The RAF Total Safety Magazine

Issue 38

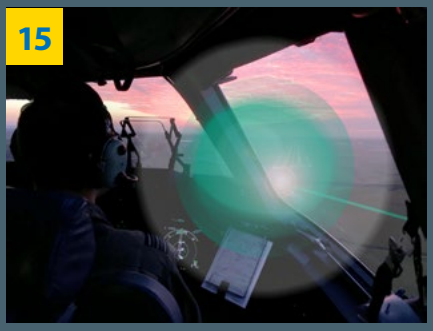
AirClues

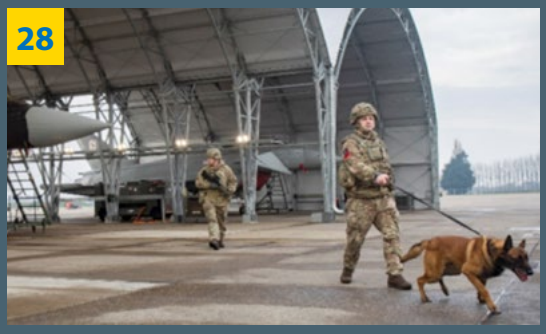
Military Working Dogs and their Handlers

Laser Illumination Hazards

Simplifying Safety in the Nuclear Industry

ROYAL AIR FORCE Safety Centre





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June 2022
Produced by Air Media Centre, HQ Air Command. XXXX_22WP

Foreword

by the Inspector of Safety (RAF) Air Cdre Sam Sansome

Air Commodore Sam Sansome

Welcome to Issue 38 of Air Clues. It is a little disturbing, I feel, how quickly we become adjusted to the 'new normal'. We are only shortly past the horrendous milestone of '100 days of war in Ukraine' and yet the daily ritual of catching up on the latest news has already become a habit rather than the pressing need it was 3 months ago. The increase in operational tempo also seems to have become the 'new normal' which is a concern when there is no obvious review point to take stock and re-align task and resource – the surge is in danger of becoming steady-state. All of us do, however, still have options available to us, supported by the strong safety culture that we have been cultivating across Air Safety and now across Functional Safety. We have choices of attitude and behaviour that can make us all safer – and as my colleague from the US Marine Corps said at the Defence Aviation Safety Conference recently: "No one wants to turn round and find a gap where a teammate should have been". Nobody is going to thank you for causing an accident or getting injured yourself if you are driving when tired, nobody wants a fatigued pilot flying their plane or an engineer rushing a job to get the next serial on the flying programme. We all have the choice to be safe and to act safely – so please do all you can to make the right choices and help others to do the same.

This edition of Air Clues has something for everyone (as usual!) – from dog lovers to data lovers and lots in between. In a shameless plug, however, I'd particularly like to draw your attention to the HQ AIR Environmental Awards. The majority of our readers are from the Whole Force and there is an opportunity for everyone in it to take part in this exciting and hugely important competition. With awards covering many of our environmental targets and the most pressing environmental issues as well as awards for contractors and cadets, the awards have really spread their wings this year – we even have a special award to commemorate the Queen's Platinum Jubilee with the 'Queen's Green Canopy' award. Please take 5 minutes to have a look at the Environmental Awards information on the Safety Centre Communication page (link in the article!) and think about any projects you have running or would like to start – no project too small so get the grey cells working and step up and nominate people working in your areas!

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

Corporal Gareth Batchelor – RAF CAM Commendation

Corporal Gareth Batchelor, an Engineer with the RAF Centre of Aviation Medicine (RAF CAM) at RAF Henlow, identified that the loss of RAF Henlow's Airfield Manager had resulted in a lack of an airfield ops subject matter expert (SME); this risked failure to safely complete the required airfield closure actions, including declaring the airfield surfaces out of use. He recognised the clear risk to both military and civilian aviation and undertook to coordinate with both the No.1 Aeronautical Information Documents Unit (AIDU) and civilian publications to ensure Henlow's 'disused' status was correctly published. When an unknown civil aircraft landed at Henlow, Corporal Batchelor submitted a Defence Air Safety Occurrence Report (DASOR). He found that an expired NOTAM was identified as the culprit; details were handed to UK CAA for further action.

Separately, Corporal Batchelor paid extraordinarily close attention to DASOR of relevance to RAF CAM. Through his role as a prime recipient, he realised that the system could be significantly improved. He proposed that ASIMS be amended to include RAF CAM as a new role group in the distribution lists. Occurrence managers have, for the first time, an ability to flag DASOR of Aviation Medicine concern straight to the SME. His proposal was actioned in a matter of weeks and proved immediately effective.

Finally, Corporal Batchelor has qualified as an MAA Air Safety Manager and Practitioner and assumed responsibility as the RAF CAM Air Safety Information Management System point of contact. He has already voluntarily expanded this role to the benefit to RAF Henlow, identifying and correcting erroneous information and further volunteering as the Henlow HLS coordinator.

Mr Steve Milligan – Babcock, 6 FTS RAF Wittering
Well Done

On 28 October 2021, Mr Steve Milligan, an Aircraft Handler working for Babcock International Group, was conducting the see-off of a Grob Tutor aircraft at RAF Wittering.
As the engine was started, Mr Milligan thought he heard an unusual rattling sound coming from the aircraft. However, there were no external indications of anything untoward before the aircraft taxied for take-off. After returning to the flight line operations room, Mr Milligan discussed with his colleagues what such a noise could have been and decided to recall the aircraft for further investigation before it could get airborne.

During the subsequent investigation, it was discovered that the No.2 cylinder exhaust manifold had sheared. This fault might have led to CO emissions finding their way into the cockpit, the consequences of which could have been serious. CO is insidious, its presence easily going unnoticed, and could have resulted in the crew becoming incapacitated.

Recent Awards – Send us a photo of the presentation and we will include it in Air Clues

Sgt James Chalmers	903 EAW	47 Sqn	**Well Done**
SAC Megan Lea	RAFC Cranwell	Ops Sqn	**Well Done**
SAC(T) Andrew O'Brien	RAF Odiham	18 Sqn	**Well Done**
Flt Lt Matthew McLean	RAF Brize Norton	99 Sqn	**Good Show**
SAC(T) James Woodhouse	RAF Brize Norton	LXX Sqn	**Well Done**
Mr John Littler	RAF Marham	ATC	**Well Done**
SAC(T) Aaron Dack	RAF Marham	207 Sqn	**Well Done**
SAC Corey Passant	RAF Marham	207 Sqn	**Well Done**
Sgt Scott Sharkey	RAF Spadeadam	Ops Sqn	**Well Done**
Flt Lt Michael Thomsen	RAF Boulmer	20 Sqn	**Good Show**
Cpl Alethea McKay	RAF Lossiemouth	ATC	**Well Done**
A/Cpl Jack Knight	RAF Coningsby	MT	**Commendation**
Cpl Barry Latter	RAF Lossiemouth	IX(B) Sqn	**Well Done**
SAC(T) Jack Blackwell	RAF Lossiemouth	IX(B) Sqn	**Well Done**
Mr Ian Walsh	RAF Marham	MFF	**Well Done**
207 Sqn See-In Team	RAF Marham	207 Sqn	**Good Show**
Mr Martyn Cox	Boscombe Down	CH-47 Maintenance	**Good Show**
Flt Lt Trevor Grant	RAFC Cranwell	45 Sqn	**Commendation**
Pte Moesh Patrichot	RAF Northolt	MPGS	**Well Done**
Mr Noel Allsop	RAF Northolt	VASS	**Well Done**
SAC Ross Elliott	RAF Odiham	18(B) Sqn	**Well Done**
SAC Poppy Tatam	RAF Lossiemouth	51 Sqn RAF Regt	**Well Done**
Mr Phillip Adkins	RAF Brize Norton	Air Tanker	**Well Done**
Mr Steven Bolger	RAFC Cranwell	Babcock	**Good Show**
SAC(T) James Darwin	RAF Scampton	RAFAT	**Well Done**
PC Stephanie Blakemore	RAF Gibraltar	Gibraltar Defence Police	**Well Done**
Cpl Lee Burtle	RAF Gibraltar	GES	**Well Done**
Flt Lt Matthew Clarkson	RAF Odiham	18 sqn	**Well Done**
Flt Lt Andrew Preece	RAF Coningsby	BBMF	**Green Endorsement**

Air Command
Environmental Awards

By RAF Safety Centre

In 2020, the first Air Command Environmental awards launched, co-ordinated and led by the CESO EP team at the RAF Safety Centre. This was an important opportunity to encourage, recognise and deliver environmental outcomes and engage colleagues across the Air TLB. The awards commenced with simple categories that allowed teams or individuals to enter nominations or submissions to showcase initiatives that were subsequently assessed through a scoring matrix of key values. Principles such as the ability to replicate the idea, social value, community contribution, cost and resourcefulness, and evidence of really going above and beyond the day job. The awards include an ethos of 'no project too small' to really promote the bigger picture benefit of every single effort that contributes to the environment.

2020/21 Air Command Environmental Award winners:

Environmental Champion Team Award
RAF Leeming EXperimental Innovation Hub (RAFX) for its work to trial and implement multiple different energy conservation technologies with an aspiration for these to be scaled up across Stations in the future. In addition, the team set up polytunnels for service families to grow crops and pursued several sustainable agricultural trials.

Energy Conservation Champion, Individual Award
Mr Glenn Chatwood, HMS Sultan. Glenn demonstrated significant personal commitment to his role, going above and beyond to implement energy management and water saving technologies across the HMS Sultan site.

Environmental Champion, Individual Award
This accolade was bestowed upon Warrant Officer Graham Spark at RAF Marham. Demolition and construction work to make way for the F-35 Lightning in 2014 sparked Graham's dedication to the environment and he quickly led a team and community projects, to create a new area of natural habitat for wildlife.

2020/21 Award winners
clockwise, WO Graham Spark – RAF Marham, Mr Glenn Chatwood – HMS Sultan and Group Capt Blythe Crawford representing the team at RAF Leeming RAFX eXperimental innovation hub

Air Command Environmental Awards 2022

This year, the Air Command Environmental Awards is back with an exciting new set of categories that have been specially developed to focus on some of the more pressing aspects of Environment that we need everyone's help to focus on. In May 2022, we launched the next round of the Air Command Environmental awards with the following categories:

- **Best Environmental Project in Waste and Resource Innovation.**
  Let's start thinking of waste as a resource, rather than something we throw away, so how might we rethink anything from a process we follow or product we use – to reduce anything we discard at the end? This category is looking for those solutions that helps us to reduce waste and reuse what we have. Can you or your team find a new solution for something simple?

- **Best Environmental Project in Water Conservation or Protection.**
  Water is a hugely precious resource and is set to become increasingly scarce. It takes a great deal of energy to clean water for use fresh from the tap, but it is all too often polluted very easily. This can have significant impacts on human health and nature. Can we find ways to better harvest water as a resource or protect water quality?

- **Best Environmental Project in Biodiversity and habitat enhancement.**
  Our estates contain huge areas of natural habitat that we're very proud to be custodians of. With growing pressure on biodiversity from Climate Change and land use requirements, we need to find novel ways to enhance and protect nature. Can you find a way to ensure a natural habitat is enhanced or protected at your Station? Perhaps you have a novel idea to integrate nature with our infrastructure?

- **Special Award in commemoration of Her Majesty The Queen's Platinum Jubilee, through project delivery of the Queens Green Canopy initiative.**
  This year all our Stations are participating in the Queen's Green Canopy initiative to commemorate Her Majesty's Platinum Jubilee. Thanks to extra funding made available our teams are really going the extra mile to leave a lasting legacy through tree planting. We've included a special category to recognise one project that really embraces this theme. We can't wait to showcase these fantastic projects!

- **Best Environmental Project in Energy and Emissions Innovation.**
  The RAF has an exciting aspiration to become Net Zero Carbon emissions by 2040. Work is underway to make our estates and equipment more sustainable and to reduce our impact on Climate Change. We need everyone to play their part in reducing fuel and energy consumption. Are you working on something that might help the Air Force to become Net Zero? Can you implement an idea that might fit this requirement? Thinking about everything from systems and processes to technology and logistics, how can we reduce the carbon footprint of our infrastructure and operations? Remember, no project is too small!

- **Best Contractor delivering Environmental Excellence.**
  Embracing the ethos of 'whole force' and recognition of every effort contributing to environmental outcomes, this year we have included a category which will recognise the efforts of our contractors in helping us to achieve our environmental outcomes. We'll be looking for evidence of projects that go above and beyond and really have that extra social value contribution. Calling all contractors!

- **RAF Air Cadets – Best Environmental Initiative.**
  This year we are delighted to be including the RAF Air Cadets within our main Air Force Environmental Awards. We recognise the importance of engaging the next generation of RAF recruits and we want to harness the ideas and ambitions of our potential future recruits, whilst also taking the opportunity to demonstrate in return, that the RAF recognises the importance of Environment and Sustainability to the next generation.

The awards will close to entries on 28th October 2022, so be sure to submit your winning nominations by the closing date. Entries will be judged by a panel of technical specialists and endorsed accordingly by the award sponsors DCom Ops and DCom Cap, who will then award the winners their trophies via a special ceremony at a date to be confirmed.

Calling the Whole Force:

Enter HQ Air's Environmental Awards!

Open to the Whole Force, the Environmental Awards categories include:

- **Best Environmental Project in Waste & Resource Innovation**
- **Best Environmental Project in Water Conservation or Protection**
- **Best Environmental Project in Biodiversity and Habitat Enhancement** (including the Queen's Green Canopy)
- **Best Environmental Project in Energy & Emissions Innovation**
- **Best Contractor delivering Environmental Excellence**
- **Best Environmental Initiative (RAF Air Cadets)**

No project too small!

Visit the Safety Centre SharePoint*:
https://modgovuk.sharepoint.com/teams/23116
for more information and how to enter.
Closing date for entries is **28 October 2022.**

***Only accessible on MOD devices**

Produced by Air Media Centre, HQ Air Command. 0100_22TW

ROYAL AIR FORCE Safety Centre

We Must All Learn About Simulating From That!
(Occurrence Reporting in the Sim)

by Gp Capt Mark Manwaring, Inspector of Flight Safety, RAF Safety Centre

Two months after starting the Phantom Operational Conversion Unit (OCU) Air Defence Course, my student pilot and I flew into the North Sea and survived. The reason we did not perish during this crash was that we were on Simulator Exercise 15 and this Controlled Flight Into Terrain (CFIT) resulted in nothing more fatal than the possibility of being placed on review.

This simulator sortie introduced student crews to visual identification procedures against an unknown target at heights below 10,000' in cloud. This was pretty much the limit of the F-4 simulator which was not a 'visual' simulator; however, the radar and weapons system provided an accurate representation of the real aircraft and the best opportunity to rehearse the profile in a safe environment.

After an uneventful long-range intercept on a target at 5,000', we followed the Standard Operating Procedure of closing to 200 yards, from below the target (which improved pulse radar performance against background clutter). For new OCU students, operating as an all-student crew, this was one of the most demanding exercises, requiring total concentration and constant communication. Inside 1,000 yards, with overtake of around 40 knots, things start to get busier and of course there was the additional expectation of simulator instructors' inputs such as a catastrophic double-engine fire! Inside 500 yards, the overtake was under control, we were maintaining 10 degrees elevation below the target and all seemed to be going well when the simulator froze and the canopies automatically opened. 'Oh well, the Sim is broken again' we said to each other, only to notice the instructors stood there to inform us

that we were now both 'dead' – they had slowly descended the target aircraft without us noticing and we had consequently descended into the sea by remaining below it. The debrief was rightly embarrassing and the lessons were learnt and stored away for the long-term by that young and handsome crew.

Q1. So, apart from the other members of our course, who benefitted and was able to learn from our mistaken experience?
A1. No one.

Q2. Was an occurrence report from the synthetic environment 'even a thing'?
A2. No.

Q3. Why not?
A3. Immature Reporting Culture (and possibly the-then lack of a Just Culture).

Throughout my flying career, I consider myself to have been lucky in avoiding near life-threatening circumstances – or at least those that I noticed! Wherever and whenever a near-miss or mishap occurred in the live environment, reports have been meticulously completed and the Reporting Culture supported. However, I can honestly say that I have never reported an occurrence in the synthetic environment, which I now consider to be an unacceptable omission on my part. It takes vast amounts of accumulated evidence to populate the unseen part of the iceberg and to bring awareness and subsequent changes to training and put other mitigations into place. I often wonder if that missing occurrence report might have been the final piece of evidence that could have prevented a subsequent fatal CFIT accident.

> “I often wonder if that missing occurrence report might have been the final piece of evidence that could have prevented a subsequent fatal CFIT accident.”

As we continue to evolve the live/synthetic mix towards that of simulation, it is critical that synthetic sorties are treated the same as live when it comes to Reporting and Learning Cultures. Disappointingly, the statistics do not currently support this, with just 0.73% of all RAF DASORs originating from the synthetic environment (and 0.66% across Defence). This must improve. Failure to do this will result in an unacceptable decline in reporting. Given the control we have in safely creating scenarios in the synthetic environment, it provides fantastic learning opportunities for the crews involved – now we must ensure these lessons are more broadly shared.

Civil Insights from the UK Flight Safety Committee

What Does Data Mean To You?

by Air Cdre (Retd) Dai Whittingham, Chief Executive, UK Flight Safety Committee

Having a budget that is stretched to deliver the required operational capability is not a new phenomenon. Even before budgets were delegated, there were times when the demand for savings had effects that were very definitely felt at the front line. In my own case, I was on a squadron when the financial pressure manifested as a hard limit on fuel. The sqn cdr was told he only had X cubic metres of Avtur to play with but that he still had to meet the NATO target of 20hrs per pilot per month (the Cold War was still in full swing). As a contextual flavour, there was also a moratorium on the purchase of any form of stationery, which saw some of the support staff having to buy their own pens to complete their normal tasks.

The fuel situation was both a limitation and a blessing, because it coincided with a 'small problem' with the consumption of aircraft fatigue life which was in turn driving the need for penalty maintenance and reducing fleet availability. The answer was for several months to fly carefully, conserving fuel and fatigue at the same time, however frustrating that might be. There was enough of each to do some high-tariff training but it was still quite a serious limitation on 'normal' activity. While all I had to manage at that stage was myself, and my only leadership burden was the occasional 4-ship, the Boss and SEngO were still trying to manage the hours/fuel/fatigue equation and it was not balancing as hoped.

The answer eventually emerged from the data, or at least what passed for data in a non-digital age. A manual extraction from the F700s of fuel consumption, hours accrued and fatigue units consumed across all 24 pilots in the sqn showed that the 2 pilots with the lowest average hours per sortie were also responsible for much of the excess fuel consumption and most of the fatigue use. While most us had been tip-toeing through initials at 300kts and turning so gently downwind we might have been mistaken for crews from another large NATO nation, these two were arriving at warp speed before breaking with a minimum of 4G and usually closer to 6G if their navigators were to be believed. Similar behaviour was being exhibited throughout their sorties, turns using less than 4G apparently being reserved for less punchy people.

As you might imagine, the Boss decided that some counselling was required, which involved "Rip the wings off" formation being confronted with the evidence and left in no doubt that they either complied with the handling policy or spent some significant time on the ground. The latter option would of course have given them time to

drink the coffee the Boss had failed to provide as part of his counselling session but, in the event, they chose to step into line. That said, they had broken no limits and their only real sin was one of interpretation.

A deeper look at the F700 history showed the evidence, had anyone looked for it, was there long before the fuel moratorium was introduced. And perhaps a wider and earlier look might have staved off the fatigue problem before it became limiting, because lots of people were using more G and fuel than necessary it affected every sqn in one way or another.

Having data gives you the ability to conduct trend analysis, which matters if you want to preserve resources for operational tasks and have the right equipment for the job. The availability of flight data monitoring (FDM), in whatever form it takes, also allows the engineers to keep an eye on fatigue life and hopefully to head off some of the disasters of the past. I am old enough to remember the loss of 2 Buccaneer crews in separate fatigue-related accidents, both involving structural failures and immediate loss of control at low level in comparatively benign flight conditions. Part of the chain of events had been use of the aircraft on sortie profiles that were not envisaged by the designers – prolonged overland low level rather than less turbulent over-water work. The 'work as done versus work as imagined' difference would perhaps have become clear much earlier had that data been easily available, and 4 families might have had a very different path through life.

While FDM works its way through the front line there are clear signs that it will be a weapon in the battle for Net-Zero Carbon. Data on the more efficient continuous descent profiles is already allowing your commercial colleagues to burn less fuel and make less noise while doing it, reduce the risk of unstable approaches (speed, configuration, runway alignment and descent rates) and hence reduce the risk of a runway excursion. Unstable approaches are perhaps less of a problem with Typhoon or Chinook, but it is certainly something the ME fleets will be thinking about.

Fuel carriage is another area for saving, provided the data is used sensibly. Twenty years ago, or thereabouts, it was calculated that E-3D training sorties were routinely landing with around 50 kg of fuel beyond that needed for the task, and often more. Crews were rounding up the plan fuel and then adding a comfort factor rather than find themselves landing a few minutes early or getting into the 'special fuel handling' regime that generated a minor pitch attitude limitation. In practice, it meant the fleet was burning over 115 tonnes of fuel per year just to carry the extra. Not exactly green, and certainly a waste of resources…

A large UK operator has taken this concept further and has instituted a Statistical Contingency Fuel system. It has used the data from hundreds of flights into specific destinations and worked out how much fuel should be in the tanks after landing, taking full account of the final reserve fuel regulatory requirement and typical experiences with delays and the like. Captains still have the authority to load additional fuel if they judge it necessary, such as concerns about unusually difficult arrival weather. The data gives additional management information, for example a consistent approach to carrying extra fuel could indicate an issue with the training system or with an over-conservative approach to risk.

One of the issues facing safety managers and regulators is what constitutes data (evidence), what should be included and what should not – this is not an unreasonable question when you are trying to manage a performance-based system. The difficulty is that opinions on data are variable. There are some who argue that data can only be empirical and are absolute, such as numbers of incidents, safety reports, etc. There is no denying that hard facts such as report numbers give you evidence. However, it only gives you evidence of what has been reported, and here we drift into the Donald Rumsfeld world of known unknowns and unknown unknowns. How do you judge the volume of unreported events?

Compared with some elements of commercial aviation, the reporting culture in UK military aviation is very good because it is backed up by a solid safety culture. Whilst most airlines will claim to have a Just Culture process, in practice this can often be a long way from reality and reporting is suppressed as a result. Some European operators have seen reporting levels dwindle over the last year, with the ground handling element of one announcing that it saw no need to have a Just Culture approach. Sadly, these instances can normally be traced to the top of the organisations concerned – good leadership in these areas really matters. The words and especially actions emanating from board level ripple downwards, and sacking the messenger had predictable outcomes.

It does not take much to deter open and honest reporting. Ease of reporting is a case in point. A friend recently confided that he had stopped reporting because his company's new App was frustratingly difficult and time consuming, and he had no feedback on the outcome. He is an ex-FJ QWI and an experienced training captain and examiner; he was saddened that his own professional standards had been eroded by the system but had reluctantly decided to report only the mandated occurrences. He knows this is far from ideal and that there is a loss of data as a result. He will not be alone in taking such a line; a comment from a colleague in a European airline suggested that not only has the volume of reporting reduced but so has the richness of the information within the reports.

In the absence of empirical data, there are still avenues for understanding what is happening. Anecdotal evidence can be important too, though it is often dismissed as unscientific or prone to bias. When leaders and safety managers actively listen and reflect on what they are being told there is usually a grain of truth to be extracted, because people in aviation systems don't tend to make things up just to cause trouble. So, you need to get out there and listen.

The other advantage of anecdotal evidence is, as the name implies, the story-based nature of the information. The learning specialists will tell you that we are very good at remembering stories – it is the way our forebears used to pass on their own learning and history. "War stories" have their place in learning and development, which is why time spent chatting in the crew room is not as unproductive as some would have you think. There is a rich source of information there should you choose to listen (that word again…) and reflect. Debriefing is a skill that perhaps needs to be taught rather than absorbed but capturing the stories from the trip you have just flown is important.

The good news here is that the Services have a deeply ingrained debriefing culture. Your commercial colleagues do not, a post-flight discussion of any form tending to be the exception rather than the rule. Just think about the volume of information – data – that goes missing as a result. Per the Rumsfeld question, what don't we know we don't know?

Laser Illumination Hazards and Protection

By Dr Eric P Liggins CPhys, Principal Scientist, QinetiQ

Laser hazards

Lasers have come out of the comic book and James Bond movie, out of the research laboratory and into everyday life. Lasers are now ubiquitous in IT equipment, home appliances and the workplace; but what properties of lasers make them different from other light sources, and why does it matter to aircrew?

Laser light differs from other light sources such as lamps, LEDs and digital projectors in a number of ways. The main reasons that a laser beam can be a safety problem for aircrew are two-fold: firstly, what is called "collimation" – how quickly the beam spreads out, or diverges, as it travels; and secondly, the fact that lasers emitting in the visible spectrum almost always appear as a point source to the observer, and thus even low-power lasers seem subjectively very "bright". Both these aspects mark out lasers as something requiring special attention.

Laser collimation arises from the way that the light is generated in the laser device, meaning that the light emerges in a single direction. Due to the optical phenomenon of diffraction, a laser beam does diverge very slightly as it propagates, but the degree of spread is usually very small, and much smaller than can be achieved by, say,

adding lenses to a conventional light source to focus it. As a result, when a laser beam arrives at the cockpit, and at the eye, the chance of a large amount of energy entering through the ocular pupil is much higher than for a source such as a searchlight or a torch. That energy can cause temporary or permanent effects in the eye of the individual who has been exposed to it – something we'll touch on in a moment.

The point source nature of a laser means that, where the emitted radiation is in the visible spectrum, the source appears incredibly bright. A modestly-powered laser can easily exceed the brightness of the sun's surface as viewed from the earth. Having said that, not all laser beams are visible, and it is therefore possible to have a large dose of energy from, for example, an infra-red laser, enter the eye and not be aware of it.

Three flavours – distraction, damage and dazzle

Transient and permanent laser effects were mentioned above. These effects (see Fig.1) can be categorized into:

- distraction (transient),
- dazzle, also called glare, that is usually accompanied by a short period of flashblindness after the light source is removed (transient),
- retinal or corneal damage (permanent).

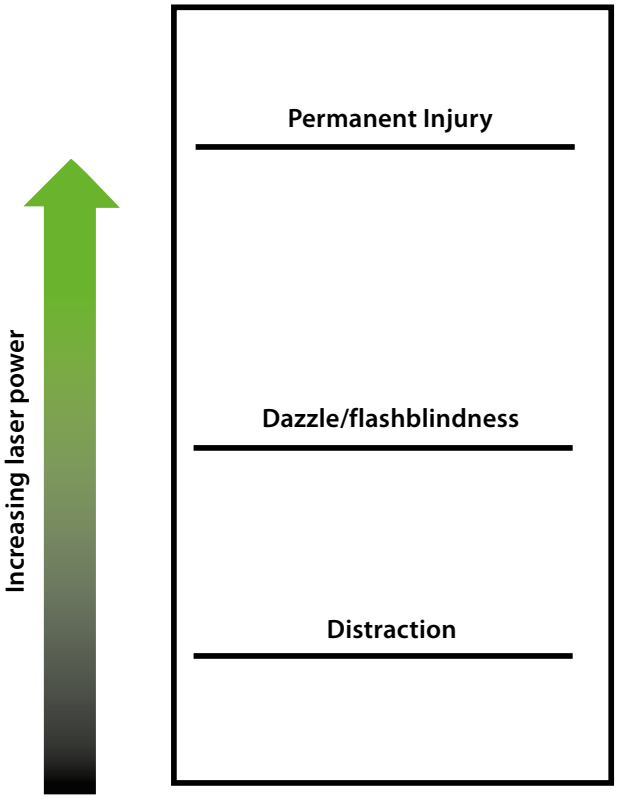


Fig. 1

A large number of light sources – not just lasers – can give rise to distraction, particularly at night. Lasers may stand out from the crowd by virtue of their high apparent brightness, monochromatic nature (in most cases there is only one very pure colour present in a laser beam) and possible speckle or other novel visual effects caused by optical interference between the beam, the atmosphere and cockpit transparencies. As such, they are hard to ignore, in case they signal a flight hazard. Because lasers are collimated, directing one's gaze towards a laser source in the periphery could be unhelpful if the result is a direct laser exposure, causing dazzle or even permanent damage. It would usually be best to categorise the distraction laser as just that – a distraction – and deny it the ability to degrade vision any further.

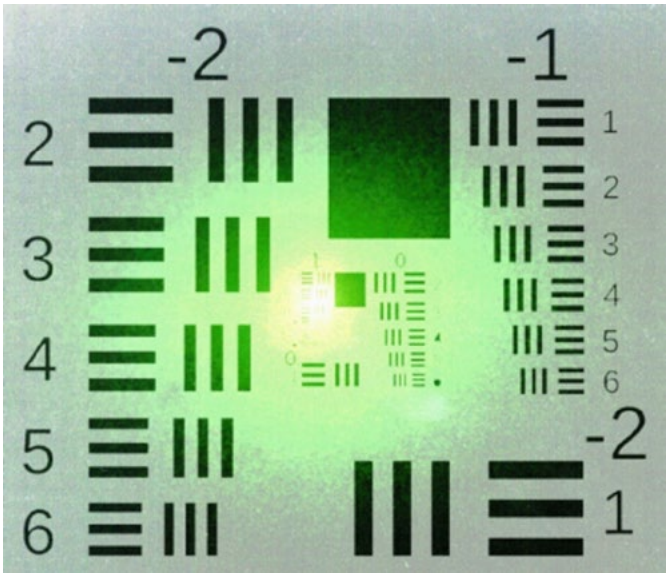


Fig. 2 - it is impossible to represent the sheer impact of viewing a laser using a picture

Low-to medium-power lasers that are not pulsed (referred to as "continuous wave" or CW) can cause temporary dazzle or glare when viewed directly. More powerful CW lasers, along with most lasers that deliver energy in short pulses, can cause permanent eye damage. The difficulty is that laser beams don't arrive at the cockpit with a convenient label, telling us whether they will cause a temporary effect or permanent damage. Thankfully, the best response is similar for both types: only the consequences of exposure are different. Consult the flowchart at Fig. 4 at the end of this article for more guidance.

During the exposure, temporary dazzle or glare leads to complete or partial obscuration of a portion of the visual field. Close to the laser's position, nothing can be seen except laser light. Further away from the central bright spot, the laser casts an obscuring veil of light over the scene, which sounds quite attractive but can be very annoying when trying to read instruments or see outside the cockpit.

The "odd man out" in this discussion is an invisible laser beam that could cause permanent eye damage without advertising its presence; we will address that in the section on the management of suspected eye injuries. It's also worth noting that night vision devices are not addressed in this

article; these devices can be dazzled or damaged, but the mechanisms and severity are naturally different from those for the naked eye.

Central versus peripheral laser exposures

Lasers that appear in the periphery of one's vision are less hazardous, watt for watt, than those in the central visual field, both in terms of permanent damage potential and dazzle/glare effects on visual tasks. The eye is an imperfect optical system and does not focus incoming beams from the periphery as well as it does those that are straight ahead or on-axis for the eye, meaning that energy from the laser is focussed onto a larger area of the retina. Thus the potential damage is less severe than for a tightly-focussed spot on the retina that would result from a straight-ahead exposure.
In terms of dazzle or glare, a visible-band laser in the periphery will still lead to part of the visual field being either totally or partially obscured, but the effect on the eye's ability to acquire key visual information is less severe than if a laser were to appear in the direction of gaze. This is because the centre of the visual field is used for high-resolution vision whilst the periphery is better suited to acquiring information relating to situational awareness. Knocking out that high-resolution central area has a more serious impact on visual task performance, particularly under low light conditions when recovery from afterimages can sometimes take several minutes.

If all this sounds like a cause for concern, the next question might inevitably be, "How do I protect myself against lasers?"

Protection

There are two broad categories of protection against laser attack in an aircraft: behavioural strategies and personal protective equipment (PPE). In this context, more ambitious ideas such as applying filters to the cockpit windows can be considered part of PPE.

Behavioural protection is a challenge because it is non-intuitive and – as noted when considering laser distraction – runs somewhat counter to a pilot's instinct to attend to anything outside the cockpit that is abnormal, that could be a threat, or could be safety-related (e.g. another aircraft approaching at the same altitude). However, it could be the difference between surviving the encounter and an air accident. Since the victim of an attack does not know whether the laser has the ability to cause permanent eye damage, the advice for aircrew being targeted by a visible laser is to avert the gaze from the perceived direction of the laser. If possible, use a hand or other opaque object to provide additional shielding. The sun glare visor offers a modest amount of protection (reducing the intensity to about 10% of its original level) but can be difficult to deploy without attenuating the whole visual field. Above all else, do not look directly at the laser.

More advice on action during – and following – a laser illumination incident is given below.

PPE - also known in the military domain as laser eye protection (LEP) - is great in theory, but if the laser wavelength (colour) is unknown, it is simply not possible to block out the whole spectrum and still see where one is flying. A perfect protector that absorbed completely at all wavelengths would be opaque! A more likely problem is that a threat laser line is very close in the spectrum to the colour of an indicator or display in the cockpit – or even colour-coded lighting on an airfield. Blocking the laser line completely could render that particular indicator or runway light invisible, or at least lead to it appearing dimmer; it could even change its perceived colour by notching out part of the spectrum where the light is emitting.

The result is akin to a game of "laser Russian roulette", where the designer of laser protection has to take a gamble on the most likely laser wavelengths (colours) that could appear in the cockpit, without blocking the output of any visible light sources that are critical for flight. Some laser wavelengths are more common than others – or, it would be fairer to say, are readily available at low cost and with significant amounts of output power. If PPE is to be used, it is usually advisable to tailor it to these commonly occurring wavelengths: the aim is then to absorb light sufficiently to reduce the impact of the laser on aircrew whilst simultaneously getting the overall optical transmission of the filter to be as high as possible. We normally recommend that a specifically calculated value called the luminous transmittance is at least 45%.

Luminous transmittance, also known as visible light transmittance (VLT) or Integrated Visible Photopic Transmittance (IVPT) is defined mathematically (see CIE Publication 015, Edition 4 (2018)). Essentially the transmittance of a filter, visor etc. across the visible spectrum is weighted by the sensitivity curve for the human eye (peaking in the green part of the spectrum) and a valid light source – usually one of a set of defined daylight spectra.

Modern materials are rapidly evolving, to the extent that yesterday's impossibility could well become tomorrow's commonplace. However, at the time of writing, PPE for lasers in the visible band still comes with a penalty in terms of visibility. It is possible that future systems, such as active protection (which, like a welding filter, only activates in the presence of an incoming laser beam) will get around the "unknown laser wavelengths" problem. Such systems are currently still in the research phase, but could appear in the future.

Another option that has been considered is to apply a coating or treatment to the aircraft windows or canopy to

block laser light but transmit non-laser light. For laser beams that are invisible, this is eminently possible. For visible laser beams, the "unknown wavelength problem" is still present – but is, in fact, more problematic because cockpit window treatments cannot be easily removed if they cause issues with visibility.

A concept currently being considered is a distributed system, where cockpit transparencies, helmet visors and spectacles worn under the visor could all work in combination to reduce laser threats to an acceptable level, with each element performing one laser-elimination role. The advantage of such an approach is that individual sub-components can be upgraded or removed as required, without the need to replace the whole laser protection suite.

Actions during and after a laser exposure

If flying with other aircrew, alert them to the laser illumination event and determine whether others have been – or are being – affected by the incident. If there are 2 crew and the other pilot has not been affected, hand over control to them as soon as it is safe to do so. Single-seat pilots should climb the aircraft as soon as possible. In the most commonly encountered laser illumination scenario (a ground-based source), this makes it a good deal harder for a threat laser beam to enter the cockpit.

If possible, manoeuvre the aircraft to block the laser. If on an approach, consider a go-around. If warned in advance by ATC of laser activity, request a different runway, holding until it is available, or consider diverting.

If the autopilot is not engaged, and it is safe to do so, engage it now.

Immediately after vision has recovered sufficiently, check instruments and ensure that the aircraft is at a safe height, heading and speed.

Turn cockpit or flight deck lighting to maximum brightness to minimise any further illumination or after-image effects. Useful vision recovers more rapidly in brighter ambient surroundings.

Report the laser strike to ATC including, if known, the direction and location of the laser source, beam colour and whether it appeared flashing (pulsed) or continuous and/or was perceived to be intentionally tracking the aircraft.
As noted above, do not look directly at the beam in order to do this, and consider declaring an emergency.

As soon as flight safety allows, check for dark/disturbed areas in your vision, one eye at a time.

If incapacitated, contact ATC for priority/emergency handling. For the single-seat pilot, your options are more limited. Depending on the severity of the damage to your eyesight, you may be left with no option but to eject from the aircraft (this is extremely unlikely, and most effects should recover within a few minutes).

If symptoms persist after landing, obtain an eye examination as soon as practicable (see the ALESA checklist below).
File a DASOR – MOR if civilian. Reporting of laser strikes (and indeed interference from any high powered light) is mandatory under the Air Navigation Order (2016), EU and Military Regulations. In the UK, ATC will notify the Police.
Write down as much information as possible for the Police.
Give serious consideration as to how the flight was affected. It is important to include in any report details of how the flight was disrupted. Include details of any distraction and visual interference (however short in duration) that was experienced, and details of any checklists interrupted.
If the flight profile was changed or energy management affected then this needs to be included. Any of the above may indicate the possible endangerment of the aircraft and should be reported as such.

If the normal procedures of a flight have been disrupted, especially if a handover of control has been required, then do not refrain from declaring that there was "endangerment" of flight upon a laser strike. This will allow perpetrators to be prosecuted under Article 240 of the Air Navigation Order (2016) as opposed to solely Article 225. This will give the courts the option to impose significant punishments that will, hopefully, attract media attention and act as a deterrent to others.

Consider carefully whether you are fit to fly future events, both physically and psychologically. It is for individual flight crew to determine their fitness to fly in such circumstances, regardless of operator policy.

If the manoeuvre and avoidance actions listed above not successful, and the worst case scenario happens – a full laser exposure – or if you suspect that you or a colleague may have been lased (even by an invisible laser) then the CAA has developed the Aviation Laser Exposure Self-Assessment (ALESA) tool. It is well suited to military as well as civilian aircrew. The tool can be downloaded for free, with instructions, for flight bags. It is a good idea to print a copy of the test grid (Fig. 3) and the flowchart (Fig. 4) in advance, for use in the case of a laser illumination incident.

The presence or absence of pain should not be used as an indicator of laser damage to the eyes; there are no pain-sensitive nerves in the retina at the back of the eye, so pain will not necessarily be present with a laser injury.
If any visual symptoms persist after landing then obtain an ophthalmologic examination. The ALESA flowchart gives good guidance on how seriously to take an illumination incident in terms of your personal ocular health.

Aviation Laser Exposure Self-Assessment (ALESA)
As published by the CAA. Downloadable from https://www.caa.co.uk/media/ycpd3nns/alesa-card-web-2.pdf.
Military aircrew can also access AP1269A, Leaflet 5-14, Annex D, Appendix 2 which is identical.

This self-assessment is designed to aid pilots, air-traffic controllers, or flight crew members who have been exposed to a laser beam in making a decision on whether or not to see an eye specialist.

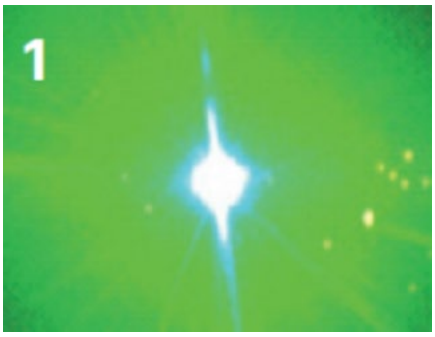
The eye specialist may be either an optometrist or ophthalmologist. It is extremely unlikely that a laser beam exposure will result in permanent eye damage.
Eye discomfort and irritation during the exposure is common and rubbing your eye can result in an abrasion that may be painful.

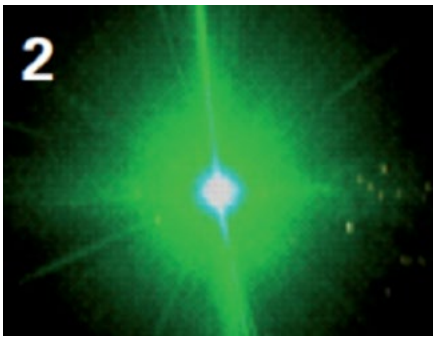
Symptoms
If you have experienced one or more of the following symptoms after a laser beam exposure please consult an eye specialist: Eye problems – swelling, pain, itching, watering, discharge, dryness or redness of the eye. Visual disturbance – blurring, black spot, trouble reading, loss of peripheral vision, floaters, halos, poor night vision, sensitivity to light.
These symptoms may not appear until hours after the incident and may not be related directly to laser exposure but could reflect other eye issues perhaps not previously noticed.

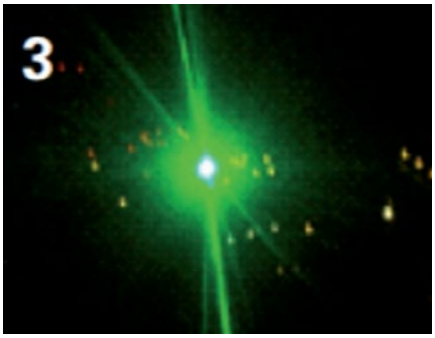
1. Flash blindness. A visual impairment during and after exposure to a brief, very bright light. It may last for seconds or minutes.

2. Glare or dazzle. Difficulty seeing in the presence of a bright light.

3. Distraction. A light bright enough to disrupt attention.







Amsler Grid Test
While viewing the grid from 30cm in front of your eyes, please test one eye at a time to answer the following Amsler Grid Questions:

1. Can you see a dot in the centre of the grid?
2. While looking at the centre dot, can you see all four sides and corners of the grid?

3. While looking at the centre dot, do all of the lines appear straight with no distortions or blank or faded areas?

If you answered YES to all three questions then please see the ALESA Flowchart at Fig. 4. If you answered NO to any of the above questions then you may wish to remove yourself from flying or controlling duties as soon as it is safe to do so and consult an eye specialist.
ALESA Flowchart (Fig. 4)

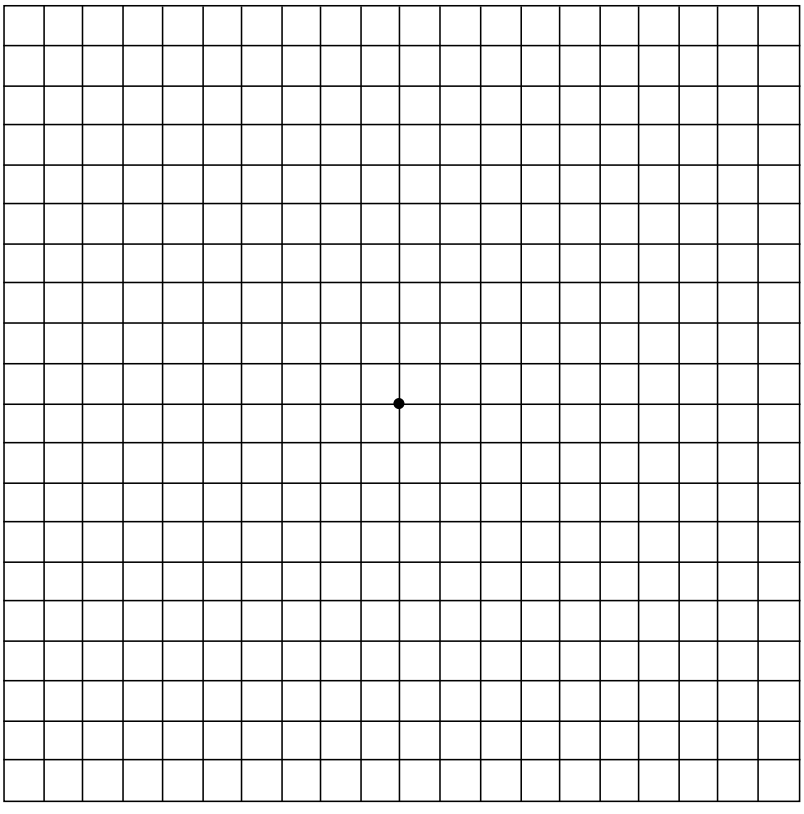
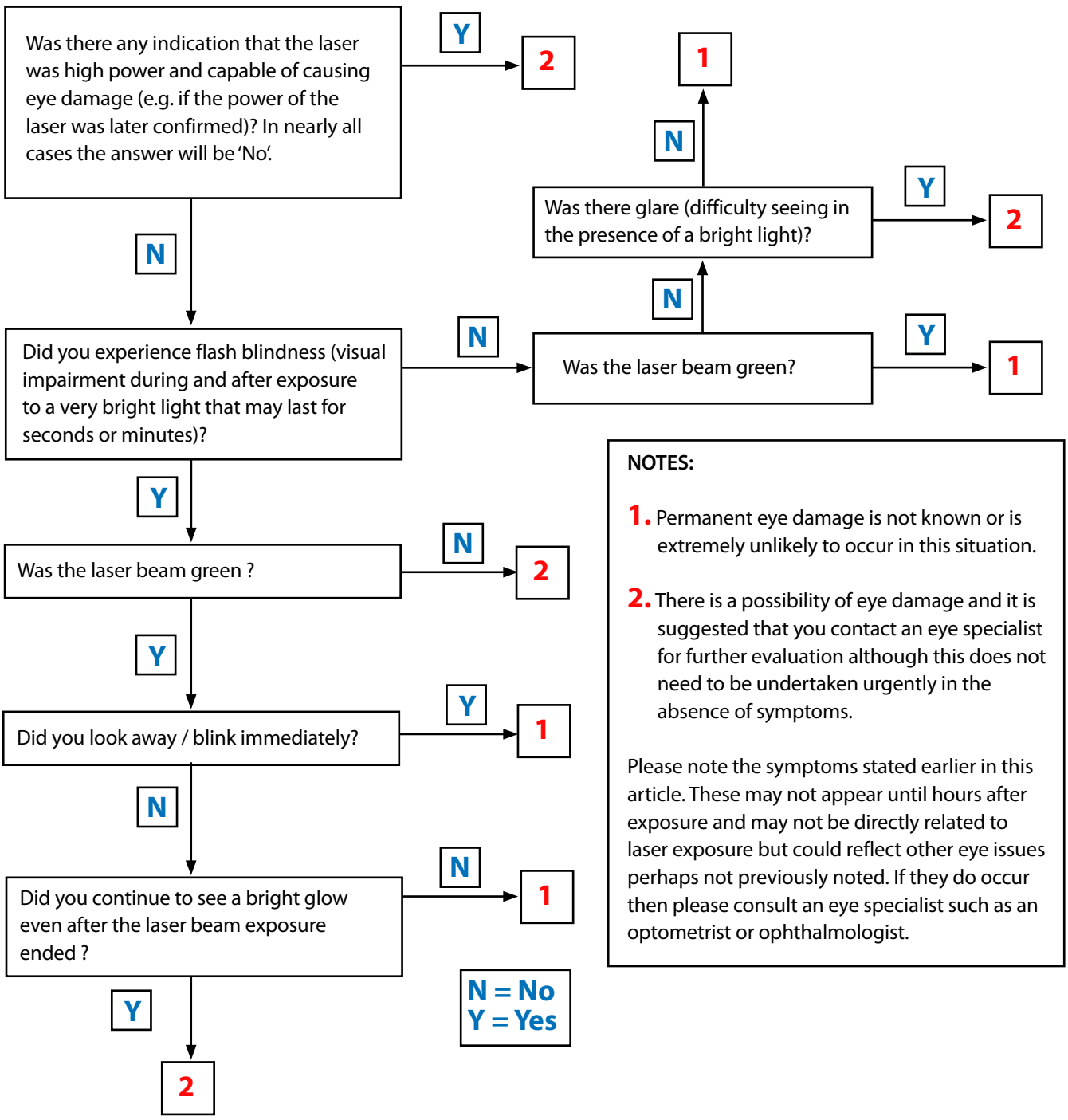


Fig. 3 - Amsler Grid. The dimensions of the grid should be 10cm x 10cm.

In some circumstances it may be possible to have retinal damage without obvious symptoms. The relevance of this is uncertain in the absence of abnormal visual signs (e.g. answering "yes" to all three Amsler Grid Questions) as it is unlikely to have an operational impact or be amenable to treatment. The following flowchart is designed to aid a pilot or ATCO in deciding whether or not an assessment should be sought with an optometrist or ophthalmologist after an exposure.



NOTES:

1. Permanent eye damage is not known or is extremely unlikely to occur in this situation.

2. There is a possibility of eye damage and it is suggested that you contact an eye specialist for further evaluation although this does not need to be undertaken urgently in the absence of symptoms.

Please note the symptoms stated earlier in this article. These may not appear until hours after exposure and may not be directly related to laser exposure but could reflect other eye issues perhaps not previously noted. If they do occur then please consult an eye specialist such as an optometrist or ophthalmologist.

Dr. Eric Liggins studied physics at the University of Warwick then completed a PhD at the University of Manchester in optometry and visual science. He worked on laser eye protection at the MOD from 1985 until QinetiQ was created in 2001, where he is now a Principal Scientist and technical leader. Eric is Chair of BSI Technical Committee EPL/76, Optical Radiation and Laser Safety, and is head of the UK delegation to the international laser safety committee IEC/TC 76. He is a member of the Executive Committee of the Applied Vision Association.
epliggins@qinetiq.com

LASER Attacks

Shining a laser is **not**
an offence, endangerment
and intent must be proven.

So Report It !

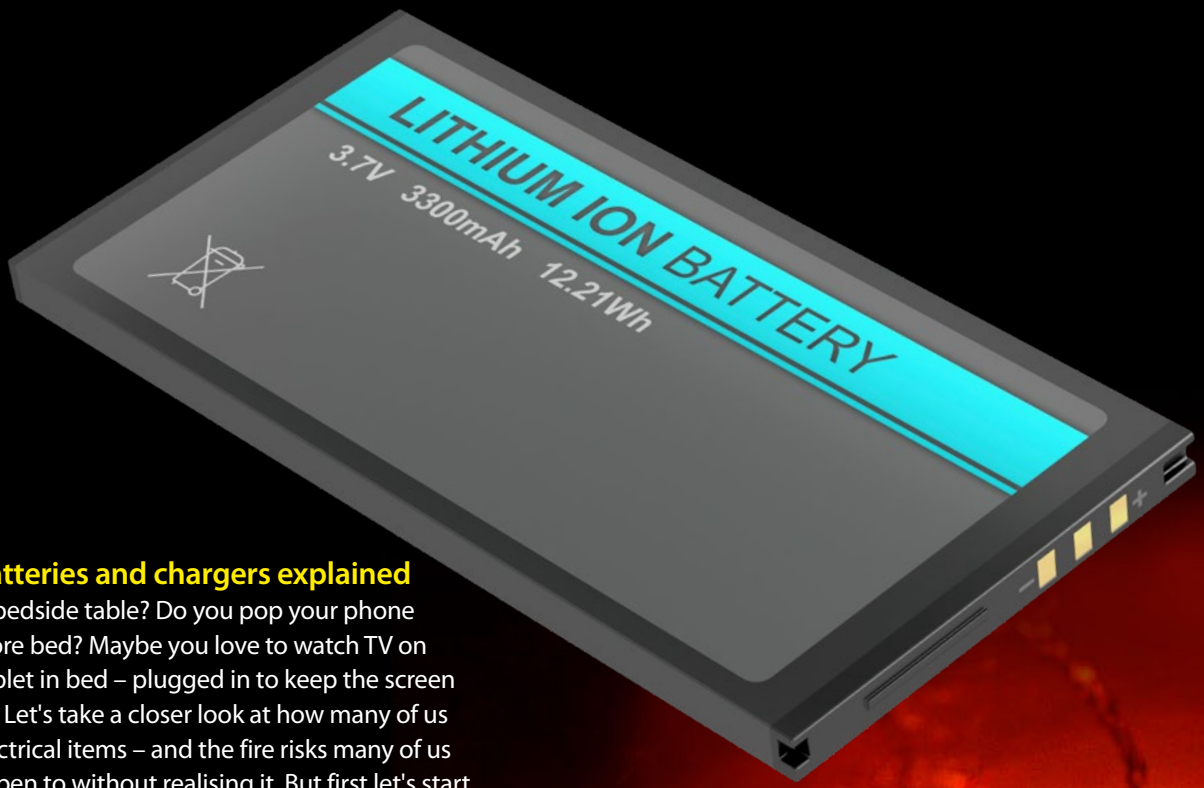
ROYAL AIR FORCE
Safety Centre

SC08
Produced by Air Media Centre, HQ Air Command.

Fire Safety Matters

Information from a fire safety leaflet issued by Strategic Command

Chargers, batteries, and fire safety. Did you know that the Fire Service attend on average 24 fires each week that have been started by chargers, batteries, and cables?[1]



Fire risks of batteries and chargers explained

How safe is your bedside table? Do you pop your phone on to charge before bed? Maybe you love to watch TV on your laptop or tablet in bed – plugged in to keep the screen bright, of course? Let's take a closer look at how many of us use every day electrical items – and the fire risks many of us leave ourselves open to without realising it. But first let's start at the beginning...

What is a Lithium-ion battery?

Lithium-ion batteries or li-ion batteries (sometimes called LIBs) are the lightweight, rechargeable batteries that power our phones, laptops, cameras and recently electrical scooters. They're found in many electrical devices from mobility scooters to e-cigarettes and are used safely by millions of people every day. However, there are some things you need to know when it comes to fire safety, chargers, and batteries.

Are batteries dangerous?

When used properly, no. But batteries can present a fire risk when over-charged, short-circuited, submerged in water or if they are damaged. It's really important to charge them safely too and not charge or keep them on escape routes.

1 Based on UK NFCC stats

Did you know?

Counterfeit electrical chargers can be deadly – many fail to meet UK safety regulations leading to fires and injury. What may seem like a bargain at the market isn't worth the risk when you consider that it could cost a family member's life.

If a fire should breakout:

- Call the fire and rescue service and give the exact location.

If you discover a fire:

- Do not be tempted to investigate.
- Leave the area as quickly as possible and ring for the fire and rescue service.
- Do not return unless the fire and rescue service tell you that it is safe to do so.

Further Information

For further information regarding Fire Safety in the workplace contact your unit Fire Safety team or Establishment Fire Focal Point in the first instance.

Further advice available on the HM Government Fire Kills Website which is the current national Fire Safety campaign offering further practical Fire Safety advice.

Fire Safety tips for charging your devices

- Always use the charger that came with your phone, tablet, e-cigarette or electrical device.
- If you need to buy a replacement, always choose a branded, genuine product from a supplier you can trust. There are lots of fakes out there, and it can be difficult to spot the difference.
- Avoid storing, using, or charging batteries at very high or low temperatures.
- Protect batteries against being damaged – that's crushed, punctured, or immersed in water.
- Don't leave items continuously on charge after the charge cycle is complete – it's best not to leave your phone plugged in overnight for example.
- Do not charge on escape routes
- Never cover chargers or charging devices that includes using your laptop power lead in bed.
- When you travel, avoid keeping all your items containing lithium ion batteries together, especially on a plane. Check with your flight carrier for additional information or advice.
- Don't overload your sockets.
- Follow Unit portable appliance policy.

Unusual Flight Modes

By Trevor Brown

Operators like their crews to use automatics to reduce pilot workload and improve both safety and economy of operation but still expect them to fly in conditions up to the cleared limits which are always significantly greater than the limits for operation using the autopilot. So we need regularly and routinely to disconnect the autopilot and turn off the flight director for a hand flown landing. After seven years on Tristars with a major airline I was comfortable in my role as a training captain. They then became the launch customer for the Rolls Royce powered A330 which we knew had even more automated functions. A big, exciting, step in technology and I was to be a training captain from launch. Things moved quickly in January 1995 and amongst other things I learned, just as I did with the earlier A320, was that any automated flight mode change should be confirmed on the readout (FMA) above the electronic artificial horizon, all about how you couldn't stall it or overstress it and that full thrust would automatically appear with Alpha Floor mode if I was distracted with too low an airspeed. For this last point there was a caveat and we were all mindful of the horrible accident at Habsheim airshow (1988) when the crew endeavoured to repeat the manufacturer's demonstration during a slow fly by. Sadly they dropped below 120ft with thrust levers at idle where the Alpha Floor system would be inoperative, as also happened at Bangalore (1990) on the approach to land.

I was soon training and it was my turn to demonstrate how amazing this new jet was to a young co-pilot on the busy 20 minute sector from KL to Penang. The longer more formal route was programmed into the computer but, on arrival, the sun shone and I decided I needed to demonstrate how we could shorten the route considerably and how it was just like any other aircraft if we just flew manually and made it a visual approach to keep myself in practice.

We needed to get rid of the now excess height so I set and pulled the autopilot altitude knob to commence descent which also sent thrust to idle for us as I looked down at the

FMA and announced the flight mode changes I had caused in the first two columns:

Thrust Idle Open Descent *I then took some speed brake as well, disconnected and announced autopilot off and commanded flight directors off (the cue for the co-pilot to turn off his own flight director as I had turned off my own) as I started a right hand turn towards finals. We rapidly lost that unwanted height, started to configure for landing and were soon nearing stable target approach speed when I called for landing checks:*

"Autothrust"……'Ahh!"

the speed was still decaying and the FMA said **Thrust Idle**. Why is it still at idle? We need thrust, no thrust response, in no time at all it's going to shout "Speed Speed" then if we're not too low perhaps so much thrust it's going to be a G/A or no thrust response at all and it was going to be Habsheim or Bangalore all over again. I felt sick to my stomach. What to do! At that moment I looked across as we lined up with the runway and noticed the co-pilot still had his flight director bars on his Attitude Indicator pointing askew towards where we used to be going. "FD OFF!"

"Autothrust ……..**SPEED**"
and we completed the checks in time for a safe landing.

So this was different to my Tristar. I needed both Flight Directors to be off to guarantee the correct thrust mode. Yes I could have spotted it on my Flight Mode Annunciator if I'd read the columns all the way to the right hand side of the display and seen – **FD2** and I could have taken manual thrust but I had not practiced it except for a pre-planned abnormal procedure but never again did I just turn off my own FD, instead just like going visual and taking manual control from a non-precision approach, I asked the co-pilot to set "Both FD Off'.

Finally, apologies to all Voyager pilots for the fact that I've written the FMA readouts in full and talked about Artificial Horizon for the wider readership. They may also like to consider the Airbus Golden Rules we forgot to adhere to. The co-pilot might also have liked to call out "Flight Director" when they saw I was disregarding them on his own Attitude Indicator.

Day 1 Groundschool - Airbus Golden Rules:

1. Fly, Navigate and Communicate – in this order and with appropriate task sharing.
2. Use the appropriate level automation at all times.
3. Understand the FMA at all times.
4. Take action if things do not go as expected.

The author: Trevor Brown is an ex-RAF pilot who flew the Canberra and Buccaneer before being selected for ETPS (38 Fixed Wing Course 1979). At the end of 1983 he had qualified on all front-line aircraft of the time bar the Phantom. Trevor rounded up almost exactly 20yrs of RAF service as an instructor on the Tornado Tri-National Training Establishment in 1987 and then settled in Hong Kong flying Tristar, A330 and A340 for Cathay Pacific returning to UK in 2000 to fly the A320 with BMED and British Midland before being re-acquainted with the A330 on a summer contract with Thomas Cook. He then conducted Training and Checking on the A320 and A330 almost exclusively on flight simulators as a consultant working for Airbus Training Toulouse, CTC (now L-3 CTC Ltd) and Air Tanker Training at Brize Norton where his last day of employment was spent training a very able crew on the Voyager simulator in Oct 2016.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ZM327


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DANGER
EJECTION SEAT
DANGER

Military Working Dogs and their Handlers

By Julie Brown, Air FP, RAF Honington

"Air Force Stop or I will release my dog" are words you never want to hear! The most sensible thing for any potential intruder to do would be to stop otherwise they will feel the power of a very strong Military Working Dog (MWD) running towards them determined to stop them in their tracks.

RAF Police and Military Working Dog teams routinely patrol RAF Units at night to deter, detect and/or deny any potential intruders. Police dogs are also trained to protect sensitive locations and support criminal investigations using their tracking and evidential search capabilities.

Specialist Search dogs include Arms and Explosives Search, Vehicle Search and Drug Detection Search dogs – all of which provide assurance and investigative support to criminal investigations and security related assurance operations. RAF Police Military Working dogs are used in a wide range of roles for the protection of critical assets, personnel, and information in the UK and on behalf of Strategic Command in deployed operating environments such as Cyprus, Diego Garcia and the Falkland Islands.

Personal Stories
Sgt Shaun Perkes – Provost Marshal Dog Trainer

Sgt Perkes joined the RAF in 2007 and has served as ever since within the RAFP Military Working Dog (MWD) specialisations. With the amount of experience he has gained from being employed on a number of UK bases, deploying on Operations and running a number of MWD sections makes him the perfect fit for the role as one of the Provost Marshal Dog Trainers. Shaun holds several specialist dog qualifications; Arms Explosive Search, Improvised Explosive Device Detection, Police, Drug Detection, Dog Inspector, Kennel manager and QPD2

On Patrol at RAF Coningsby

dog training qualification. He has conducted countless jobs around the UK both within MOD establishments and alongside other agencies. Ranging from routine Drug detection sweeps, working targeted intelligence lead drug search Operations, routine Police dog handler duties alongside Home Office Police Forces to Arms Explosive Search on events such as the Battle of Britain memorial in London.

He has deployed on two tours of Afghanistan firstly in 2009 on Force Protection as a patrol dog handler attached to 1 Theatre Military Working Dog Support Unit at Camp Bastion. This saw him conducting routine patrols of the airfield and key locations on the base - then again in 2011 as an Improvised Explosive Device Detection Dog handler attached to 42 Commando, Lima Company, Royal Marines working within Helmand. This role involved searching ahead of patrols for Improvised Explosive Devices.

Shaun said: "*all the dogs I have had the pleasure of working with over my career have had amazing characters very much loving and affectionate always wanting to please and work – as long as you were on the right side of the law that is!*"

Cpl Bearcroft & Coco conduct a vehicle search

Cpl Jenni Bearcroft and Vehicle Search Dog Coco

Cpl Jenni Bearcroft from RAF Brize Norton has been a dog handler for 3 years and is teamed with Coco. She loves dogs so this is her dream job. Initially starting as a Patrol dog handler, Cpl Bearcroft completed a Vehicle Search course where the dog searches vehicles for explosives then later expanded her skillset by completing a Drugs Detection course.

Cpl Bearcroft has carried out many tasks with Coco but most notably they supported Devon and Cornwall police when protecting world Leaders attending the G7 Summit. With a huge grin on her face she describes Coco as a wonderful little English Springer Spaniel who loves working and is always excited to see Jenni. Coco doesn't understand what she is looking for could be dangerous, she just thinks it's a game to get her tennis ball. They do lots of training together to keep Coco keen for work and this was recognised when they won the Von Wolf K9 Trophy for the Best Vehicle Search Team.

Cpl Bearcroft said: "*Maintaining a close bond and training regularly with Coco is very important. I need to be able to recognise a change in her behaviour because it might mean she has found something that could potentially put people's lives at risk. I love giving Coco cuddles and I hope to one day retire her once she's finished working (normally around 7 or 8 years old)*".

Cpl Bearcroft receives the Vehicle Search Trophy

Cpl Webb and DJ

Cpl Alys Webb and Patrol Dog DJ

Cpl Alys Webb and Patrol Dog DJ have been teamed together since April 2021. They can be seen patrolling at RAF Northolt protecting and securing the people and critical assets housed there.

Cpl Webb has had a passion for dogs from a very young age and is extremely interested in training dogs and agility and show competitions such as Crufts. She said: "being employed on dogs means no two days are the same, it is interesting and active, and I much prefer it to an office dog. I aspire to continue handling whilst gaining knowledge of the trade from those more experienced as I would eventually like to be employed in a training role within dogs after completing a specification such as the Police Dog course."

DJ is a young, energetic, intelligent Mali with a high drive, who loves all aspects of his job from obedience and agility in the arena to bitework. Cpl Webb also introduced an element of search work as another form of stimulation for his constantly active brain, he really enjoys the work which benefits his welfare immensely. DJ is highly driven but, at times, can become stressed and anxious. Due to the a strong bond with her dog, Cpl Webb can identify when he is displaying these behaviours and rectify it immediately. DJ loves structure, being firm yet kind and working hard.

Cpl Webb explains: "*Having a strong bond with DJ gives me a lot more job satisfaction and enjoyment. Because of our bond, DJ works to please me and responds well to commands which makes training with him easier.*"

Cpl Webb and DJ were crowned the UK 2021 Dog Trials champions and although DJ performed well there were a few hairy moments: "*DJ and I were participating in a scenario where the PMDI team set up a stack of cardboard boxes as an obstacle for the dogs to negotiate by jumping through and knocking them down. To ensure the dogs could not avoid the boxes there was a crowd control barrier set up to one side of the stack and concrete wall on the other side. DJ took a look at the boxes and decided that he would prefer to headbutt through the metal barrier several times to knock it down rather than gracefully jump through the boxes. Nevertheless, he made it through and completed the bitework scenario even if it was the unconventional way!*"

Cpl Webb and DJ Patrolling at RAF Northolt

The RAF's Military Working Dogs play a vital role supporting RAF Police Handlers in patrolling, arms and explosives searching, drug detection, and police work. Before being paired with RAF Police Dog Handlers, Military Working Dogs are trained by the Canine Training Squadron at the Defence Animal Training Regiment in Melton Mowbray. Once the dogs arrive at their Units the hard work begins.

Cpl Webb and DJ UK 2021 Dog Trials champions

FSIMS Functional Safety Information Management Reporting

By the RAF Safety Centre

Did you know there is a mandated Statutory HS&EP requirement to report any injury or environmental occurrence, whether it was a near miss, an incident or an accident?

The Functional Safety Information Management System (FSIMS) has been developed to bring functional safety occurrence reporting in line with the same high standard as air safety reporting. It has been developed to allow all members of the RAF to report functional safety and environmental safety Accidents, Incidents and Near Misses and more importantly, investigate and learn from these occurrences. You can access FSIMS as a Guest User and create an accident report.

What is a Functional Safety incident? It's pretty much anything that occurs which is not related to flying. We used to badge these kinds of incidents under 'Health & Safety' but now we include Environmental Protection too. So, trapped thumbs, falling off ladders, fuel spills, hand-arm vibration etc. Pretty much anything that is work-related that has happened, has nearly happened, or is likely to cause an incident to happen.

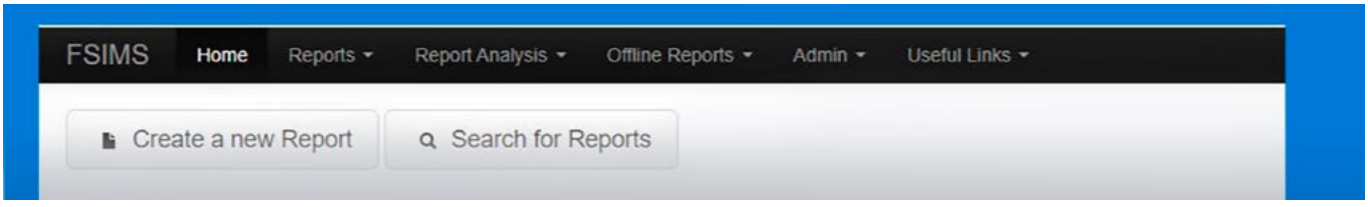
All RAF Service and Civil Service personnel are encouraged to report all functional safety occurrences whilst on duty or attending an organised sporting event. Whilst off duty, any incidents in relation to a failure of Station infrastructure are also to be reported on FSIMS. This can be done either as a Guest User or by applying for a Commentator account, occurrences can also be reported via the FSOR or In-Form.

Functional Safety occurrences and near-misses are to be recorded on FSIMS within 72 hours of the occurrence taking place, unless operational reasons prohibit it. Individuals involved in the occurrence must ensure they report the incident to their line manager who in turn, is to ensure the incident is recorded on FSIMS.

Why Near-Misses? It's important to record a near-miss because this does one of two things. Firstly, and most importantly, it highlights a potential hazard that can be eliminated as a result of your report. Secondly, the database provides an opportunity to see just how much risk exists in a particular area. Now, we are not talking about sliding tackles that could have caused a broken bone. We are talking about things like slipping on a dangerous surface, but where perhaps you recovered in time. If that surface is permanently slippy i.e. it cannot just be cleaned up, it needs to be reported.

If you want to access FSIMS Reporting and it is not available to you locally, speak to your local HS&EP representative. Alternatively, you can look at the suite of information available on the RAF Safety Centre Comms site at:

https://modgovuk.sharepoint.com/teams/23116



Simplifying Safety

How 'doing the right thing' has made safety demonstration too complicated, and what to do about it.

By Professor Andrew H. Sherry FREng FNucl FIMMM, The University of Manchester

Alongside many high hazard sectors, the nuclear industry has a mantra of 'do the right thing' with respect to safety. The workforce is encouraged to take responsibility, to stop, think, act, and review all activities, and to continually learn from experience to improve safety. Just what you would expect. But might a relentless focus to improve safety at all costs actually increase safety risk? I suggest it could, and in the light of my experience in the civil and defence nuclear sectors offer some thoughts as to why, and what can be done about it.

I have had the privilege of visiting operating nuclear sites around the world in my career in industry, national laboratories and academia and also as an independent government advisor. Decades of visiting sites, observing operations, and talking to safety leaders across the civil and defence nuclear programmes has generated a growing body of evidence that indicates a trend of increasing complexity and bureaucracy in demonstrating safe operations. This trend is not unique to nuclear. Discussions with leaders and regulators of other high-hazard sectors reveals an increase in complexity and bureaucracy in safety arrangements more widely. My thesis is that rather than ensuring safe standards are maintained, this trend has the potential to undermine safety.

Let me explain.

A mantra of the nuclear sector is to 'do the right thing', particularly where safety is concerned. This means that the workforce is relentlessly encouraged to always put safety first, to discuss safety at every opportunity, to halt operations when a safety concern is raised, and to continually learn from experience; and with good reason.

A nuclear accident is one of the most terrible things imaginable as was seen at Chernobyl, Ukraine, in April 1986 and in Fukushima Daiichi, Japan, in March 2011. A nuclear accident not only impacts a region with whole communities displaced from their homes at a moment's notice with the fear of being exposed to unseen and odourless radiative

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contamination. A nuclear accident impacts a whole country's economic wellbeing, changing its energy policy and making thousands of well-paid and highly skilled people unemployed. News of a nuclear accident reverberates around the world with its impact felt in other countries. In many cases, this means revisiting energy policy including the role nuclear energy might play in a low carbon energy future.

The nuclear workforce, and I include myself here, are rightly encouraged to 'do the right thing', to continually improve, and this is what we do. When a safety risk is observed, we 'Stop, we Think, we Act, and we Review'. The 'S.T.A.R.' acronym is branded on our minds, so that at the start of each programme, each project, each experiment, we 'S.T.A.R.' This encourages us to consider whether our safety processes and procedures are good enough and where we see gaps, where we observe text that might be misinterpreted or steps that are not explained sufficiently, we make reasonable changes to improve.
Each time we observe an incident or a near-miss, we 'S.T.A.R.' and add new guidance to our safety documentation. This is engrained in us, it is what we do, and it keeps us and the public safe.

The UK's nuclear safety regulators also 'do the right thing'. They operate a goals-based regulatory regime which means that safe operations can be demonstrated in a flexible way. Independent regulators assess safety compliance according to an organisation's own operating processes and procedures, albeit via specific regulatory requirements. Regulators provide guidance to their own inspectors and to Duty Holders on what regulatory requirements mean and entirely reasonably, supplementary detail is added to regulatory information when misinterpretation or gaps are found. This is engrained in us, it is what we do, and it keeps us and the public safe.

When regulatory inspectors or independent assurers challenge the mitigation of a particular safety risk, the Duty Holder expands the explanation of a safety claim, provides more detail to set out the safety argument more precisely, and/or offers additional evidence to underpin this.
This process of reasonable challenge and response improves the robustness of the safety case until all parties in the 'triple lock' (Duty Holder, Independent Assurer and Regulators) are satisfied. This process is engrained in us, it is what we do, and it keeps us and the public safe.

Or does it?

I was hosting a Safety Seminar recently at which the following equation was presented:

$$\sum_{i} \text{Reasonable} = \text{Unreasonable}$$

Put into plain English, this little equation suggests that the accumulation of a number (i) of *reasonable* actions can lead to an *unreasonable* outcome. In the context of nuclear safety, this little equation suggests that the cumulative effect of reasonable additions to safety documentation, reasonable supplementary details to regulatory guidance, and reasonable challenges/responses to both regulatory inspections or independent assurance, will build and build over time and have the arresting potential to deliver an unreasonable outcome.

In my experience, this accumulation of the reasonable is leading to an unreasonable increase in the complexity and bureaucracy of safety arrangements to the extent that one nuclear organisation observed a doubling of operating processes and procedures over a ten-year period, with some safety documentation increasing in length by a factor of ten. This means that simple safety improvements can take months to plan and approve and longer to deliver.

But, as suggested by the Hon. Mr Justice Haddon-Cave QC, in a talk to the Nuclear Industry Association and Institute of Mechanical Engineers in 2017:[1]

"It is easy to become seduced and mesmerised by complexity. But remember, there is a false comfort in complexity."

This progressive increase in complexity and bureaucracy concerns me.

But there is a second challenge that arises, and this is a safety culture which despite the 'S.T.A.R.' acronym focuses on blind compliance; compliance with complex and bureaucratic safety arrangements because this is the only way to get things done. Once again, the workforce wants to 'do the right thing' and this means that complying with the safety arrangements can become an end in itself.

The result is supervisors who will not sign-off safety documentation to do laboratory work because of the format of a full stop ("bold not plain text"), a proliferation of safety checks to put the right tick in an increasing number of boxes which actually reduces the level of scrutiny and challenge ("I'll sign because they did"), and a progressive shift in focus away from mitigating the real safety risk towards generating high volumes of good quality paperwork as an end in itself ("look at the volume of safety reports, does that not give you comfort?").

Once again, I quote Haddon-Cave:[2]

"I felt strongly that the Safety Case regime had lost its way. It had led to a culture of 'paper safety' at the expense of real safety."

This twin trend of increasing complexity on the one hand and a growing culture of blind compliance on the other is illustrated schematically in Fig. 1 with the current trend shown by the bold arrow and shading.

The challenge, increasingly recognised by safety leaders across the civil and defence nuclear sectors, is to reverse this trend and create a new definition of 'do the right thing' by placing greater value on continual improvement by increasing simplicity and empowering constructive challenge.

Put simply, the goal is to 'turn the arrow' in Figure 1(a) until it points to the bottom left quadrant as in Figure 1(b).

The good news is that the need to 'turn the arrow' and build a simpler and less bureaucratic approach to safety demonstration is becoming recognised more widely by an increasing number of leaders in the nuclear and other high hazard sectors.

The process has been started by progressive leaders in some industry associations, in some organisations under the banner of delivering excellence, cultural transformation, or the case for change across civil nuclear, defence nuclear and other high hazard sectors.

Here, I offer four actions that can put even greater momentum behind such initiatives to 'turn the arrow' and renew our focus on 'real safety' and not 'paper safety'. These actions are consistent with the four principles of good safety articulated by Haddon-Cave in the Nimrod review: [2]

- Leadership,
- Independence,
- People (not process and paper), and
- Simplicity.

First, leaders within the Duty Holder organisations must engage effectively with senior independent regulators early. This is not to compromise regulatory independence or to win the regulatory approval too soon, but rather to share their perspective on safety risks and how to address them in a simplified manner in an open and 'challenge early' forum. The nuclear sector has established several such forums for engagement: the G6 at Sellafield, the A6 at AWE and the Senior Users Group at Devonport Royal Dockyard. Each of these have the potential to help turn the arrow and align with the aspiration set out in the Office for Nuclear Regulation's 'enabling regulation' approach to *"engage openly with stakeholders to agree priorities, provide guidance and advice, to establish a 'no surprises' culture"*.[3]

Secondly, leaders should empower their people to 'do the right thing' and continually improve by simplifying safety through meaningful and constructive challenge.
This represents a significant shift away from 'do as I say' to, 'what do you intend to do?', transferring the need for leaders to have all the ideas to giving greater responsibility to those who understand the hazard and whose lives would be most affected by a safety incident. Rather than waiting to be told what to do, those who live in the world of complexity and compliance can actually 'do the right thing' and continually improve through simplification. In his book, "Turn the Ship Around", retired Captain of the U.S. Navy David Marquet asks a pertinent question in this regard, *"are you underutilising the ideas, creativity and passion of your middle-managers who want to be responsible…"?*[4]

Thirdly, the people should enhance simplified safety approaches as a priority to reduce complexity through

Figure 1(a)

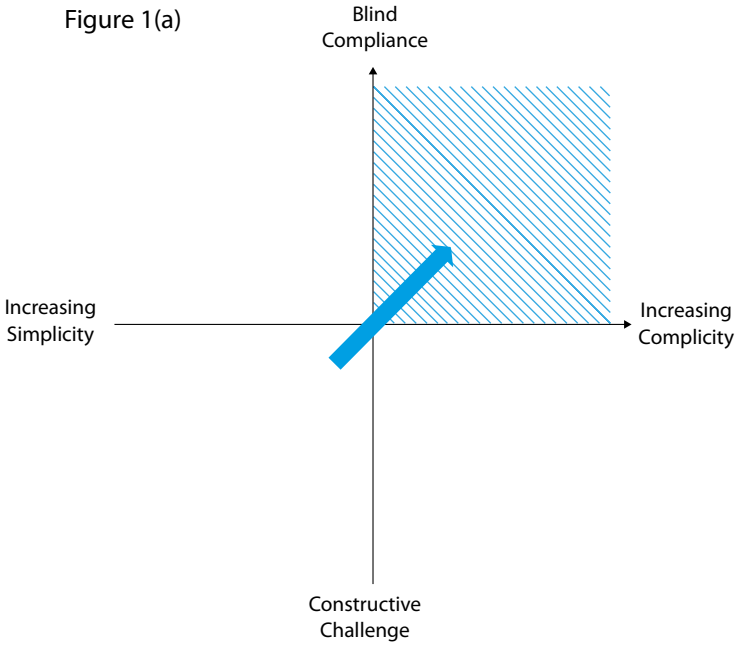

Figure 1(b)

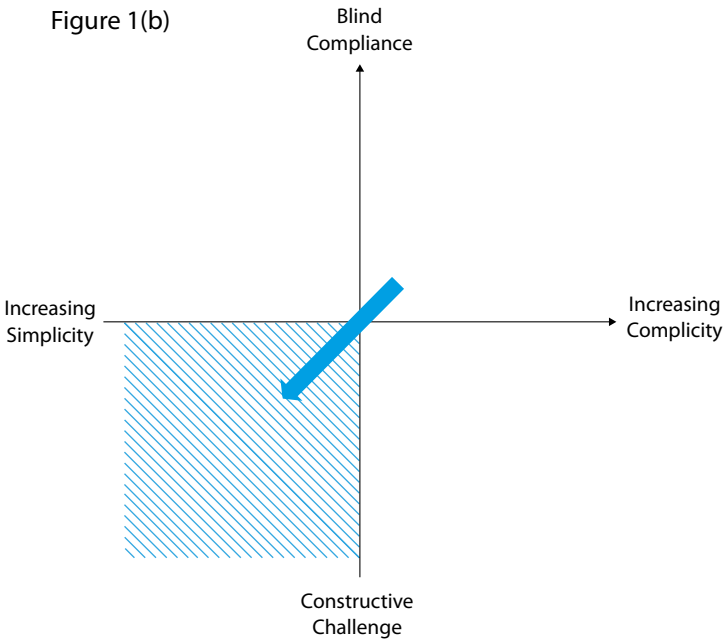

Figure 1. Schematic diagram showing: 1(a) the progressive trend towards increasing complexity and blind compliance, 1(b) a new trend to 'turn the arrow' towards increasing simplicity and constructive challenge.

constructive challenge. By gripping this challenge of complexity through the opportunity afforded by a new empowerment, the people who really understand the hazard, the safety risk and its consequence can progressively simplify safety arrangements. Under the existing management of change approach, people can remove unnecessary checks, declutter operating guidance, and thereby improve safety. This is a cultural change, and one that some organisations are fully behind. For example, the National Nuclear Laboratory is reducing operational complexity in some of its nuclear facilities through its 'Delivering Excellence' culture change programme to great effect, and is now focused on *"enhancing our capabilities, processes and culture" more widely.* [5]

Fourthly, independent regulators must expect simplified safety documentation, that has received constructive challenge and is fit for purpose. Independent regulators should challenge complexity and an over-reliance on 'paper safety' with blind compliance and encourage this innovative approach to simplifying safety. This is fully aligned with the Office for Nuclear Regulation's guidance on regulating innovation where they aim to, *"ensure that our regulatory system is sufficiently flexible and outcomes-focused to enable innovation to thrive".* [6]

Summary

People want to *'do the right thing,'* but reasonable changes have accumulated over time to create safety arrangements that risk being unreasonable, complex, and overly bureaucratic. This risks building a culture of blind compliance with a focus on paperwork not on real safety.

A renewed drive to simplify and challenge safety approaches is needed that encourages increasing simplification and constructive challenge. This can be enabled by:

- Leaders *engaging* effectively with independent regulators early,
- Leaders *empowering* their people by creating a culture of constructive challenge rather than blind compliance,
- People *enhancing* simplified safety approaches that reduce complexity, and
- Regulators *expecting* simplified approaches that are fit for purpose.

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1 Mr. Justice Haddon Cave, "Zen and the Art of Safety Case Maintenance in the Post-Nimrod World", Keynote speech to the Nuclear Industry Association Conference on Fit for Purpose Safety Cases in the Nuclear Industry, 6 June 2017.

2 C Haddon-Cave QC, "The Nimrod Review: an independent review into the broader issues surrounding the loss of the RAF Nimrod MR2 Aircraft XV230 in Afghanistan in 2006", HC 1025, October 2009.

3 Office for Nuclear Regulation, "Holding Industry to Account and Influencing Improvements: a Guide to Enabling regulation in Practice", February 2018.

4 L. David Marquet, "Turn the Ship Around! A true story of turning followers into leaders", published by Penguin Business, 2019.

5 National Nuclear Laboratory, "Annual Report and Accounts", 2020.

6 Office for Nuclear Regulation, "Approach to Regulating Innovation", September 2020.

Airbus 320 Near-Miss at San Francisco Airport – July 2017

By Claire Coombes, BALPA Human Factors Scientist

Laurent ERRERA from L'Union, France, derivative work Lämpel, CC BY-SA 2.0 <https://creativecommons.org/licenses/by-sa/2.0>, via Wikimedia Commons

It was the near miss that could have resulted in the worst aviation disaster in history, with over 1,000 people at imminent risk of death. This article sets out the NTSB's description of the events of the taxiway overflight on July 7th 2017, and the human performance factors and subsequent recommendations arising from this serious occurrence are reviewed.

What Happened

Air Canada Flight 759, an Airbus A320 was on approach into San Francisco International Airport (SFO) at around midnight on July 7th, and cleared to land on runway 28R, but instead lined up with the parallel taxiway C. The flight crew was familiar with the normal SFO parallel 28L|28R runway configuration. However, on this night, the runway 28L was closed and unlit, providing some visually misleading cues that 28R and the adjacent taxiway to the right were in fact the two parallel runways. On the taxiway were four airplanes awaiting clearance to take off from runway 28R. At around 300ft in the descent, the flight crew of Air Canada 759, questioned their visual understanding of what resembled the runway in front of them (which was actually taxiway C) with the Control Tower;

ACA 759: *"Just want to confirm this is Air Canada seven five nine, we see some lights on the runway there, across the runway. Can you confirm we're cleared to land?"*

The controller on duty noted that the ACA 759 data symbol was just to the right of the centreline on their screen displays, but felt this was normal for the FMS Bridge visual approach to runway 28R. Furthermore, runway 28R was clear.

Controller: *"Air Canada seven five nine confirmed cleared to land runway two eight right. There's no one on runway two eight right but you".*

At roughly 200ft, ACA 759 flight crew acknowledged the ATC transmission. A second later, the Captain of United Airlines flight 1 (UA 1) from the first airplane on taxiway C made a transmission on the tower frequency:
UA 1: *"Where's this guy going?"*

ACA 759 had descended to 100ft above ground, flying over the first UAL1 airplane on the taxiway. The UAL1 Captain made a second transmission on the tower frequency;

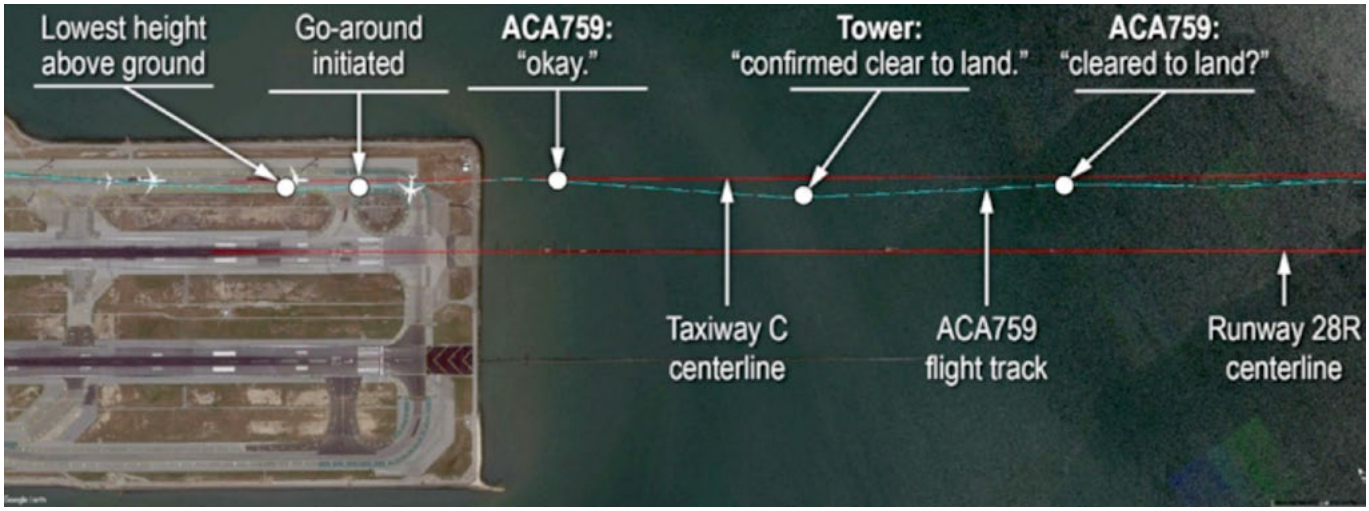

Diagram taken from NTSB Report – (not in original article)

UA 1: *"He's on the taxiway".*

At about the same time, the flight crew from the second airplane on the taxiway C turned on their landing gear and nose lights, lighting up a section of the taxiway and the UA 1 plane in front. Around 89ft, ACA 759 flight crew initiated a go-around, descending to 60ft before climbing, narrowly clearing the second and third airplanes on the taxiway by just 10-20 ft vertical separation. The controller had also instructed ACA 759 flight crew to go-around, and in the unfolding moments afterwards, advised ACA 759 flight crew that they had been lined up on the taxiway. The second approach to SFO was uneventful, with ACA 759 successfully landing on runway 28R.

So what human performance factors were at play in this serious near miss? Why did taxiway C so strongly resemble a runway to the pilots of ACA 759, and why was their course correction and go-around relatively delayed? As always, there were a number of interacting factors, not all of which we can cover here. However, outlined below are some key ones.

NOTAMS

To begin with, the flight crew were unaware or could not recall information of a runway closure at SFO. The NTSB report indicates that this pre-flight information was presented via a NOTAM page 8 of 27 and was the fourth line on the in-flight ACARS information. Pilots reading this will know the reality of pre-flight reviews of NOTAMs. They are not easy to digest, and there is often insufficient time to read and disentangle poorly described bits of information. This can place an intolerably heavy burden on crews to find 'the needle in the haystack' that is relevant to their upcoming flight, particularly when priority items may be buried under pages of other irrelevant items. In this incident, the FO did not recall a specific NOTAM about 28L closure, whilst the Captain's actions in lining up on the taxiway suggest that he did not recall that information. Hence, for this approach taking place during nighttime conditions, both flight crew had the expectation of illuminated 'normally configured' parallel runways 28L|28R.

Expectation Bias and Conflicting Visual Cues

The Captain and First Officer were experienced and familiar with SFO runway configuration. The Captain had not experienced a previous occasion in which either runway had been 'dark', so both flight crew expected to see two illuminated parallel runways on their descent. Whilst there would have been light cues coming from the taxiway, such as green (not white) centreline lights and taxiway in-pavement flashing guard lights which differ to the surface of a runway, there were also a number of visually supporting clues that fed into taxiway C's resemblance to runway 28R. Specifically, the navigation lights on the wingtips of the airplanes lined up on the taxiway partially resembled the runway edge lighting, whilst their flashing red beacon lights were consistent with features associated with approach lighting. Another supporting cue was the presence of runway and approach lights on the actual 28R, which would have appeared to the left of the pilots' primary field of vision, and hence appeared to confirm they were correctly situated with respect to the normally adjacent parallel runway 28L. This expectation bias should not be understated – runway lighting aids are normally powerful conspicuous features, but humans are vastly better at recognizing features that 'pop out' than detecting missing features or slightly off-hue features in a visual scene. The NTSB analyses also note that whilst a runway closure marker – a flashing white 'X' – was placed at the start of runway 28L, it would not have been in the flight crews' primary field of view and the flash rate (2.5 seconds on and off) may have been too slow to capture their attention, unless they were directly looking in that direction. Interestingly, the flight crew from the preceding DAL 521 flight into SFO who were aware of the runway closure also reported that the taxiway lights gave the impression that the surface could have been a runway, especially as none of the lined-up airplane shapes could be seen in the dark. So even though their expectations were different and they knew that runway 28L was closed, they too felt the taxiway could be perceived as a runway.

Setting these visual features aside, normal cues that could have been provided from the backup lateral guidance

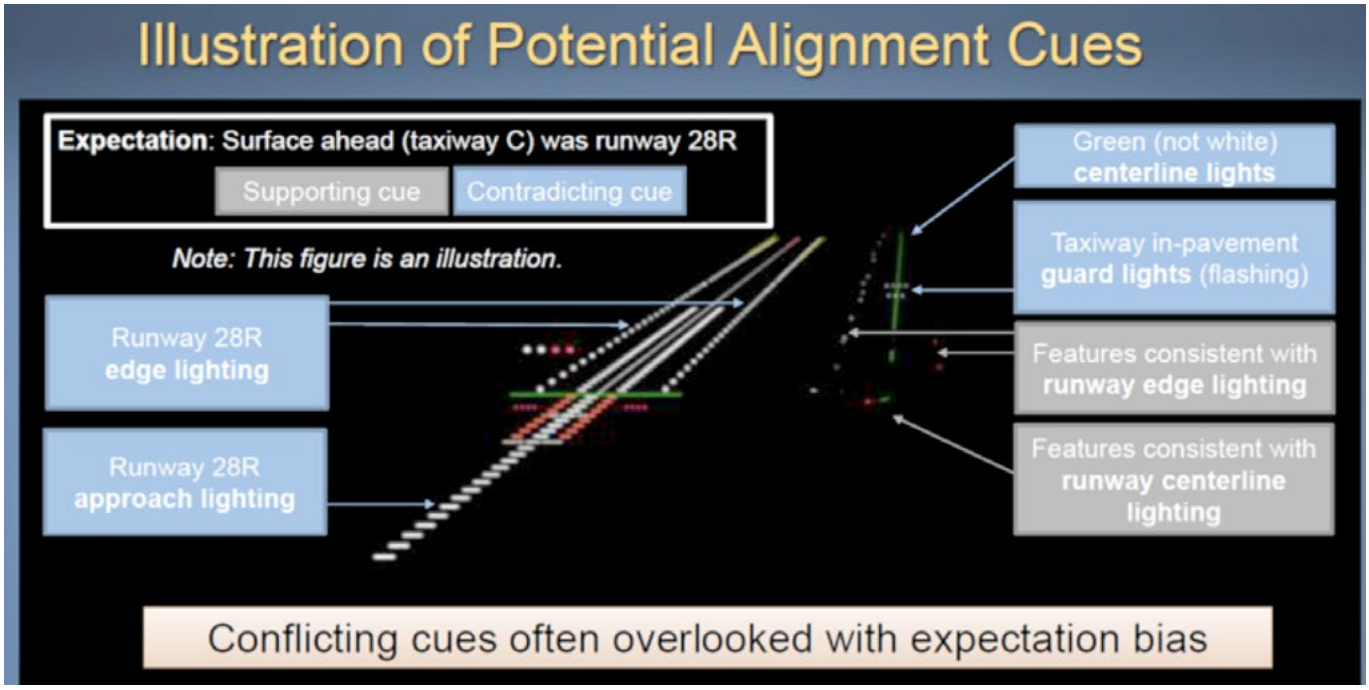

Diagram taken from NTSB Human Factors Analysis (supplied by author)

(via the localizer) were missing for ACA759. When the First Officer (Pilot Monitoring) had set up the approach, he did not manually tune the ILS frequency, and the Captain either did not notice or address the fact this step had been missed.

Fatigue

There were several reasons why fatigue was thought to play a prominent role in this incident. First, both pilots had been continuously awake for an extended period of time, and they were landing precisely during the circadian lowest period of the 24 day-night cycle. The incident occurred at 23:56 local (roughly 0256 for the flight crews' normal body clock time). The Captain, who was called from reserve, had been awake for more than 19 hours, and the First Officer, more than 12 hours. The Captain had been assigned to the flight at 08:49 local (11.49 body clock) resulting in a notice period of 7 hours 51 minutes prior to report. The report also suggests an elevated workload factor additionally contributed to the pilots' fatigue, as they were dealing with thunderstorms during the first half of the flight and preparing for the approach during the second half of the flight. Both pilots' understanding of the unfolding situation and actions were furthermore consistent with hallmark features of performance declines associated with fatigue. Indeed, increasing fatigue is associated with degraded information processing, deteriorating perception, memory, a narrowing of attentional focus and increased difficulty in overcoming 'anchoring' biases to a particular plan. Not much is known about how fatigue affects colour perception, but deteriorating binocular vision and ability to distinguish flashing from continuous visual signals is furthermore an area of fatigue-driven decrement. Against this context, the NTSB concluded that the performance consequences of fatigue likely contributed to their ongoing expectation bias and delayed decision to go around.

But why had both crew been awake for such an extended period of time? It is interesting to see that the NTSB notes that, 'the flight crew's work schedule for the incident flight complied with the applicable Canadian flight time limitations and rest requirements.' In fact, it goes further to state that the flight crew technically could have been on duty for 14 hours plus an additional 3 hour extension due to the unforeseen operational circumstances that led to their delayed departure from Toronto.

What The reaction Has Been?

It should be noted that this flight-crew initiated low altitude go-around was successful and prevented a serious collision. As underscored by NTSB Board member Bruce Landsberg, "unless someone is habitually error prone…., punitive response is completely ill-suited to critical performance environments." That said, the NTSB outlined some clear recommendations, including the need to review existing methods for presenting flight operations information to pilots both pre-flight and during flight, and develop ways to ensure they are organized and optimized for pilot review. It was suggested that technical solutions alerting misalignment with a runway surface should be required for airplanes landing at primary airports within Class B and C airspace. With respect to fatigue, the NTSB concluded that Canadian regulations "do not, in some circumstances, allow for sufficient rest for reserve pilots…", leading to a recommendation for Transport Canada to revise regulations to address the potential for fatigue on reserve duties. However, on fatigue, Landsberg was explicit: "If we expect solid human performance where lives are at stake, fatigue rules need to be based on human factors science and not on economic considerations."

BALPA Comment: We hope that this important message is received loud and clear across the entire aviation industry.

Wg Cdr Spry's Comments:

Perhaps the most famous severe near miss in aviation history and one which reminds us of how easily things can go wrong in relatively benign circumstances. Notice to Aviator (NOTAM) review is a critical part of pre-flight planning, especially for departure, destination, and main diversion airfields. Any salient points should be highlighted to the crew but, as ever, things can get missed, especially when one of the pilots gets less than 8 hours' notice to crew in! In this case the crew did not realise that Runway 28L was closed – the first hole in the 'Swiss Cheese'. Expectation bias, and the related confirmation bias, can cause a person to incorrectly persist in activity believing everything is ok, despite visible evidence to the contrary i.e. we see what we expect to see. It is a function of the way our brain processes information.
Fatigue/tiredness is a common issue which affects all those involved in safety (not just air safety). In this case, landing during the Window of Circadian Low is likely to have affected the performance of the crew. Guidance on fatigue can be found in AP8000 Leaflet 8009. Luckily, in this instance, the crew conducted a late go-around and avoided disaster. ■

The Waiting Room – Puzzles

Sudoku

9	7	5						
	1	6	5			2		
3					1		5	
		7		9	6	3	8	
	3						7	
	4	1	7	3		9		
	9		2					7
		8			5	4	2	
						5	1	8

Easy

	9		8	4				
1							9	
		7	6	1				
5		9	1					
	8	3				6	4	
					7	9		5
				5	4	8		
	2							7
				9	8		3	

Hard

Programme Marshall

Air Traffic Capability Takes a Leap Forward

by Wg Cdr Alexa Smyth, SO1 Programme Marshall, 2 Group BMFHQ

Programme Marshall is both a new asset and service delivery contract, delivering new, regulatory compliant and highly reliable air traffic control equipment to units across the Army, RN, RAF, and MOD sites as well as support and maintenance of the equipment until 2037. Teams from Air Capability Delivery, Battlespace Management Force HQ and DE&S Marshall DT are working alongside the contractor Aquila (a joint venture between NATS and Thales) to deliver a huge £1.9bn Government Major Projects Portfolio (GMPP) programme covering 65 sites worldwide. Marshall is creating transformational change within the ATM community; it's a step change in technology and is creating opportunities for new ways of working for the entire air traffic community, moving old equipment to new, and is like going from a Nokia 3310 to an iPhone.

Fig. 1. Tower Phase 1&2 legacy and new equipment

Following a significant equipment delivery hiatus (resulting from a considerable number of MOD air systems lacking regulatory compliant transponders), an amendment to the contract was approved in Oct 2020, leading to a kick start in the delivery of Marshall equipment. Whilst the programme delivers capabilities such as Military Airfield Simulators (MASIM), Tactical Air Navigation System (TACAN), Air Defence radios and deployed tactical/static equipment, there are 3 main areas that affect most terminal units and Air Weapons Ranges:

1. **Tower Phase 1 & 2** – Voice Communications Control System (VCCS), Emergency Voice Communications System (EVCS), High Resolution Direction Finding (HRDF) and Record & Replay. (Fig. 1)

2. **Tower Phase 3** – TopSky Radar Data Processor (RDP), TopSky Support Information System (SIS) and Digital Automated Terminal Information Service (DATIS). (Fig. 2 & 3)

3. **Surveillance Sensors** – cooperative and non-cooperative. Thales STAR-Next Generation (STAR-NG) primary surveillance radar and the Wide Area Multi-lateration (WAM), RSM970S co-mounted radar or Watchman enhancement.

Fig. 2. Legacy ATM equipment showing critical ATM information stored on bits of paper and post-it notes

What's New?

Programme Marshall has introduced a hub/satellite model for delivery of ATS. Radar services for multiple units will be delivered from one location. This isn't really anything new, it's just on a much larger scale than we've ever done before – radar services for Northolt have been provided from Swanwick for many years – this is just one of several examples. The hub locations are known as Terminal Air Traffic Control Centres (TATCC), of which there are three:

Fig. 3. Tower Phase 3 – New Marshall equipment

Fig. 4. Lincs TATCC

1. **Lincolnshire TATCC** (location Coningsby) – providing radar services for Barkston Heath, Coningsby, Cranwell and Waddington.

2. **Eastern TATCC** (location Marham) – providing radar services for Marham and Wittering.

3. **Southern TATCC** (location Brize Norton) – providing radar services for Benson, Boscombe Down, Brize Norton and Odiham.

The STAR-NG (non-cooperative) and WAM (cooperative) are new types of surveillance sensors – they're compliant with current regulatory standards, have excellent serviceability rates and clear operating parameters; the legacy equipment has none of those. Although it will take time for our operators to become familiar with how our new systems work, we simply must update our equipment. WAM specifically is the greatest departure from the familiar. It is a series of antennas which utilises 'time difference of arrival' calculations to detect the position of air systems with international regulatory compliant transponders. Given the multiple antennas, the system has much greater redundancy than legacy equipment and whilst it does not have the full ADS-B functionality enabled, it will detect an air system fitted with ADS-B if 3 or more WAM antennas detect it. Utilising ADS-B for controlling purposes is currently not authorised by the CAA or MAA hence WAM has not been enabled for ADS-B; however, the additional situational awareness provided by the current provision is extremely useful.

Programme Progress

There are many units affected by Marshall including Air Weapons Ranges but to focus on main locations, all units except for Odiham, Lossiemouth, Boscombe Down, Gibraltar and MPA have undertaken the Tower Phase 1 & 2 transition;

remaining units will transition by the end of 2022 and by Jul 2023 for MPA. Tower Phase 3 and surveillance sensor transitions are gathering pace with 6 units (Brize Norton, Coningsby, Marham, Shawbury, Valley and Waddington) operating on their new TopSky equipment and 4 (Coningsby, Marham, Shawbury and Valley) operating on new surveillance sensors. The rest will follow later this year or through 2023.

Moving forward, most units will undergo Tower Phase 3 transition and the delivery of their surveillance sensors at the same time. If it hasn't happened at your unit yet…it will happen soon…Marshall is coming!

The Future

Feedback on the new equipment has been very positive to date. But as with all new equipment programmes there are some teething issues – to reassure you, we know about them, we're working hard to resolve them and we're on it! A software upgrade was undertaken over the last couple of months to rectify some of the niggles and a further software patch will be introduced in the coming weeks. Additionally, we're working with Aquila to provide another full software upgrade to be delivered in Q4 2022 to rectify several other issues that have been highlighted by operators.

The future is bright – our people undertake a complex and challenging task, they deserve modern, state of the art ATM equipment to allow them to do that job to the best of their abilities. The Marshall equipment rollout is long overdue but it's now happening. We have a talented team of people working hard to deliver the programme and they will continue to work alongside controllers and ASOS alike to deliver.

Green = delivery in 2022
Amber = delivery in 2023

Site	Twr Ph 1+2	Twr Ph 3	Surveillance Sensors	
			Non-cooperative	Cooperative
Shawbury	COMPLETE	COMPLETE	COMPLETE	COMPLETE
Coningsby	COMPLETE	COMPLETE	COMPLETE	COMPLETE
Valley	COMPLETE	COMPLETE	COMPLETE	COMPLETE
Marham	COMPLETE	COMPLETE	COMPLETE	
Brize Norton	COMPLETE	COMPLETE		
Waddington	COMPLETE	COMPLETE		
Cranwell / Barkston Heath	COMPLETE			
Wattisham	COMPLETE			
Akrotiri	COMPLETE			
Benson	COMPLETE			
Leeming	COMPLETE			
Wittering	COMPLETE			
Middle Wallop	COMPLETE			
Northolt	COMPLETE		N/A - provided by NATS feeds	
Odiham				
Boscombe Down				
Lossiemouth				
Gibraltar				
MPA				N/A

All images by Wg Cdr Travis Stone – Reproduced by kind permission

Doc's Corner: **Hydration and Urination Research** The results are in

By Wg Cdr Jemma Austin (CAS Trenchard Fellow) and Gp Capt Gwynne Harper, CO RAF CAM and Research Sponsor

(See issue 35 for the details of this RAF CAM Research.) Last summer nearly 250 UK aircrew participated in research looking into the hydration (drinking) and urination (peeing) habits of UK military aircrew. We heard from regular and reserve aircrew across all roles (71% pilots) and every platform type. This showed that many aircrew are making choices that don't enable them to remain well hydrated. This is less than ideal as even small amounts of dehydration can have operational consequences, for example by impacting on the ability to concentrate on a task.

The topics of drinking and especially peeing may seem personal and it may feel a little intrusive to describe such personal habits. However, within Aviation and Space medicine we are charged with supporting and optimising health, safety and human performance. Basic human needs are an essential component of this, and so cannot be a taboo topic.

What our aircrew told us: You reported reducing your fluid intake on flying days compared with non-flying days. This was the opposite of what we would have expected – increasing your fluid intake to counter the physical and environmental demands of flying. Female aircrew reported a 4 times greater reduction in average fluid intake compared with male colleagues and a similar degree of reduction was seen in all aircrew who reported no access to a toileting facility or device whilst flying. There was no reported difference in being 'too busy to drink', but it was noted that drinking in-cockpit was prohibited in a small number of platforms.

You reported holding your urine for prolonged periods to the point of feeling distracted. A third of male aircrew and two thirds of female aircrew reported holding their urine for some to most of the time whilst flying. Distraction from a full bladder was a linked and common occurrence, 70% of you having experienced some degree of distraction from the need to urinate whilst flying.

You reported that urinating in an airborne environment is both a physical and a psychological burden. Three quarters of female crew and 14% males experienced some form of shame and embarrassment around urination. The physical impact of urinating was rated a moderate to severe problem by nearly half of aircrew (43% male, 60% female). This is your primary workplace and we should be working to reduce any impediments.

You reported that the airborne operating environment presented many barriers to urinating. You described challenges across every platform type and role. These included:

- Sitting on an ejection seat
- Longer sortie durations
- SOPs restricting personnel to the flight deck
- BALCS impeding free movement
- Turbulence
- Onboard temperatures

Female aircrew faced additional challenges. Single-piece flying clothing is difficult or impossible to manage in-flight: the more widespread use of two-piece flying garments was suggested. This would simplify the use of facilities and toileting devices, reduce bodily exposure (especially when in open cabins) and reduce the peril of sleeves dangling into facilities or onto floors.

The use of Shewee™ and similar devices, to enable an individual without a directional appendage to pee standing, came with their own tales of caution. Trying to balance aircraft movement, holding flying clothing layers at bay and directing the flow accurately required more than 2 hands and rendered use almost impossible. This further limited the options available to female aircrew.

There was no significant relationship found between behaviour change and poor urinary (bladder and kidney) health. Whilst the research findings demonstrated some urinary symptoms increasing with age or with increasing caffeine use, this was in keeping with non-flying populations. There was no significant evidence that flying as an occupation was correlated with any urinary health problems.

Female aircrew reported greater levels of behaviour adaptation and burden around urination. Female aircrew are generally believed to be lower risk takers than their male colleagues. Therefore, the additional risks taken by females (through maladaptive behaviour adoption) strongly implies

that elements of the airborne environment are forcing those behaviours. This probably represents a sex-based inequality that is disproportionately impacting the lived-experience of our female aircrew.

So what?

You'll recall from the previous article 'Too pee or not to pee?' (Air Clues Issue 35) that remaining hydrated is important within military flying activity (in addition to life in general) as this keeps your body functioning well and reduces the risk of heat illness. Indeed, dehydration can cause many significant but avoidable aeromedical risks, from reduced mental performance, poorer mood and impaired concentration through to reduced Gz tolerance and an increased risk of decompression illness.

In research conducted within a flight simulator, dehydrated aircrew had significantly poorer spatial cognition and flight performance scoring than when hydrated. It is worrying to note that this error rate is equivalent to that when an individual's blood alcohol level is at the UK drink drive limit (80mg/100ml).

At the other end of what goes in, is what comes out. Being unable to urinate when needed, and then holding it in for prolonged periods, is clearly distracting. However, the consequences are likely underestimated: this distraction again causes unforced errors at the same level of that at the UK drink drive limit. At the very least the distraction from an overfull bladder can reduce situational awareness; this is likely to come at a critical time towards the end of a sortie.
Therefore, if you cannot urinate whilst flying you will likely impede your ability to optimally hydrate and therefore potentially risk your health, safety and performance.

What can be done?

This research has confirmed both the presence of 'tactical (deliberate) dehydration' and the presence of distraction (and loss of situational awareness) from the need to urinate.

At RAF CAM changes to both healthcare and aircrew aviation medicine training have already been adopted. The research additionally confirmed RAF CAM's suspicions that female aircrews carry a greater burden of unmet need compared with male counterparts. With full support of the Senior Leadership, work is therefore now underway to improve Aircrew Equipment Assemblies and their associated platform integration; the first of which will be ground and air testing of the female Skydrate™ system, the latest version of the Aircrew Mission Extension Device (AMXD) currently in use on F-35.

Infection. Prevention. Control.
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NHS

The urine colour guide

Be aware that limiting fluid intake can cause urinary tract infections.
Aim for approximately 6-8 glasses a day to stay hydrated. Choose a drink that you are most likely to finish, all fluids count except alcohol.

Colours 1-3 suggest normal urine

1. Clear to pale yellow urine suggests that you are well hydrated.
2. Light/transparent yellow urine suggests an ideal level of hydration
3. A darker yellow/pale honey coloured urine suggests that you may need to hydrate soon.

Colours 4-8 suggest you need to rehydrate

4. A yellow, cloudier urine colour suggests you are ready for a drink.
5. A darker yellow urine suggests you are starting to become dehydrated.
6. Amber coloured urine is not healthy, your body really needs more liquid. All fluids count (except alcohol).
7. Orange/yellow urine suggest that you are becoming severely dehydrated.
8. If your urine is this dark, darker than this or red/brown it may not be due to dehydration. Seek advice from your GP.

However, a large part of the drive for change must come from you. Few DASORs capture incidents arising in relation to urination despite much of the research findings warranting a report. Examples included the need to make unscheduled landings in fields, deficient and/or insufficient equipment provision and the failure of devices and ensuing leakage within the aircraft.

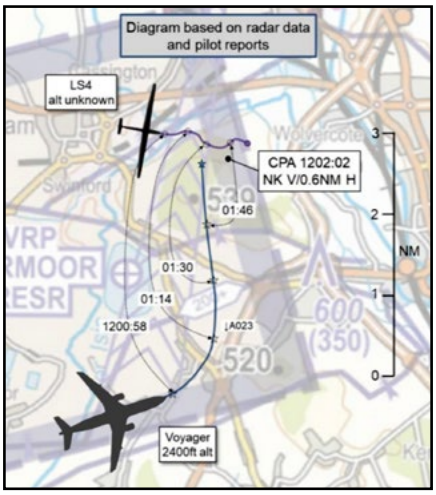
Being under the influence of alcohol is illegal within the flying environment due to the inherent and risks to flight safety. Although less obvious, both dehydration and distraction by a full bladder can cause errors to a similar degree as being at the legal alcohol limit: we should not have to accept this avoidable risk.

Only through thorough visibility of the impact of any urination related challenges within your working roles, can any need for re-prioritisation of urination support be identified. Your voiced and lived experience needs to be heard, change is driven by visibility of the problem. Use of DASORs and reporting of issues and deficiencies through platform capability planning groups, will drive any required, invested and prioritised change.

Finally, thank you to all of you who contributed. This research wouldn't have happened without your involvement and willingness to share so candidly. This research was conducted as part of a CAS fellowship and was given approval by the MOD Research Ethics Committee (2047/MODREC/21).

Airprox Highlights

With Comments from Wg Cdr Spry



16 July 2021
Voyager v LS4 Glider
Airprox No. 202118

The Voyager Pilot reported that they were recovering from an AAR1 mission on the south coast. After a substantial hold overhead the BZ [NDB] at FL60, they were cleared for the NDB ILS DME for RW25 at Brize Norton. It was noted during the hold that there was a high level of General Aviation in the vicinity of Brize Norton and a good lookout would be required. During the base turn at 2,300ft, Brize Director called "pop-up traffic at 1 o'clock, no height indication". They replied "looking" and searched for traffic. The traffic was sighted just before intercepting the localiser; it was co-altitude and estimated within 400-500m of their aircraft. The traffic was a glider and started a left-hand turn away from them as it was sighted, and as they turned left onto the localiser.

The glider had no transponder [they opined] so wasn't squawking.
The rest of the approach was continued without incident.

The LS4 Glider Pilot reported that they were flying on a cross-country flight, routing from [departure airfield] to Chippenham. The thermic conditions were not as good as they had expected. They were climbing on the eastern edge of the Brize Zone, under a high workload, when they spotted the Airbus A330 approaching from within the Brize Zone. At the time, they believed they were just on the outside of the Brize Zone. They have since been informed by the RAF that it has been identified that they were inside the Brize Zone when the incident occurred. This was a genuine mistake and was in no way intentional.
The trajectory of the Airbus appeared to be above their height. In their opinion as a pilot, they believed there was no risk of collision so they continued to climb as the Airbus passed by. Since they did not believe there was any risk of collision, nor were they aware of any airspace infringement, they thought no more of the matter.

The Brize Director Controller reported that they had 2 aircraft on frequency [the incident Voyager and an A109]. [The Voyager] had to make multiple holds due to inbound traffic causing RW inspections to be delayed. Once [the Voyager pilot] was cleared for the procedure, the controller noticed a primary contact operating approximately 10 miles in the approach lane. The traffic was called but at the time was believed to be outside CAS. [The Voyager pilot] turned to intercept the ILS and this was when they reported that the glider was in close proximity to them. [The A109 pilot] had the traffic called and could see it on their TCAS [they believed] but wasn't visual. To keep 5 miles [separation] on the unknown traffic, [The A109 pilot] was given a different approach to that which they had requested.

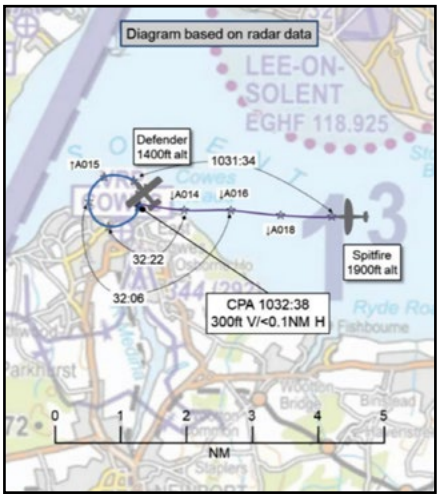
The Brize Supervisor reported that this incident occurred towards the end of a particularly complex and busy hour. The Approach and Director controllers had been working a difficult scenario with A330 inbounds, ATC-enforced holds to facilitate RW inspections, A330 departures as well as light aircraft and returning parachute aircraft, and a busy zone frequency. Their attention had been split between this, the controllers upstairs in the visual control room who were managing a complex taxi pattern and the need to juggle aircraft taxiing and runway inspections, and the LARS controller who had been working 8 aircraft on frequency (the maximum [permitted at Brize Norton]) for most of the past hour. The Supervisor had noticed the non-squawking aircraft over the eastern edge of the CTR when the A330 was overhead Brize Norton and, from the speed, direction and size of radar return, they believed it to be a

glider. They powered-up the PAR2 (an accurate radar with a quick refresh rate used to control aircraft from 10NM to touchdown in a narrow cone) to see if it showed any returns in the approach cone; there was nothing displayed out to 10NM from the threshold.
They monitored the PAR display as the A330 went outbound on the NDB-ILS procedure and saw no returns in the location of the non-squawking aircraft. ATC does not yet have FLARM installed so they did not check that, but they were content that the PAR showing nothing and the rules of the air stating that aircraft cannot enter the Class D [airspace] without a clearance to do so meant the aircraft was not inside the CTR. When the A330 [pilot] said that the glider had passed close, they spoke to the Director [controller] to ensure they were going to avoid the non-squawking aircraft with their [A109] (they were), then found their phone and looked on the FLARM website to obtain details of the glider, which FLARM showed as inside the Brize CTR and indicating an altitude of 900m [~3,000ft].

For full details of this Report see AIRPROX REPORT No 2021118 on the Airprox Board Website.

Spry's Comment:

The positioning by the glider pilot was unfortunate; operating within the airspace without clearance and close to the runway centreline without squawking or talking to the ATC unit is never a good idea. The glider pilot was unaware that they were in Controlled Airspace and had they stayed outside, this Airprox may not have happened. ATC picked up a non-squawking contact (the glider) at the eastern edge of the Brize airspace and, despite the assumption it was outside controlled airspace, passed it to the Voyager crew. The Voyager crew had also noted that there was a high level of GA activity in the vicinity of Brize and adopted a good lookout throughout the hold and procedure. ATC should be commended for their pragmatism and efforts to obtain more information on the contact via the Precision Approach Radar with its higher fidelity and refresh rate. Unfortunately, this provided none. On this occasion it was lucky that the glider appeared on radar; all-too-often the radar cannot normally detect gliders. The proactive actions of ATC facilitated the Voyager's situational awareness on the glider and the crew was able to acquire it visually. ■



8 July 2021
Defender v Spitfire
Airprox No. 2021132

The Defender Pilot reported that, on visual approach to Daedalus Airfield [Lee-on-Solent], there was a high amount of GA traffic in the RH circuit to RW23. Due to this, they elected to hold over VRP Cowes to await the circuit becoming less congested, which was reported to Lee-on-Solent Radio. Whilst conducting a routine lookout, a 2-ship formation of low-winged aircraft was spotted, later confirmed to be GA Spitfires departing Daedalus. At the time of the event, they believed that the traffic might be converging and they received a TAS TA. As a result, they began a climb and observed the formation passing underneath and behind them. Upon landing, they contacted the Spitfire formation lead pilot who confirmed that they could also see [the Defender] throughout the event. All [pilots] were visual with each other's aircraft. However, from the Defender crew's perspective, a TA is undesirable as their holding location was reported on the radio and therefore good airmanship should have resulted in greater separation, they thought.

The Spitfire Pilot reported they were flying the lead aircraft of a pair of Spitfires from Lee-on-Solent (EGHF) on a 20min local flight, anticlockwise around the Isle of Wight. Prior to their departure, [they heard] the 'Islander' pilot transmit their position, orbiting over Cowes, while waiting for circuit traffic to land. The formation departed the airfield as briefed and, once outside the ATZ, the pilot of the lead aircraft called the pair over to a company frequency. They crossed the Solent while joining into close formation and conducted a gentle descending right-hand turn to set course along the coast of the island at 230mph. Both Spitfire pilots became visual with the Defender at a range of around 3NM and descended to 1,000ft, the minimum permitted for their activity, to allow them to pass safely under it with around 200-300ft vertical separation. However, due to the Defender's orbital path, lateral separation was not possible to achieve without compromising ability to glide back to land in the event of an engine failure, or without positioning over a congested area – which is prohibited under the conditions of the [aircraft's] Permits to Fly. Furthermore, the formation lead pilot was conscious of keeping their manoeuvring as gentle as possible with their wingman in close formation. The [lead] formation pilot was visually avoiding throughout; they considered that at no point was safety of flight compromised. No further avoiding action was required, however

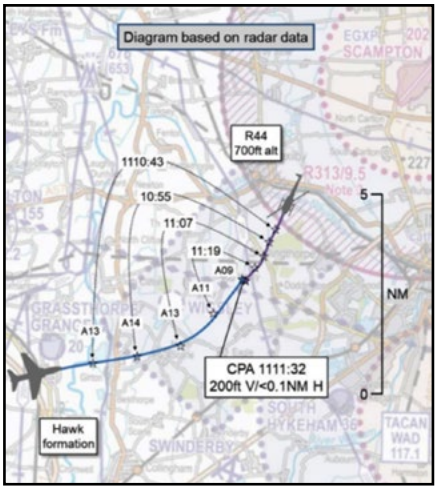
they recognise that more separation would have been preferable.

The Lee-On-Solent AFISO reported they had no recollection of any Airprox occurring or being mentioned that day and all flights were handled safely and appropriately. The pilot of [the Defender] was reluctant to join the circuit with other aircraft operating in it, so chose to hold outside the ATZ. An AFISO is not able to instruct them when to join downwind but did give, and subsequently updated, relevant Traffic Information in real time as per their AFISO role, including the departure of two Spitfires to the south, who were aware of the position of the Defender. [At the time] there were no concerns raised by anyone of any confliction.

For full details of this Report see AIRPROX REPORT No 2021132 on the Airprox Board Website.

Spry's Comments:

On arrival at Lee-on-Solent, the Defender crew sensibly elected to hold to assess circuit traffic to enable them to integrate more safely. The crew was visual with the departing Spitfires, although was not aware of their specific routing or flight restrictions. On receiving the Traffic Alert System (TAS) Traffic Advisory (TA), they responded accordingly and re-acquired the Spitfire formation flying beneath them. With the benefit of hindsight and given the flight profile limitations faced by the Spitfires, a verbal brief on frequency of the routing by the Spitfires may have influenced the Defender crew to increase height separation. Whilst not a contributory factor in this Airprox, the UKAB discussed the positioning of the hold being flown by the Defender pilot at the Cowes Visual Reporting Point (VRP). This is a potential 'hot spot' for joining traffic but it is worth noting that, although it is not regulation, the CAA recommends that: "Pilots should as far as practicable avoid direct overflight of a VRP" to mitigate the risk of MAC. The CAA Safety and Regulatory Group (SARG) documentation states the following: The purpose of a VRP is to provide a visual reference marked on an aeronautical chart to facilitate: a. ATC provision of routing advice within, beneath or adjacent to Controlled Airspace to facilitate access and transit of VFR traffic; b. ATC provision of routing advice outside Controlled Airspace to assist the deconfliction of traffic using instrument approaches or departure procedures; and c. Radar identification. Better military awareness of this advice should help influence your hold, routing and expectations of other air users in the vicinity of a VRP.



26 June 2021
Hawk v R44
Airprox No. 2021095

The Hawk Pilot reported that the Royal Air Force Aerobatic Team (RAFAT) was conducting a transit to RAF Scampton, including a flypast. They were the sortie navigator, responsible for planning, airborne navigation and ATC communication on behalf of the Team leader.

The sortie was planned and conducted iaw RAFAT SOPs and a pre-sortie CADS check showed no conflicts; Pipeline Inspection aircraft were notified as not active. The sortie had been busy with significant GA traffic in the area of the departure airfield and poor weather in the Midlands area, however, the flypast was conducted as tasked. Post flypast, Red 1 flowed along the NOTAM'd planned route for recovery to Scampton where Waddington ATC is the usual provider for an ATC service when departing from, or recovering to, Scampton. However, due to the current agreement between RAFAT and RAF Waddington for weekend operations, Waddington ATC was stood down because the forecast weather for the recovery was WHT/BLU1F 2 . Therefore, the only option for a radar service for recovery from the south at low-level was with East Midlands. The recovery was initiated 10NM west of Newark and at that time the formation held a reduced Traffic Service (due to limits of radar performance and formation altitude) from East Midlands Radar. Approaching the edge of their radar coverage, about 15NM from Scampton, They were informed of 5 contacts 5-8NM west of Scampton. Altitude information was provided for 2 of the 5. They asked for a position update which was provided for the nearest 2 contacts. All Traffic Information was relayed to Red 1 and the rest of the formation on UHF R/T frequency. Shortly after this, on a bearing of about 220°/4NM from Scampton, they became visual with a light aircraft in the right 1 o'clock high position that was not a confliction. The position of this traffic correlated with one of the contacts called by East Midlands Radar and was called almost simultaneously to Red 1 by another formation member who was also visual with it. At virtually the same time they saw a helicopter, slightly low, opposite track which passed underneath the right hand side of the rear section (comprising Reds 6-10, in 0.5NM trail on the front section of Reds 1-5). There was no time to call the traffic

or take avoiding action. The helicopter appeared to be dark blue in colour with some yellow markings (possibly one of the blades painted yellow).
The helicopter passed closest to Red 10 and was assessed visually as having very little lateral separation, 150ft below.
The pilot assessed other relevant factors to be that they had no radar service, no on-board collision avoidance system or radar and that there is no radar feed to Scampton Tower.

Another formation member was nominated to contact Scampton Tower on recovery, iaw RAFAT SOPs. They called ahead, whilst the reporting Hawk pilot maintained communications with East Midlands Radar, and was provided information on the helicopter which was relayed to the rest of the formation on a UHF radio frequency. The traffic was called as just outside the ATZ, bearing 270° from Scampton at approx. 3-4NM. They were also informed that the traffic was heading south and had been requested to be below 500ft on the Scampton QFE. The other formation member contacted Scampton Tower on 125.35MHz, the helicopter traffic was on 122.1MHz so all position reports from the helicopter were being relayed via Scampton Tower.

The R44 Pilot reported that, rather than making the assumption they were closed on a Saturday, they spoke to Scampton Tower to request a transit through the western side of their ATZ. This was granted and the pilot was informed the Red Arrows were inbound with 10min to run and were on frequency. On leaving the ATZ on a southerly heading, the R44 pilot began a descent to deconflict with the inbound Red Arrows. The pilot was informed of their location, altitude and heading. The R44 pilot saw them at a range of 3NM, where they were expected to be and where they had been advised as being, at which point the pilot was on final descent to a landing site. The Red Arrows passed down the right side about 500ft above. No avoiding action was required because the R44 pilot was in contact with Scampton Tower, knew where they were coming from and at what altitude, and the Red Arrows knew the R44 pilot's heading and altitude.

The Scampton Tower Controller reported that Waddington Radar had not been called in as the weather was BLU/WHT and fit VFR recoveries. This was unknown by Scampton ATC until after opening the Tower for the RAFAT recovery. As such, the controller had no awareness of any radar tracks nor were they able to receive any 'warning in' calls [from Waddington radar]. The only information received prior to recovery was that RAFAT was delayed by about 10min on departure and the POB for each aircraft. An R44 helicopter pilot free called on 122.100MHz stating he was positioned to the west by about 3 miles at 900ft and wished to transit the edge of the ATZ to the west. The controller was not speaking to RAFAT, had not received a 'warning in' call from any other unit and did not see an issue at first, so told the pilot the transit was approved. The pilot was also informed that RAFAT were expected to recover in about 10-15min and asked if they would be 'out of the way'. The pilot stated they would be clear of the area in 5min and was also happy to accept a descent. A few minutes later, RAFAT checked in on 125.350MHz and requested the airfield details. The controller asked the helicopter pilot to be not above 500ft on Scampton QFE which was acknowledged but could not see the helicopter at that point. Information was passed to the helicopter on RAFAT, including last reported position and height. A minute or so later RAFAT asked for an update at which point the helicopter was in sight, visually assessed and relayed as approximately Scampton 270° at 3.5-4 miles and not above 500ft (there is no radar feed in the Scampton Tower). At this point RAFAT was over 20 miles away from Scampton. RAFAT requested that the helicopter pilot report outside of 5 miles. Again, the helicopter pilot obliged, reported outside of 5 miles, that they were also visual with the Red Arrows and then went en-route.
The controller was surprised when RAFAT stated they had come so close to the helicopter because they had expected RAFAT to remain not below 1,000ft QFE until within the circuit at Scampton and/or visual with the helicopter. Waddington ATC would ordinarily activate R313 for the RAFAT recovery and it was not something that Scampton ATC would routinely do. The controller felt that perhaps on this occasion they should have initiated [R313 activation] but would have done this only once they knew RAFAT was inbound and therefore it was highly unlikely it would have prevented the helicopter from appearing in the position it did. Given that RAFAT would have placed a NOTAM in the system for this sortie, the controller expected that the helicopter pilot would have been aware of their impending recovery profile and timings. Post event, Waddington ATC confirmed that if they had been called in to provide a radar service, they would not have activated R313 for recovery.

For full details see Airprox No 2021095 on the Airprox Board website.

Spry's Comments:

This incident highlighted the classic Swiss cheese model for how this Airprox transpired; where if just one of the barriers was functioning as it should do, it may not have happened. The holes that aligned are:

- There was no radar feed as Waddington was stood down as per the standard agreement, meaning there was no accurate feed to reference traffic in the local area.
- Vague and incorrect position calls from the R44, leading to the mental models of the controller, as well as the recovering Hawks, were not wholly accurate. This can affect look out and decision-making processes.
- R313 around Scampton MATZ was not active; its published hours are weekdays only and when activated by NOTAM. There was an incorrect assumption that a NOTAM had been submitted for activation on this day. "Assumption is the mother of all mistakes".
- At the time of the incident, the Scampton Flying Order Book (FOB) defines a standard join as flown through the Initial Point at the intended circuit height but then listed 3 differing heights for different types of circuit. During the join, the recovering Hawks unwittingly descended towards the R44 due to an incomplete mental model of its position and heading.

Post the investigation, this Airprox prompted an immediate review of Waddington ATC provision for weekend RAFAT movements, and it has been agreed that Waddington will open routinely for RAFAT departures and recoveries whenever possible. The process for activating R313 at the weekends has been reviewed and formalised and the FOB circuit join procedure is being reviewed; thus, demonstrating how the process has worked and the benefits of reporting and thorough investigation to reducing the likelihood of Mid-Air Collision. ■

15 June 2021
Prefect v Paraglider/Paramotor
Airprox No. 2021085

The Prefect Pilot reported that, at approximately 1230z, they departed Barkston Heath for a medium level navigation exercise to the north. As the sortie progressed further north at 5,000ft, a handover from Waddington to Humberside was requested, however Waddington ATC advised this was not possible due to contact issues and the aircrew was requested to free call Humberside instead. In the short period between leaving Waddington frequency and calling Humberside, the aircraft was approaching Trent Falls at approximately 1245z. As the student was preparing for their initial call to Humberside for a Traffic Service, the QFI spotted, at the last minute, a paraglider in the 11 o'clock position by 100-200m roughly 100ft above. It appeared to the QFI that the white and blue paraglider was tracking left-to-right, so the QFI took control from the student and positioned the aircraft out of the way of the paraglider's track however once the paraglider had cleared to the right hand side, the crew was no longer able to see it. The event lasted only a couple of seconds, but it was noted that the paraglider appeared to have deployed what looked to be an orange, circular parachute which later was discovered that was likely to be the reserve parachute. They had a very thorough brief before setting off on the instructional navigation sortie and there were no NOTAMs or CANPs active up in that area; at the point of conflict the closest NOTAM was model flying up to 1,600ft AMSL but this was in the wrong direction to where the paraglider came from. The QFI noted that they had seen paragliders flying in uncontrolled airspace before but usually around hilly areas such as the Peak District and Lake District and usually confined to a dedicated paragliding area, but certainly not as high as 5,000ft.

The Paramotor Pilot could not be traced. The Airprox Board had concluded that, although the Prefect pilot reported a paraglider, the weather conditions on the day meant that it was more likely to have been a paramotor.

The Waddington Controller reported that they were working the Zone position when a Prefect was handed over from Cranwell, under a Traffic Service. The aircraft was handed over as it was performing a navex to the North in the Humberside area. As the aircraft approached Scampton MATZ

the controller informed the pilot that both Hibaldstow and Kirton Lindsay were active. Close to this time they recalled calling traffic to the pilot, probably when the aircraft was between Cottam and Gainsborough. Shortly after this the pilot requested a handover to Humberside. Humberside had been busy when they had tried to handover a previous track, also on a navex to the north, and had requested that Waddington free-called that aircraft across. They were unable to get through to Humberside on this occasion and informed the pilot that they were unable to arrange a handover and asked the pilot if they were able to accept a free call. The pilot stated that they were. The controller once again called the traffic, gave the pilot their position, told them to squawk 7,000 and free-call Humberside.

The Waddington Supervisor reported that they were not aware of the incident after the aircraft left the Waddington frequency, however they were monitoring the frequencies whilst the aircraft was with Waddington Zone.

For full details see Airprox No 2021095 on the Airprox Board website.

Spry's Comments:

Although this Airprox occurred during a period of flight without a Traffic Service, as a handover couldn't be arranged, it is unlikely that a Traffic Service would have provided any warning to the Prefect crew (the paraglider (or paramotor) had not taken a service nor likely was visible on radar); similarly, the absence of any form of Electronic Conspicuity from the paraglider rendered the Traffic Alert System and FLARM redundant. This just leaves "See and Avoid" as the final barrier in this situation and the crew of the Prefect did a sterling job at spotting the paraglider and manoeuvring in time to avoid the likelihood of collision. However, it was still a close enough call for the crew to believe the paraglider may have initiated an emergency parachute and, on landing, Humberside Police were contacted to check any reported incidents for the welfare of the paraglider (none was traced). Again, this Airprox highlights the continuing need for all pilots to maintain a constant look-out, especially when flying in Class G airspace and when the area is not considered to be a 'free-flying' hot-spot due to the nature of the low-lying terrain. ■

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 (Trg) 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	-
3FTS	01400 267536	-
4 FTS	01407 762241 6666	-
6FTS	01400 266944	-
Air Cadets (RAFAC)	-	01400 0267817
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 657640
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	-
Linton-on-Ouse	01347 848261 6666	01347 847422 / 7617
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 857264 / 7858
Syerston	01400 264522	-
Tactical Supply Wing	95461 7177	-
Valley	01407 762241 6666	01407 767800 / 7685
Waddington	01522 726666	03001684954
Wittering	01780 416377	01780 417611
Wyton	01480 52451 7554 / 7146	-

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Al Udeid	9250 060 451 3043	83EAG-DepFSO@mod.gov.uk
Ascension	00247 63307	BFSAI-ASCOpsOC@mod.uk
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83 EAG	9250 060 451 3050	83EAG-AIROPSFSO@mod.gov.uk
Gibraltar	9231 98531 3365	GIB-RAF-ASM@mod.uk
MPA	00500 75490 or 94130 5490	BFSAI-AirOpsWg-ASM@mod.gov.uk
Tactical Leadership Programme	0034 967 598527	aa3@tlp-info.org
Naval Air Station Jacksonville	001 904 542 4738	-

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