal found that doubling CO_2 levels would increase North Atlantic CAT at FL390 by 149%.

Williams & Joshi (2013) shows a range of 21 CAT measures diagnosed from climate simulations are significantly modified if CO_2 is doubled. The change varies: the equator shows a light reduction, with the largest increases expected in the regions containing the most flown routes. At cruise altitudes within 50-75 °N most measures show a 40-170% increase in airspace volumes containing moderate CAT.

'The forecasting methods have been tested using aircraft measurements and found to work,' explains Paul, 'but we're talking about increases over decades.' Whilst exact figures vary according to model and scope, they all agree that bumpier transatlantic flights can be expected by mid-century. 'It's quite sobering, a clear trend consistent among different data sets,' says Williams, adding that a given increase in shear doesn't equate directly to turbulence. 'It's more complicated than that: turbulence generation is a non-linear effect.'

Image: ShintarTatsiana, Envato Elements.

Others

Beyond Paul's work, there are at least two other effects yet to receive analysis on an equivalent scale. One is the number of Mediterranean outstations requiring frostbuster equipment, at least one carrier now contracting this in Cyprus. The second is bird activity: scientists having already made the parallel that displaced migration, nesting and food is akin to the canary in the mine. 'Flyways' are the migration corridors spanning continents, the migratory Canada geese threat synonymous with Chesley Sullenberger. The feathers recovered from his engines contained the deuterium signature of the latitude of their last moult: the Labrador region. Scientists hypothesized that frozen ground and water prompted their off-schedule movement south on the Atlantic Flyway in January 2009.

Insects are similar: pests and predators, pollinators and plants coexist in a climate-dependent cycle. Significant rainfall on the Horn of Africa in 2019 boosted the region's worst locust plagues in decades the following year; in January 2020 an Ethiopian Airlines 737 aborted two consecutive approaches in locust swarms.

Critical

Climate and aviation are both vast networks of sensitive, interrelated systems, often displaying lag or tipping points. Regardless of belief over cause of changing climate and its current small contribution to the carbon budget, aviation stands to be disproportionately squeezed by the effects. Recent events have served as catalysts for organisations to begin considering adaptation strategies; airlines also now publicly acknowledging climate change impacts as a strategic risk in their own sustainability reports.

Reproduced by Kind Permission: originally published in 'The Log Spring 2023'. Commercial pilot and freelance writer Robin Evans (Twitter/X @robskievans) is a former environmental consultant.

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Practice Forced Landings

By Flt Lt Bruce Lloyd, 22Gp DFT ASAR ME

On 30 Nov 2023 Defence Airspace and Air Traffic Management (DAATM) agreed to a change of rules governing aircraft conducting Practice Forced Landings (PFL). The key change is that some 22 Gp aircraft will no longer be required to make a Low Flying booking when operating below 500ft whilst conducting PFLs. The MAA has also amended RA 2330 (Low Flying) to permit light fixed wing aircraft and rotary wing aircraft to conduct PFLs to a minimum height of 100 ft AGL. For those of you that can recall, this is a return to the way we used to do business, albeit now with new Regulation, Orders and caveats.

'Light FW Aircraft' is a new category in RA2330 defined as:

Propeller-driven aircraft with a Maximum Take-Off Mass (MTOM) of 2730 Kg or less.

For 22 Gp that equates to Tutor, Prefect and the Robin aerotow aircraft (operated in support of Volunteer Glider Squadron activity).

So What?
Light FW Aircraft could be operating down to 100ft without a LL booking. UKLFS users should be aware when operating close to UAS units, Cranwell, Barkston Heath and Syerston.

So, when am I Low Flying?
Low Flying (LF) Definitions have not changed and assumes LF by day when:

- Fixed Wing (FW) Aircraft <2000'agl / AMSL.
- Light FW Aircraft and RW Aircraft <500' AGL / AMSL

All Aircraft are considered to be LF by night when <2000'agl / AMSL.
However, RA 2330 states that aircraft conducting PFLs are not considered LF.

So, what do the changes mean to me in practice?
The analysis of MAC of aircraft threat surmises airspace between 250ft-500ft is highest risk. Aircraft using or planning similar routes in the LFS should be avoided. Collision Warning Systems and Electronic Conspicuity are significant barriers, whilst the GA community are rule-bound to be above this height band, except when conducting PFLs. CFIT risk is minimised due to procedures, including taught abandonment height / committal height decision points and good lookout. Drones can operate legally without NOTAM below 400ft AGL and effective lookout is a key, and often the only, mitigation to Mid-Air Collision (MAC). Furthermore, PFLs should not be flown at designated choke points or where there are obvious high rates of LL flow, indicated by flow arrows.

Crew operating Low Level:
Crews should understand that a check on CADS, before walking for a Low Level sortie, may not yield a potential confliction with aircraft conducting PFLs between 2000 and 100' AGL. Whilst CADS is an effective means to deconflict a nav route, it is less effective at describing General Handling offering only generic SA and no location granularity on Light FW Aircraft that might be conducting PFLs.

Mitigation against MAC risk is provided by effective lookout and by a new 22 Gp requirement for radio transmissions, both when entering, and completing, the PFL exercise. When operating LL, listening out on an appropriate frequency will assist gaining SA on a PFL Aircraft. But what is the appropriate frequency? Practically this is dependent on location. Where LL Aircraft are adjacent to, and within radio range of a LARS or ATC unit, this is likely to be the frequency used by a PFL aircraft transmission. In locations beyond unit LL radio range, on a LL Nav route for example (approximately 20nm and beyond), PFL aircraft will transmit on VHF 130.490 MHz LL common.

PFL crew:
Whilst Light FW Aircraft and RW Aircraft are considered to be low flying when operating below 500 ft AGL, LFA bookings are not required for conducting practice forced landing exercises below 500ft AGL. However, auth sheets must include annotation of MSD / MSC- including AGL whenever operating below 2000ft AGL.

22 Gp aircrew are now required to make a radio call on either LL common or the ATC frequency currently in use when a PFL has been initiated away from an airfield. Operators should state the minimum MSD they intend to fly to (e.g. 100ft or 500ft MSD) and should report climbing away from Low Level; both calls should include location.

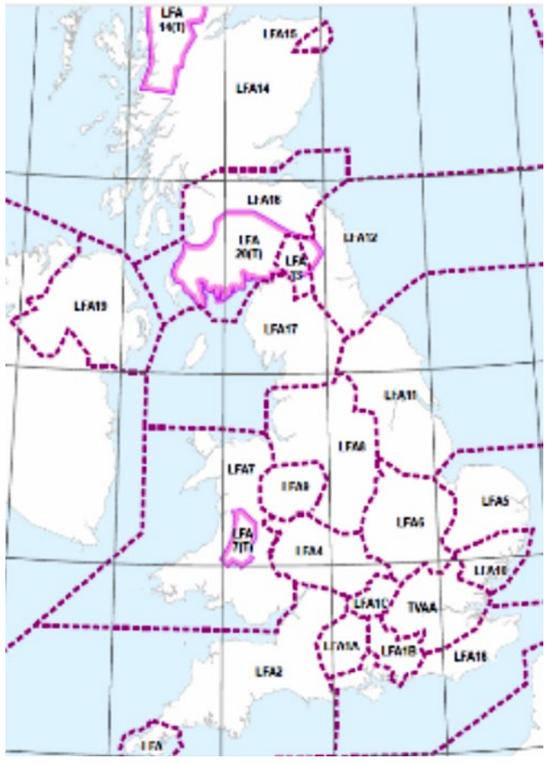
Dynamic risk assessment is conducted by pilots throughout PFL serials which considers CFIT, bird / drone strike and MAC with low flying aircraft as the significant threats.

It is good practice that Aircraft Commanders record details (date, time, callsign, min height, and location) which can be recorded in unit's Low Flying Record Folder and in authorisation sheets which ensures compliance against UKMLFHB requirements to document a post flight record of flight for LL sorties.

What about CADs bookings?
UKMLFHB states all military air systems utilising the UKLFS including DUAs (below 2000' AGL) should input their routes into CADS iaw CADS SOPs (Section 5). 22 Gp crews are required by 22 Gp Air Staff Orders 2305(4) to input all sortie routings (including working airspace outside of a danger area) and timings onto CADS prior to flight, with some exceptions; one being for "Transitory height changes for PFL elements of Test, Composite, or LL Navigation sortie". Others being when a sortie is entirely within CAS / MATZ / ATZ, and day RW sorties within the LFA9 DUA

If you plan to conduct a PFL on a Navigation / Composite sortie, it is good practice to include the words "PFL(S) TO 100FT MSD" in the overall 'Comment' box. If it doesn't detract from the training benefit or test conditions, putting this comment against the intended leg(s) comment box can enhance other CADS users' SA.

Where's the greatest threat?
Cranwell based Prefect, and Tutors based across the UK are 22 Gp aircraft that can be expected to operate to 100ft AGL when conducting PFLs. LL flying vigilance is particularly required when operating in LFA 11. Shawbury-based Juno and Jupiter operate in their DUA LFA 9. Visitors can expect to encounter Shawbury based ac operating throughout the DUA and associated AIAA from GL to 3000 ft AMSL. LL Aircraft in LFA 9 can achieve SA on Shawbury based PFL Aircraft by contacting Shawbury LL UHF frequency 376.675.

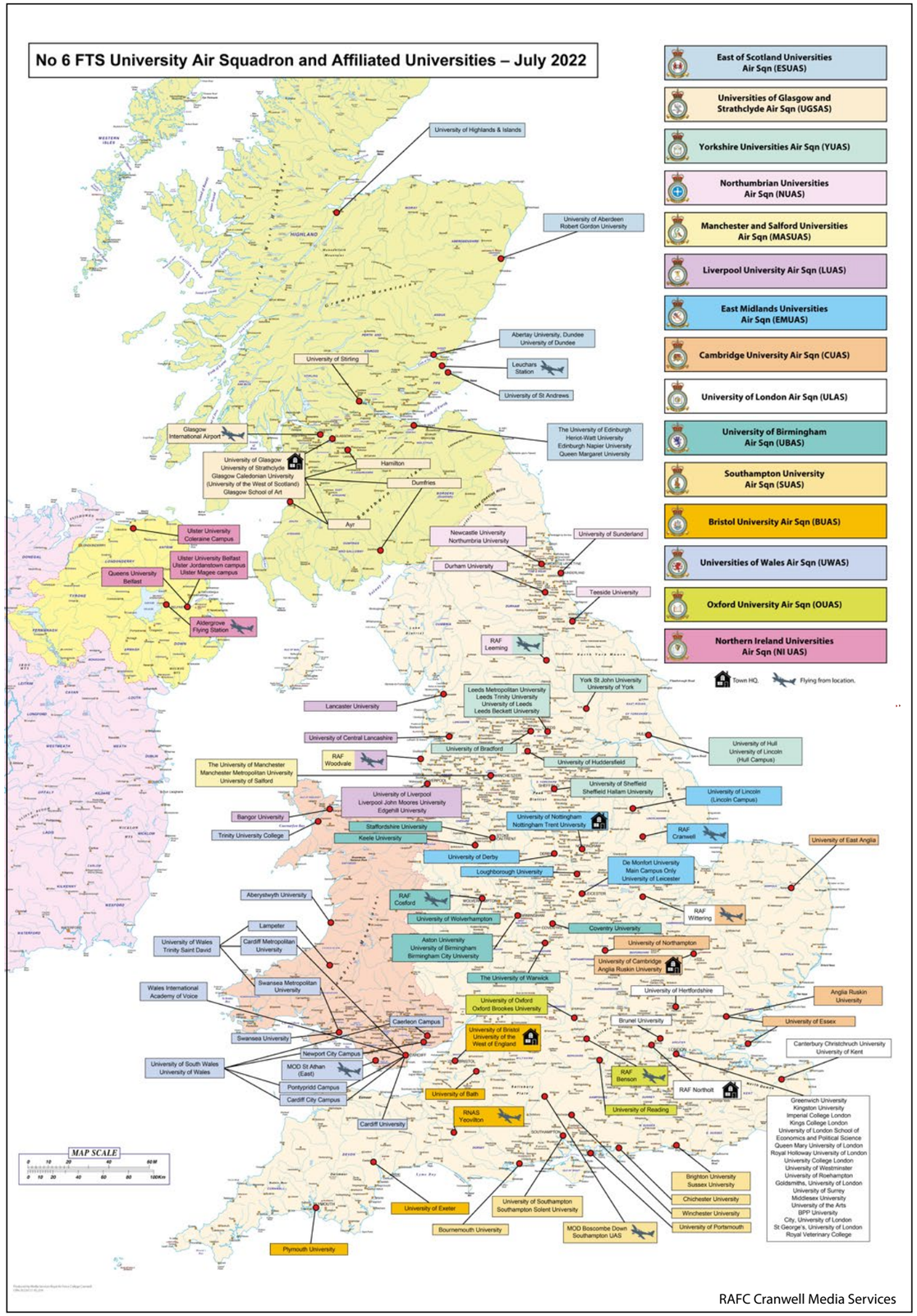


Within LFA 11 is the Lincolnshire 'clutch', which is particularly busy. This is home to 1 Gp and 22 Gp aircraft, at least 8 different types that regularly fly in the Area of Intense Activity utilising the LFS. Crews should be aware that CADS only provides SA on flying activity planned by other CADS users. Furthermore, it does not allow for airborne route / timing changes due to weather or other constraints. Crews must ensure that effective lookout remains a fundamental discipline for avoiding MAC.

CADS only provides SA at the time it is checked. Experience shows that EFT sorties on the first wave of the day rarely have conflicts during the outbrief, when in reality multiple conflicts may exist by the time the aircraft is airborne. It is essential that crews maintain a robust lookout, maintain use of Collision Warning Systems and Electronic Conspicuity, Air Traffic Services, and LL Common monitoring where applicable.

Tutor is operated by 15 University Air Squadrons and Air Experience Flights from 13 different locations within the UK. Significant PFL activity can be expected by Tutor within their associated units local areas.

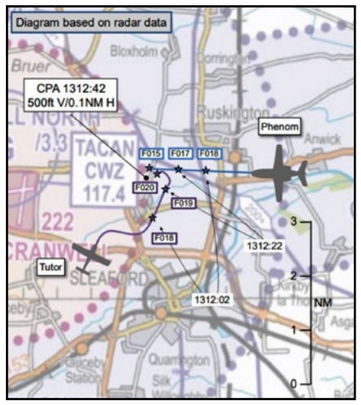
So next time you're planning a trip to Sennybridge in an A400M or Chinook the MAC threat isn't just from microlight sites, there could well be PFL Tutor aircraft from St Athan conducting PFLs down to 100ft AGL anywhere in the LFA.



RAFC Cranwell Media Services

Airprox Highlights

With Comments from Wg Cdr Spry



Airprox No. 2023005
Phenom v Tutor
18 Jan 23

The Phenom Pilot reported that they were flying a vectored SRA to RW26 at CWL with the trainee as PF and QFI as PM. The approach was flown with autopilot engaged, receiving a service from CWL SRA1. While discussing ways to fly the approach, the QFI spotted a Tutor co-alt and called the contact to the crew and ATC. This was followed by a TCAS "Traffic, Traffic" alert at approximately 1300ft agl.

The TCAS traffic corresponded with the previously sighted Tutor which was now co-altitude in their 11 o'clock approximately half a mile, seemingly turning to join. It appeared to the crew that the Tutor was going to pass behind/overhead (as they continued the descent) and thus wouldn't be an immediate factor. The crew lost sight of the Tutor as it passed overhead/ behind and continued to fly the approach. A few seconds later a TCAS "Descend" RA was generated. The trainee disconnected the autopilot and descended in accordance with the RA. As the aircraft descended through 1000ft, the RA resolved to "monitor vertical speed" and the aircraft was levelled at 700ft when all TCAS warnings ceased.

The aircraft was no longer stabilised on the approach, so the QFI instructed the trainee to go-around. The assumption was that they were clear of conflict. However, after responding to the PF call for flap 1 (limiting speed upwind. After Take-Off checks were performed and they climbed and levelled at 2500ft for a Radar-to-Visual recovery. The QFI noted that the initial phase with acquiring the Tutor visually in busy Lincolnshire airspace is normal at Cranwell, but they were surprised that [the Tutor] had not been called or deconflicted by radar. They judged visually that the Tutor was giving them safe separation, but anticipated that the reduced lateral and vertical separation would trigger a TCAS RA. By following the TCAS RA, they were confident of safe separation. On descent iaw the TCAS RA, below 1000ft agl +/-100ft TCAS RA is inhibited and "monitor vertical speed" is a less familiar scenario. With all TCAS alerts cleared they assumed that the conflict with the Tutor was now resolved and that they were ahead of it. As the approach was no longer stabilised, they felt that it was appropriate for the trainee to initiate the go-around.

After responding to PF request for Gear and Flap they then noted on the TCAS display that the Tutor was indicating on top +100ft. The trainee recollects it being rear right quarter. The QFI had electronic information telling them there was a high risk of collision at a low altitude and approaching a visual circuit.

They knew TCAS would not give an RA at this altitude and without being visual with the Tutor, they were in a very uncomfortable situation.

They had initially assumed the Tutor had been visual with them at 1400ft, but it made no sense to their mental model why they would descend on top of the Phenom. They therefore thought the Tutor crew was not visual and that they needed to rely on their TCAS display to maintain separation as they approached the CWL circuit.

The Tutor Pilot reported that they initiated a visual recovery to Cranwell for a normal join to RW26 and were handed over to Cranwell Approach as per SOP. Approach advised them of visual circuit traffic and a Phenom on an instrument approach as they approached the airfield on a roughly northerly heading from south of Sleaford at around 2000ft QFE – they were not visual with any reported traffic at that point, and Approach requested they flew one orbit for spacing for recovering and departing traffic. On completion of the orbit and heading approximately north again, they requested the position of the instrument traffic, which was reported at 5 miles – as they were still not visual with the instrument traffic, they were conscious to remain well to the south of the centreline and elected to turn left (the long way around) onto east away from the instrument traffic i.e. towards the airfield initially to ensure separation. Approach advised of traffic departing downwind on RW26, which would become a potential conflict for their left turn and recommended (not directed) a turn right onto east instead, which they expedited to ensure they still remained sufficiently south of the centreline to stay clear of the instrument traffic.

They immediately became visual with the Phenom on its approach at a range of about 2NM from their aircraft and laterally separated, although at a similar level. They informed Approach that they were visual with the radar traffic and that they would position behind for initials, at which point they were handed over to Cranwell Tower.

They called Tower to join and were cleared, so continued to position visually for Initials behind the Phenom (rear right quarter as reported in their Airprox DASOR). From Initials, the Phenom was ahead, low and left of their position with increasing separation, exactly as they would expect from an aircraft on final approach, before initiating its Missed Approach.

From initial sighting they remained visual with the Phenom at all times and maintained separation accordingly, whilst informing air traffic control of their position and intentions throughout.

The Cranwell SRA Controller reported that the Phenom was handed over from Radar Approach (RA) in the standard format. They identified it on Stud 13 and the approach continued normally. When the Phenom had roughly 4 miles to run, they noticed an RA squawk at the Phenom's 11 o'clock, 3 miles. They were preparing to confirm with RA that their traffic was visual with the Phenom so they could pass this message to the pilot. They delayed this until after the 3.5NM call and gear check. They transmitted '3.5 miles, 950 ft, check gear acknowledge'. The Phenom pilot replied with roughly '[C/S] is visual with the traffic at 11 o'clock.' They acknowledged the call and continued the approach.

At 3NM, they transmitted on the radar clearance line (RCL) for the Phenom clearance, at this point, they realised that they hadn't received a positive gear check from the pilot due to the previous transmission reporting the traffic visual. They therefore asked the pilot to confirm gear was down, which was confirmed, before finishing the clearance call on the RCL. CWL TWR cleared the Phenom to low-approach, with one in the visual circuit, they transmitted this to the pilot followed by acknowledge.

There was no acknowledgement from the pilot and they could tell that the pilot was preoccupied, so they allowed the track to run for another ½NM before asking the pilot to acknowledge their clearance.

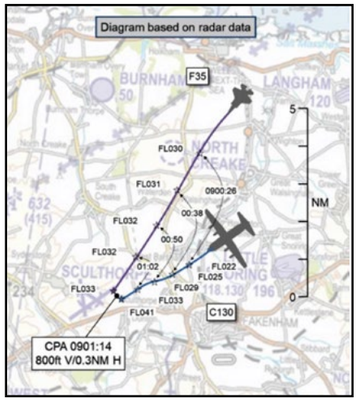
At this point [the pilot] informed them that they would be levelling off and flying straight ahead. They asked [the pilot] to confirm that their intention was to 'fly through deadside RW26'.

The answer was affirmative, so they gave a positive instruction to 'fly though deadside RW26, continue with CWL APP stud 5'; this message was transmitted on stud 13 and the RCL, to give CWL TWR awareness. The Phenom pilot also informed them that they were having to level off due to a TCAS RA that was caused by the traffic that they had earlier reported visual with, that was described as 'on top of us'. The pilot changed frequency at this point.

For the full report, see Airprox No. 2023005 on the Airprox Board Website

Spry's Comment:

Whilst there was no risk of collision in this incident, it made for an uncomfortable period for the Phenom crew post TCAS RA with incomplete situational awareness on the other aircraft during a high workload phase of flight. Sequencing aircraft of different types, flying different profiles, is always a challenge; with multiple radio frequencies in use in this case, the aircrew could not get a full picture from the other pilots' RT calls. It is unfortunate that the Tutor flew close enough to the Phenom to trigger the TCAS RA and that the Phenom crew were unaware that the Tutor pilot was visual with them. TCAS information can be unreliable in azimuth, particularly when in close proximity to other traffic. On this occasion, the coarse depiction of own aircraft and conflicting traffic reinforced the mental model of the Phenom QFI that the Tutor was extremely close. If the Phenom crew been informed that the Tutor pilot was indeed visual with them, the crew would not have been overly concerned with the situation. This incident highlights the question 'how close is too close?'. When operating in a mixed-type circuit environment, be sympathetic to others in the circuit and consider that, whilst you might be happy that the safety of your aircraft and others' is not compromised, the same situation can be viewed and experienced very differently as shown in the incident above.



Airprox No. 2023037
C-130 v F-35 Lightning II
30 Mar 23

The C-130 Pilot reported that, upon completion of their training, the C-130 crew ascended to 2000ft to establish communication with Marham followed by Swanwick, who provided a Traffic Service and clearance to climb to FL140. As the crew initiated their climb towards the Lichfield Corridor, Marham issued a traffic advisory for an F-35 approaching from the 4 o'clock position at about 2500ft. Despite initially having visual contact with the aircraft and receiving TA indications on their TCAS, the crew soon encountered clouds, after which their TCAS triggered a RA directing them to climb to avoid a potential collision. Shortly after exiting the clouds, they regained visual contact with the F-35 as it passed underneath, about 300ft below.

The F-35 Pilot reported that, in the descent to RAF Marham under a Traffic Service, ATC made them aware of a low-level contact 8 miles to the left of the nose and advised, if not sighted, to stop descent at 2500ft. They gained tally with the C-130 and called this to ATC. Shortly after, they lost tally and radar contact so levelled at 2500ft and requested an update from ATC. ATC advised the C-130 was now climbing through their level as they regained tally, estimating a CPA of approximately 1NM at the 11 o'clock and co-height. This occurred approximately 15NM to the northeast of Marham. They then continued the recovery and landed at Marham.

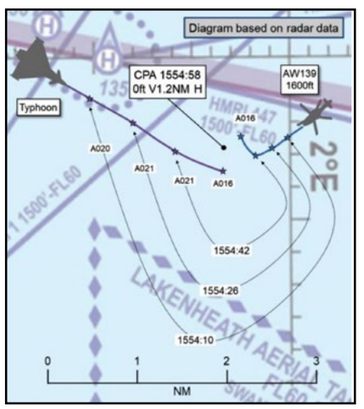
The Swanwick Controller reported they were the East Bank Tac Right controller. Personnel in position consisted of themself, a second controller (both EM) and a supervisor. At some point during their time in position they felt overloaded and remarked to the Supervisor that they did not wish to take on any further aircraft because they were starting to feel stretched. Due to having low staffing levels at the time, the second controller was still taking their break requirements and could not provide any relief or open a second TAC position. With several [pilots] on frequency taking HS transits into the 323's, tanking and a large split, they requested if 'North' could take some [aircraft] slightly earlier than expected to help relieve them. At some point a [C-130] free-called the ICF requesting a Traffic Service, climbing FL140 for the Daventry [they recalled] and it all became 'slightly too much'.
They reiterated several times that they didn't want any more [aircraft], however, unfortunately they kept coming.

The Swanwick Supervisor reported that the East Bank sector was scheduled to have 7 staff for the period 0700-1500L (2 'mornings', a morning Supervisor, an 0900L start, a 1000L start and an 1100L start), which was 1 controller below the minimum required to declare a full staffing quota. Unfortunately, the 0900L controller called in sick, which put the sector to 6 controllers. At the point of the overload, there were 3 members of staff available, one of whom was on a mandatory break as they were on console from 0730L-0930L. This left themself as the Supervisor and the controller submitting this DASOR; staff numbers were bolstered when the break finished and the 1000L controller arrived. It was noted as being a busy period on console for the controller; there were a number of high level transits, one F-35 returning to base, one KC135 at high level for an ARA as well as the final half of AAR in ARA8 prior to operational tasking. The [Swanwick Mil] traffic levels were exacerbated by equipment problems at [RAF Boulmer CRC], where their radar recording failure meant they were unable to provide radar services outside of the D323 Complex, so [Swanwick Mil was working transits of aircraft that would otherwise have been with [RAF Boulmer CRC]. At the time of the incident mentioned, the package of fighters [handled by RAF Boulmer CRC] had been handed to RAF Marham for instrument recoveries. The controller was handling a pair of Typhoons in East Anglia and had prenotes on 2 single Typhoons for a practice diversion to Leuchars. This was then joined by [a calibrator aircraft] which was setting up at Wittering. [The C-130 pilot] free-called from Sculthorpe already in a climbing profile. The controller placed a squawk upon it and they encouraged them to find out what the aircraft was doing, as often they ask for a service which would be better provided by a LARS unit. The pilot stated they were climbing out of low level at Sculthorpe and requested the Lichfield Corridor for Wales. This was acknowledged and the appropriate climb for the corridor given, along with a Traffic Service, with traffic in the Marham RTC being called. The controller was then busy passing the previously mentioned traffic to the North sector and having to react to 2 formations of 3 Typhoons stating that the weather in the D323 Complex was unsuitable for their sortie and [that they] wished to proceed to the now vacant ARA8 area. The [pair of Typhoons in East Anglia] also requested to move to the Vale of York in search of better weather. With all of this happening simultaneously, and with themself acting as a 'pseudo-Planner', both the controller from the break and the 1000L controller arrived and the traffic was re-allocated and split to allow for greater unit capacity. The second Tac controller took the general handling Typhoons in ARA8 and the Vale of York and the 1000L controller assumed the Planner role, allowing themself to return to Supervisor duties.

For the full report, see Airprox No. 2023037 on the Airprox Board Website.

Spry's Comments:

Swanwick Mil did not co-ordinate the climb-out request from the C-130 pilot against other traffic and provided them a clearance to climb which then brought them into conflict with the F35. However, both C-130 and F-35 pilots had intermittent visual contact with the other; there was opportunity for both pilots to take positive action to maintain or increase mutual separation. Under a Traffic Service, pilots retain responsibility for collision avoidance; ATC will provide Traffic Information to aid this. Ultimately it is the pilots' responsibility to take positive action to maintain separation, be it laterally and/or vertically. Consider a Deconfliction Service if you are unable to maintain visual separation due to IMC or if you are unsure as to the relative position of proximate aircraft.



Airprox No. 2023041
Typhoon v AW139
5 Apr 23

The AW139(4) Pilot reported that, whilst they were in the cruise towards Norwich, the crew was cognisant of an aircraft on TCAS, [when they had been] approximately at the Hewett Field. A company aircraft was given avoiding action. Later, [the pilot of AW139(4)] was given immediate avoiding action from their original track of 236° onto heading 360°. Whilst in the turn, the PM sitting in the left seat saw a fighter jet pass at the same level and approximately 0.5NM from them (confirmed from the aircraft's TCAS screen scale). This proximity would definitely have been closer had they not been given the avoiding action. The jet icon remained at 1500ft and within 5NM of their aircraft, but in their 6 o'clock. They were then told by Anglia [Radar] to resume their track towards Norwich. About 1min later, they were given further immediate deconfliction action back onto north, with a further turn clockwise back towards their original track. At that point, the Anglia Radar controller apologised, and stated that they could no longer maintain separation and downgraded them to a Traffic Service. The jet(s) moved west and climbed so [the pilot of AW139(4)] descended to 500ft and continued towards Norwich with no further incidents.

The Typhoon(4) Pilot reported that on 6 April 2023 [they were informed that] an Airprox had been raised [concerning] a fighter aircraft in their operating area from a sortie the previous day. Typhoon(3)/(4) flight was the closest of all Typhoons at the times notified.
On extensive inspection of mission debrief materials it was determined that neither of the formation aircraft were within 10NM of the specified location (Hewett Field) at the reported time of the incident (1550). The crews reviewed the tapes at length and the closest they knowingly came to rotary traffic was at 1557:13 at which time Typhoon(4) was westbound at 1000ft AMSL having gained radar-contact with a track manoeuvring away, 500ft above and no closer than 4NM.
The pilot of Typhoon(4) manoeuvred to the southwest to maximise deconfliction. This was coincident, and in agreement with, traffic calls from Swanwick Military from whom the formation was receiving a Traffic Service throughout.

The Anglia Radar Controller reported that it had been a quiet session on Anglia Radar. They had AW139(1) following AW139(2) with a slow catch-up and convergence. This was resolved by putting speed control on both aircraft. The catch-up was still happening, but at 6.5NM, AW139(1) pilot reported that they were visual with AW139(2) and happy to maintain their own deconfliction. Traffic Information was passed to the pilot of AW139(2) and speed control was cancelled. After this, their attention turned to the two helicopters that they had closer to Norwich when they saw that a military aircraft had descended low-level in the vicinity of AW139(3). They passed Traffic Information to the pilot of AW139(3) at 6NM and instructed that "if not sighted, avoiding action turn right heading of 290°" (they can't be sure of the exact heading).
As this was read back, they saw another low-level jet in proximity to AW139(4) at a range of 2NM. They immediately gave [the pilot of AW139(4)] avoiding action to turn to the north. After this, they noticed that the pilot of AW139(3) had not in fact taken the turn (thinking that maybe they had been visual with the military aircraft) but noticed that the pilot of AW139(2) to the north had taken the turn. Knowing that the pilot of AW139(1) behind AW139(2) was visual with them, the Anglia Radar controller continued to try to deconflict AW139(3) and AW139(4) from the two military jets, giving avoiding action another couple of times before advising that they could no longer provide deconfliction advice and reduced both aircraft to a Traffic Service. The pilot of AW139(4) advised that the military aircraft was about 0.5NM, same height and that they would be filing an Airprox. Both military aircraft were on Swanwick Military squawks, but the Anglia Radar controller didn't have time to call Swanwick Military to coordinate anything. A colleague came to help and called the military who eventually managed to get the aircraft to climb away.

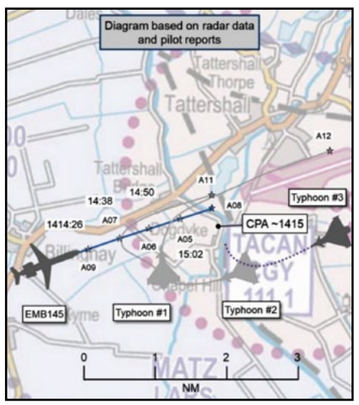
The Swanwick Military Controller reported that they had taken over the position with two Typhoons manoeuvring surface to FL160, with two more Typhoons joining initially looking to work FL170-190 on a discrete frequency north and northeast of Norwich while conducting manoeuvres. They were internally trying to arrange new levels between themselves. To avoid any confusion, the Swanwick Military controller gave all aircraft the same block with internal deconfliction, as they were all working together. During this time, the Norwich controller rang and asked for Traffic Information regarding the four Typhoons. The Swanwick Military controller gave them the levels and the Norwich controller asked if they could remain south of Y70 (a line between SUPEL and BODSO that passes through the north of the Hewett HTZ) and not below FL90.

They informed the Norwich controller that they would negotiate with the pilots who would be a factor and get back to them. After giving Traffic Information to the one pilot that would be a factor, the pilot asked if they could do one more intercept before holding for the Norwich inbound. The Swanwick Military controller assessed that this would be safe and approved it. On completion of the intercept, they gave an updated traffic call and phoned the Norwich controller to advise them that the Typhoons were now not below FL90. Whilst their attention had been focused on the Norwich inbound, the Anglia Radar controller had phoned to ask for Traffic Information on their squawks northeast of Norwich. After informing them, the Anglia Radar controller told them they had gone into avoiding action with a helicopter inbound to Norwich. On being notified of this, the Swanwick Military controller's attention was drawn back to the Typhoons operating at around 1500ft off the coast. They passed Traffic Information on the helicopters and the Swanwick Military controller was told it would be relayed by the flight lead as the low-level aircraft was more than likely out of comms range. Having called a second track believed to be a helicopter, and the previous track, the pilot of the lead aircraft called radar contact.
On completion of the final intercept, the pilot of the lead aircraft asked for a suitable heading to climb away from the traffic. The Swanwick Military controller advised them that a rough heading either northwest or southeast would be safe. The pilot then took a southeast heading and climbed to medium level. Shortly after, the Anglia Radar controller phoned back to inform that one of the helicopter pilots may be filing an Airprox, this was later confirmed by a further phone call to another controller.

For the full report, see Airprox No. 2023041 on the Airprox Board Website.

Spry's Comments:

An unfortunate incident where safe separation was maintained but significant disruption was caused to the helicopters. The Typhoons were not passed traffic information when they thought this was being covered by Swanwick. Taking this back to basic principles, the procedures for aircraft operating in the North Sea Offshore Safety Areas are laid down in the AIP. This is also referenced in the UKMLFHB. In summary, avoid the areas of known helicopter operations, if possible, and at least one pilot should establish direct comms with Anglia Radar prior to entering the area. Asking Swanwick to take this on is sometimes an unrealistic ask due to the operational pressures they face, and it's not compliant with the AIP. More detail can be found in Air Safety Matters Leaflet No.55 (Helicopter Traffic).
See https://modgovuk.sharepoint.com/teams/23116 for all Air Safety Matters Leaflets.



Airprox No. 2023050
Typhoon v EMB145
3 Apr 23

The EMB145 Pilot reported that, on initial handover to RAF Coningsby, they requested vectors to an SRA to RW07, anticipating a visual approach. Once visual with the field, and at approximately 5NM, the Radar controller informed them the airfield was in their 10 o'clock position at which point they declared visual and requested a visual approach. A visual approach was approved, and they were transferred to Tower frequency. They checked in with Tower on left base and flew a visual approach. They recalled then calling 'final 07' and the response from Tower was vague, however, they do recall being told there were '3 in' to which they understood there were three aircraft in the circuit and began looking. They observed the first aircraft on a right base turn which was subsequently instructed to go-around. This call was immediately followed by a second Typhoon declaring 'Minimum Fuel'. There were two Typhoons still on the downwind leg with one about to turn right base. Typhoon No.1 passed in front of them at a range of approximately 1NM, which triggered a 'Traffic Advisory' on the TCAS. This Typhoon was making a right hand turn to orientate itself on the deadside of the circuit pattern to follow the missed approach. At this point they heard a second go-around instruction but with a similar callsign on frequency

they asked the controller to confirm whether the instruction to go-around was for themselves or for Typhoon No.2. 1 The ambiguity they perceived was that the controller said "Go-Around deadside" which was not a term they would expect to hear having come off an instrument approach, coupled with the fact there was a Typhoon on their left (deadside) they could not comply with the instruction. They then asked the Tower controller to clarify the go-around instruction to which they replied "right-hand". They proceeded to maintain runway track, climbed to 2000ft and made a wide righthand visual circuit.

The Typhoon #3 Pilot reported that during the upwind turn, following a low approach, they heard the following check-in: "Coningsby Tower it's [EMB145], turning final runway 07". ATC responded with "[EMB145], Coningsby Tower, join runway 07RH QFE 1029, got 3 in".
The other pilot responded with "[EMB145]". With the fuel passing 900kg and concerned at where this new arrival would arrive in the circuit, the Typhoon pilot called "[Typhoon], Downwind to land, minimum fuel", in order to ensure priority and land above the [minimum landing fuel] of 800kg. Twenty-two seconds later, after the Typhoon ahead in the circuit went around, Coningsby Tower called " [EMB145 C/S], you have one ahead with minimum fuel, join or go-around deadside". The EMB145 responded with "Join, [EMB145 C/S]".
At this point, the Typhoon pilot reached the end of the downwind leg with the perception that the EMB145 was on a join and therefore no factor for their final turn. They looked into the turn to see the Typhoon ahead in the circuit going around, tipped final with the associated comm and at 1414:47 was given clearance to land. At 1414:51, the EMB145 called "[EMB145 C/S], confirm we were on a continue approach?".
ATC responded with "[EMB145 C/S], negative, go-around circuit height".
This was acknowledged and actioned at around the same time that the the EMB145 passed through their Head-up Display, co-altitude at 600ft and about 3000ft ahead. The Typhoon pilot was very surprised to see the EMB145 in front of them but perceived no collision risk. They eased left and up to increase separation before recommencing the final turn for an uneventful landing. They considered it luck rather than judgement that they did not pass closer, because they were 'belly up' for a large part of the final turn. Following discussion with the ATC Supervisor on the ground, it appeared that the EMB145 pilot joined via left base, essentially flying an opposite circuit to themselves, which allowed them to get down to about 500ft on the extended centreline with no clearance to land.

The U/T Coningsby Tower Controller reported the EMB145 came in visually on RW07RH, initially coming in on radar and then changed to visual recovery with 3 Typhoons already in the circuit.
As the EMB145 pilot requested to land with gear down, Typhoon #1 went minimum fuel late downwind.
The EMB145 was unable to get the clearance to land and was told to go around at circuit height. Typhoon #1 had the clearance to land and the EMB145 pilot once again asked for clearance to land, and again was told to go around circuit height. Once established in the circuit, the EMB145 extended far downwind at 1500ft. There was confusion from the pilot in relation to the visual circuit, which caused a delay getting the EMB145 and the Typhoons in.

The OJTI Coningsby Tower Controller reported they had been on a break and the visual circuit had 3 Typhoons in.
The EMB145 pilot then called for a left-base join. They were surprised by this as they had not seen the EMB145 join left-base before with 3 already established in the circuit. With knowledge of this, they were going to instruct the trainee to tell all Typhoons in the visual circuit to orbit at 1000ft while the EMB145 pilot completed their landing. However, Typhoon #1 downwind then declared min fuel and the EMB145 pilot was told to go around and join deadside. The min fuel Typhoon #1 was then cleared to land with the EMB145 pilot believed to be going around. [The EMB145 pilot] then asked if they were on a continue and they were again told negative go-around circuit height. [The EMB145 pilot] then positioned downwind and was told to climb to height 1500ft to ensure vertical separation with the other visual circuit traffic.

The Coningsby Supervisor reported that due to a full visual circuit, they made their way to the VCR. Furthermore, the EMB145 was on a radar approach to land. The EMB145 pilot elected to switch to a visual approach. Initially, this would have put the EMB145 No1 to use the runway but the first Typhoon downwind declared minimum fuel. Due to the priority list, the Typhoon was instructed to land ahead of the EMB145, who was instructed to go around.

For the full report, see Airprox No. 2023050 on the Airprox Board Website.

Spry's Comments:

Mixed circuits with fast jets and multi-engine aircraft offer a particular challenge due to differing requirements on-board and the size of the circuit. Many airfields prohibit mixed circuits for these reasons. Whilst there were many lessons to draw from this event, one area of focus is the use of standard CAP413 terminology. This document states that either 'go around' or 'execute the missed approach procedure' should be used. This leaves all parties aware of what they should do, or what the aircraft associated with that aircraft will do, which will enhance SA of all proximate aircraft. This document is an easy read and is easily found online with a search engine. Chapter 10 covers military-specific terminology.

Safety Contacts:

Group / Station / Unit	Flight Safety Officers	Health, Safety & Environmental Protection Advisors
1Gp	01494 495454	-
2Gp	01494 495049	-
11 Gp	0300 165 7695	-
22 Gp	030 6798 0101	-
Air Support	01494 497923	-
BM	95760 3230	
JHC	01264 381526	-
Test & Evaluation (ASWC)	01522 727743	-
1ACC	01522 603359	-
2FTS	01400 264522	01400 264551
3FTS	01400 267536	-
4 FTS	01407 762241 6666	-
6FTS	01400 266944	-
Air Cadets (RAFAC)	-	01400 267817
Boulmer	01665 607325	01665 607282 / 7289
Benson	01491 837766 6666 / 7525	01491 827109 / 7254
MOD Boscombe Down	01980 662087	01980 662312
Brize Norton	01993 895764 / 6666	01993 895525 / 7062
Coningsby	01526 346575	01526 347256 / 7196
Cosford	01902 704037	01903 37472 / 237
Cranwell	01400 266666	01400 267469 / 7498
Defence Geographic Centre	0208 8182816	94641 4816
Fylingdales	-	01751 467216
Halton	01296 656666	01296 656640
Henlow	01462 851515 6150	01462 857604
High Wycombe	01494 494454	01494 496489 / 5094
Honington	01359 236069	01359 237782 / 7516
Swanwick	01489 612082	-
Leeming	01677 456666	01677 457637 / 7231
Leuchars	01334 856666	-
Lossiemouth	01343 816666 / 7714	01343 817796 / 7697
Lynham	-	01189 763532
Marham	01760 337261 6666	01760 337595 / 7199
No1 AIDU	02082 105344	-
Northolt	020 8833 8571	02088 338319 / 38521
Odiham	01256 702134 6666 / 6724	01256 702134 7650 / 7733
Scampton	01522 733053	01522 733325 / 3137
Shawbury	01939 250351 6666	01939 250351 7529 / 7559
Spadeadam	-	01697 749204
St Athan	01446 798394	01446 797426 / 8250
St Mawgan	01637 857380/95423 7380	01637 857162
Syerston	01400 264522	01400 264551
Tactical Supply Wing	95461 7177	-
Valley	01407 762241 6666	01407 767800 / 7685
Waddington	01522 726666	03001684954
Wittering	01780 416377	01780 417611
Woodvale	01704 872287 x 7306	
Wyton	01480 52451 7554 / 7146	-
Overseas Flight Safety Contacts	**Telephone**	**Email**
Al Udeid	9250 060 451 3043	83EAG-DepFSO@mod.gov.uk
Ascension	00247 63307	BFSAI-ASCOpsOC@mod.gov.uk
Akrotiri	94120 6666	BFC-Aki-Safety-AssuranceSFSO@mod.gov.uk
83 EAG	9250 060 451 3050	83EAG-AIROPSFSO@mod.gov.uk
Gibraltar	9231 98531 3365	GIB-RAF-ASM@mod.gov.uk
MPA	00500 75490 or 94130 5490	BFSAI-AirOpsWg-ASM@mod.gov.uk
Tactical Leadership Programme	0034 967 598527	aa3@tlp-info.org
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