

# 'Poacher Turned Gamekeeper'

## Display Flying: The Human Factors and Error Management Challenge



by Cdr Steve Windebank RN, MAA

Hopefully, if I've managed to entice you this far, the somewhat unusual title has had the desired effect and I urge you to stick with this article as I attempt to explore some of the unique issues being faced in an effort to improve the safety and risk management of Air Displays.

Display flying is probably one of the most exhilarating and challenging, yet potentially hazardous, peacetime flying activities undertaken by any military or civilian aviator. As aviation has become significantly safer over the years, one area that appears to have stubbornly failed to keep pace with this trend is display flying.

I know to some this opening statement may seem controversial and the evidence is certainly not robust or necessarily reliable; I'm also very conscious that statistics can be manipulated in any number of ways to prove an author's point so I don't intend to over-analyse or debate the historical

data. I would however, ask you take a moment to examine the trends in the graph below (Fig 1: Worldwide accident rates per million flights in civilian passenger aircraft and worldwide annually recorded air display accident rates). In the interest of fairness, it is important to note that the civilian accident rates in this graph are based on total accidents per million flights. This information has been collated from highly reliable sources whereas the only available information relating to display accidents is from Wikipedia. Additionally, because total display flying hours have never been recorded, the accident rates have not been normalised in the same way. I therefore appreciate that one could argue that the comparison is somewhat unfair given the hugely differing scales. Nevertheless, I doubt anyone would argue that aviation has experienced dramatic improvements in safety over the last 50 years, whereas the air display record doesn't appear to be able to demonstrate a similar trend.

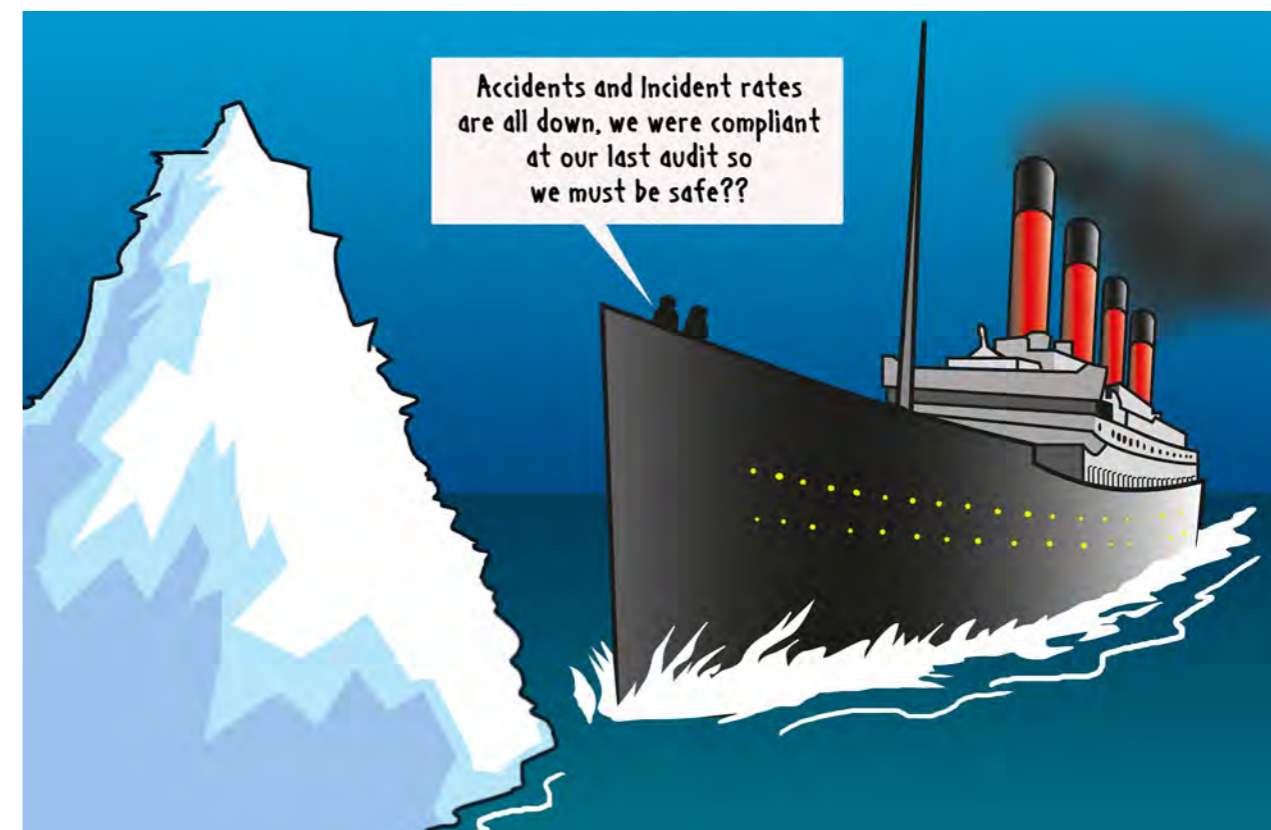
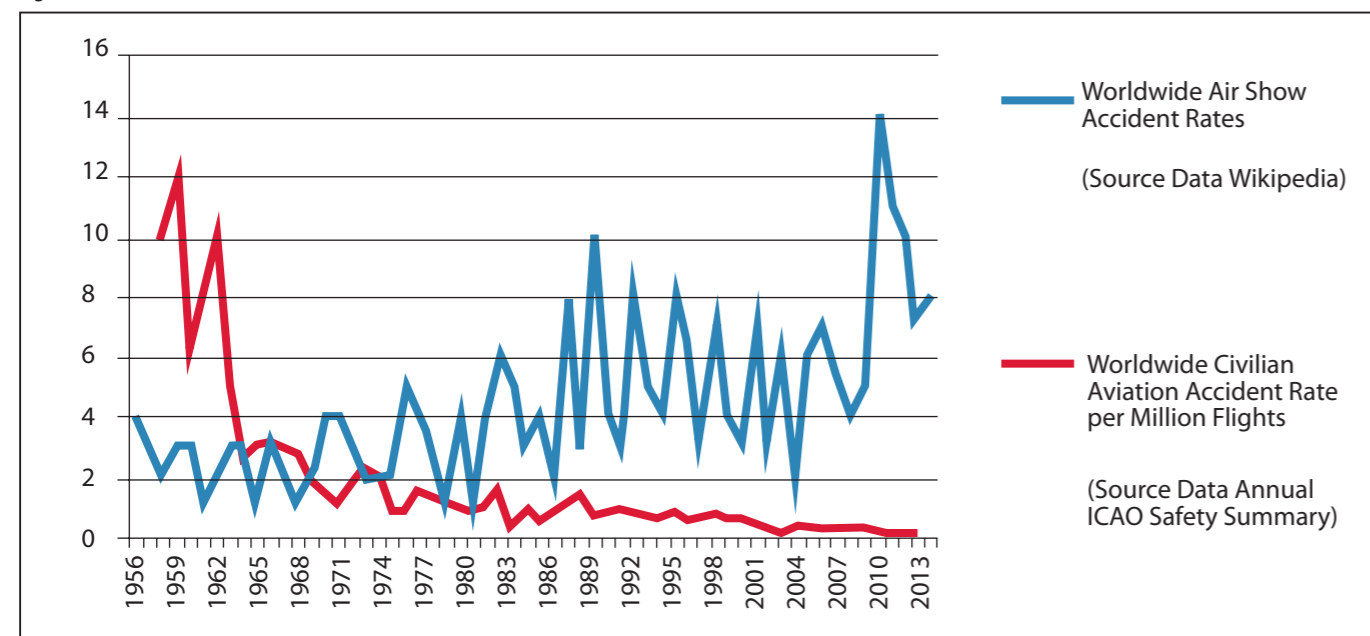
If, as I do, you believe that the safety of display flying could be improved (and this should always be an aspiration), then I'd ask you to persevere with this article as I attempt to outline the on-going work the Military Aviation Authority (MAA) is undertaking and also to highlight those areas where I feel everyone involved in the industry can do more.

Having been a display pilot for a great many years (Poacher) and now intricately involved in air display auditing and oversight activity on behalf of the MAA (Gamekeeper), I feel passionately about maintaining the success of this exciting and important industry. However, even if you don't feel as strongly as I do, it's important to remember that this is not a niche activity. Next to football, air shows draw more crowds annually than any other paid sporting activity. A recent BBC survey stated that over 5 million people paid to attend last year's events in the UK alone. There is also the wider financial impact associated with the potential loss or reduction in this activity. A recent report on the economic benefits of the Farnborough Air Show suggested that this event contributes circa £36m annually to the local community and £57m to the wider UK economy. If we extrapolate that benefit, albeit generally smaller amounts, to the other 200+ UK air displays held annually, the wider economic impacts are certainly significant. But with this popularity and financial value comes great responsibility and those involved in delivering this activity have an overriding duty to ensure the highest levels of safety for both spectators and participants. Should this responsibility be undermined, it will be increasingly difficult to justify sustaining the industry in

its current guise. Sadly, some very high profile and tragic accidents have recently challenged the industry's purported safety and, increasingly, commentators have questioned whether the associated risks are acceptable in today's society.

So what can we do to mitigate the risks further? To address this issue we need to fully understand the risks being faced and then mitigate them to a level that will withstand the potential subsequent scrutiny of a coroner's court should the worst occur. Simply accepting that dangerous activity always brings with it increased risk and that extant mitigation is adequate, based on historic accident data rates, is not an acceptable stance or an appropriate justification if those risks are realized. Up until now, I believe the air show community has tended to adopt this view and assumed, because there hasn't been a major accident involving spectators or the general public for many years, their extant safety measures must be adequate. Sadly, this rearward looking approach to risk management is all too common in many higher risk industries, despite well documented advice against this reactive approach. What is therefore needed is a concerted effort to focus everyone's efforts on identifying the risks and hazards which lie ahead and encourage the implementation of pre-emptive mitigating action. Furthermore, good risk management requires not only a shift of gaze from the wake to the bow, (sorry for the Naval parlance) but also to provide documentable evidence that the risk owners are actively trying to adopt a proactive or predictive approach to hazard identification.

Figure 1: Worldwide Accident Rates



The training courses, run out of the MAA's Centre of Air Safety Training (CoAST), and elsewhere, often cite a multitude of examples where terrible, yet avoidable, tragedies occurred because the early warning indicators (the predictive stuff) were not acknowledged and addressed. The Herald of Free Enterprise ferry disaster in 1987 and both the Challenger and Columbia space shuttle accidents are three widely publicised examples. If you have never researched these accidents I would strongly recommend them to you. They make chilling, yet compelling reading and the evidence leads you to the sad fact that these accidents could have, and should have, been avoided.

Is it fair to look back in hindsight and criticise? Furthermore, aren't we much better nowadays at recognising these potential risks, especially in the aviation industry where we pride ourselves on being world leaders in safety risk management? Certainly the data in Figure 1 previously, appears to support this assumption in regard to the commercial aviation industry. However, if this is the case, how is it that accident investigation agencies repeatedly report the reoccurrence of old accidents? Why, even in the very mature aviation industry, do we seem incapable of learning from previous mistakes and how do we break this pattern?

As I've already alluded to, there are a multitude of risks being managed in every high risk industry. The ability to survive and prosper will be heavily dependent on every company's proficiency at doing so. Take too much risk and your chance of suffering a significant or indefensible accident is very likely to increase. This could very well lead to the collapse of your industry or worse. Alternatively, adopt an overly cautious approach and mitigate those same risks to a level that makes you uncompetitive, or ineffectual, and the companies survival is equally in question. In essence what you are constantly trying to do is navigate the safety space between these two boundaries (Fig 2). This all sounds straightforward but

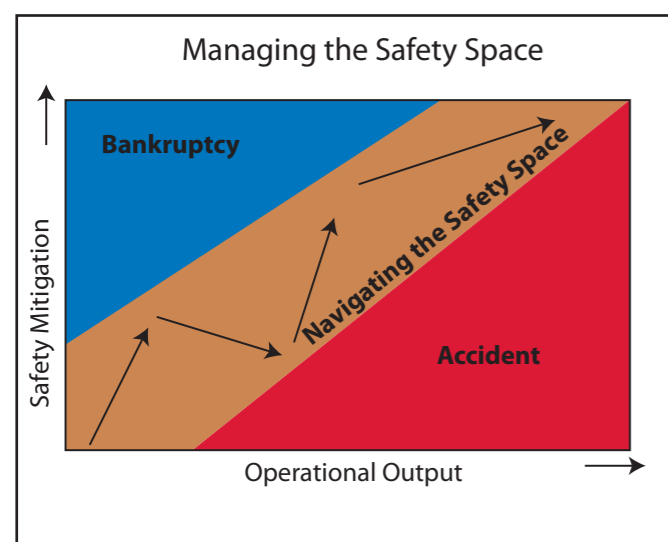


Figure 2: Managing the Safety Space

knowing where you are in this space, where you're headed and how much tolerance you have before you hit one of the boundaries is the constant challenge. Additionally, Fig 2 shows that as you increase operational output or demand, the supervisory chain and safety mitigation measures also need to increase in order to stay within that safety boundary. This fact is often overlooked when increasing demands or tasking conflicts result in a dilution of the supervisory chain or an increased willingness to unquestionably accept the additional risks.

The air show industry and Defence Aviation in general is certainly no different in this respect. Yet all too often in my 'Gamekeeper' guise, I hear complaints that compliance with safety regulations and excessive risk management adherence are preventing the delivery of operational output or the safe delivery of Air Displays. I've even heard some say that compliance with the multitude of rules and regulations is a safety risk in itself! Clearly many believe we have therefore got the balance wrong in favour of being overly cautious and yet, sadly, accidents continue to occur.

If not correctly identifying and mitigating our risks is therefore such a common issue, how can we, in the air display community, improve this situation? Furthermore, what is seen as 'good practise' elsewhere and how can we implement those practises?

To achieve this aim, in any organisation, you first need to understand the following:

1. Where do risks or hazards exist in my area of responsibility (AoR)?
2. Who is managing those risks and are they aware of their responsibilities?
3. What mitigation is in place and how effective has that mitigation proved to be?

To discover the answers to these questions you need data and lots of it! These data sets need to comprehensively capture the risks and, if realised, they also need to detail both the most likely outcome as well as the worst possible one (these risk management skills are taught by the MAA and course details can be found on the MAA Training Website). In order to identify and assess these risks you need the predictive indicators I referred to previously. Herbert Heinrich, a well-known American safety expert in the 1930s, came up with a theory which states that for every fatal accident there are, on average, around 30 related serious injuries, 300 minor incidents and an even greater number of near misses. He called this theory Heinrich's Law and this is quoted in nearly every safety lecture you will ever attend, irrespective of the industry. The 'Iceberg Principal' (Fig 3) is a simple and



frequently adopted method of demonstrating this theory. In this example, the visible portion of the iceberg represents those accidents which have had such an obvious or serious outcome that there is no way to avoid reporting them. However, using Heinrich's law, for every one of these serious outcomes, there are a huge number of lower level incidents which have gone unreported because they had either a minor outcome or could be defined as a 'near miss' (those below the waterline). It is therefore reasonable to assume that managing the risks while the outcomes are still below the waterline will significantly reduce the likelihood of the catastrophic results.

This 'below the waterline' data is invariably available. The supervisory chain just needs to actively seek it and then take appropriate action. To do this they need a simple, readily accessible method of allowing those conducting potentially hazardous tasks to tell you about their 'near misses' or to highlight what rules, regulations or procedures they feel they need to bend, break or ignore in order to 'get the job done'. You also need to encourage those who do report to be involved in any solution so it's equally important to ask for their advice on how these issues they've highlighted should be tackled. This will not only help to identify the most appropriate mitigation measures but will also make those reporting feel valued, empowered and therefore more likely to report other concerns.

But herein lies the first major hurdle. Human beings do not like admitting to their mistakes! Despite the widely acknowledged

fact that the brain is an imperfect tool, and no matter how ideal the situation or how well practised or trained the individual is, there is still a chance that mistakes will happen. It therefore seems somewhat illogical that we all struggle so much with admitting to our errors. Are we predisposed to this trait or have we learned it over a very long time? Furthermore, if we accept that we have this 'cultural' pre-disposition to deny our mistakes, how do we change this behaviour when in the working environment?

The Haddon-Cave report into the crash of the RAF Nimrod (XV230) over Afghanistan in 2006 was a very damning indictment of Defence Aviation. Sir Haddon-Cave stated that this accident was avoidable and was caused by a failure of leadership, culture and priorities. He also stated that the safety case surrounding this aircraft was "fatally undermined by a general malaise and a widespread assumption by those involved that the aircraft was safe because it had successfully flown for 30 years" (The wake viewpoint, again!). In his conclusion, one of the eight key recommendations he listed was a requirement to establish a new Safety Culture. One that comprised the following elements:

1. A Reporting Culture
2. A Just Culture
3. A Flexible Culture
4. A Learning Culture
5. A Questioning Culture

But what exactly is Culture and what can we do to change it? The most comprehensive definition I can find for describing 'organisational culture' is from a renowned Harvard Business professor called Rob Goffee and he states the following:

*"Culture is historically created guides for living and collective mental programming and these are derived from deep assumptions that are not directly accessible but may be reflected in the values, attitudes and behaviour of individuals and groups. The assumptions are learned, not innate, they have pattern, are shared and passed down through the generations"* (Goffee 1997).

So if 'culture' is learned and passed from one to another, then surely it can be re-learned and therefore changed? The difficulty in achieving this should not be underestimated. It takes considerable time and sustained effort. In the first instance, individuals have to believe that it's ok to own up to their errors and, importantly, see a benefit from doing so. In order to make this leap, they also have to feel confident that their disclosures will be treated appropriately. Hopefully, most of you will recognise what I'm talking about here? In the Defence Aviation environment we refer to this as establishing the 'Just Culture'. But the reality is that a Just Culture is much easier to state in a policy document, gathering dust on some shelf, than it is to generate and subsequently maintain. In order to implement it you need to prove to your target audience that the supervisory chain will be consistent in how it behaves when an individual owns up to a mistake. The individual will also expect the management to comprehensively consider all the causal factors and explain what corrective measures they intend to implement or, and this is equally as important, justify to their target audience their decision to not implement the changes. Unfortunately, all too often, causal factors are not comprehensively considered. The following is a list of common causal factors failings:

1. Finding only a single cause, often the final triggering event.
2. Finding only the immediate causes and not looking for ways of avoiding the hazards or weaknesses in the supervisory chain.
3. Listing human error as a cause without saying what sort of error it is. For example: those caused by ignorance, slips/lapses of attention or those due to non-compliance of rules.
4. Listing causes which we can do little about because they are just too complex.
5. We change procedures rather than identifying underlying design issues.
6. We don't share widely the lessons we have identified.

7. We don't incorporate the lessons identified into our training, procedures or subsequent behaviours and then seem surprised when the accident is repeated.

*So how can we do better and how do we begin to address these issues?*

Within the Defence Aviation environment we are fortunate to be surrounded by dedicated, motivated and highly professional individuals whose intentions are normally admirable and who are simply trying to do the best they can given the scenario and difficulties they face. In the Human Factors discipline we refer to these 'difficulties' as Performance Influencing Factors (PIFs). PIFs can be a multitude of things but are normally sub-divided into 3 categories: firstly, those physiological factors which affect the individual (tiredness, impaired judgement, anxiety etc.); second, the context in which the activity is being conducted (dark, cold, wet, inhospitable, dangerous etc.); and finally, the degree of difficulty of the task. This last point might be directly associated with the complexity of the task but you should never forget that complexity is a relative observation and will depend upon other factors such as the individual's experience, competency or currency in conducting that activity.

You can explain all of these factors to your target audience ad-infinitum; indeed your HF training should cover all of these in much greater detail and the MAA regulate (RA 1440) the periodicity of HF training for all Defence Aviation personnel. However, before individuals start to believe in the value of this process and begin to openly and honestly report, they will demand proof of your sincerity to act upon their reports and will want to see some benefit from the effort they have undergone. This will manifest itself in a 'testing' phase and normally follows a familiar pattern. This pattern sub-divides into 3 stages and by tracking progression against each stage; you can begin to measure where, on the reporting culture journey, a unit is. Within MAA safety training we refer to these stages as 'Reporting Ages'. During the 1st Age, individuals will begin to report when 'things' aren't right. They will blame tools, equipment or procedures but will not progress onto the 2nd Age unless these initial reports are acted upon and the value of their efforts recognised.

If you do act appropriately and the trust in the process improves, you will see reports progressively move onto the 2nd Age. This is where individuals feel more comfortable about reporting and will feel able and willing to raise concerns about other people, groups or organisations.

Again, if handled correctly, the trust will grow until you reach the nirvana of 3rd Age reports. This is where individuals have sufficient confidence in the system and the outcomes to tell you what they have done, or even better what nearly happened to them whilst achieving the task. This may involve an admission of rule breaking or not following procedures



and so your subsequent handling of these types of reports can be more challenging. On one hand, these reports need to be held up as exemplar and if possible, the individuals should be rewarded for having the courage to admit their mistakes. However, if some form of corrective action or punishment needs to be undertaken against the individual then it is essential that your actions are fair, consistent and most importantly, explained quickly to as wide an audience as possible. This last point of ensuring your actions are clearly articulated and quickly disseminated is vital to maintaining your 'Just Culture'. Otherwise the reputation and trust you have established will be quickly undermined as the inevitable rumour mill takes hold and distorts the facts. The MAA provides a number of courses to assist those within the supervisory chain on how best to handle these issues. The training also ensures consistency of actions between organisations or groups and facilitates the sharing of good practises.

*So why am I telling you this and in particular, why is this so relevant to the Air Display environment?*

Well.. Much of what I have said already, e.g. setting the right culture to generate the reports from which you can then proactively mitigate your risks, is already happening. In Defence Aviation we raise our reports primarily on the ASIMS data collection tool by completing Defence Aviation

Safety Occurrence Reports (DASOR). DASOR rates have been steadily increasing since their introduction and are currently averaging around 250/week. The knowledge on how and when to complete a DASOR is also improving and, importantly, so too is the quality of these reports (both Age of report and capture of causal factors). ASIMS version 3, which was due to be rolled out on 1 Apr 16, enables easier and better capture of the most pertinent data and utilises #HASHTAGS and compulsory field completion to improve the analysis and utility of this data. Much of this analysis work is being carried out by the MAA's Knowledge Exploitation and Analysis Team. They then disseminate their findings on the ASIMS tool and all Defence Aviation safety organisations are starting to utilise this rich source of information. As a consequence, the various safety organisations are building a clearer picture of the risks in their areas. This is, without doubt, an impressive success story - but we can always do better.

This leads me back to my concerns over air shows. My CoAST instructors, irrespective of which course they're teaching, will always highlight to attendees the fact that certain aviation activities are historically more prone to accidents and incidents. The list below is not meant to be exhaustive but there are some common themes to each of the activities. They all tend to be relatively autonomous and therefore often occur outside the normal or familiar supervisory chain. They also, invariably, require enhanced skills or responsibilities

and are nearly always considered as vital tasks with associated pressures, either real or perceived:

1. **Detachments: accentuated if overseas or in unfamiliar environments.**
2. **Media Demonstrations.**
3. **Public Demonstrations.**
4. **VIP transport.**
5. **Support to Special Forces Operations.**
6. **Support to SAR missions.**

It could be argued that display flying incorporates the first three activities on this list and therefore cumulatively, warrants much greater focus. The unique pressures of demonstrating your flying skills and your aircraft's capabilities, in front of thousands of people in an unfamiliar environment, should never be underestimated and it is a task very different to almost any other that a military pilot is likely to experience. Pilots are all naturally competitive creatures and the desire to show just how skilled they are is sometimes overwhelming; especially when there is the added pressure of knowing that their every action is being scrutinised by the harshest critics of all, their fellow aviators. It's therefore un-surprising that the increased Performance Influencing Factors associated with Air Displays leads to an increased chance of error. Furthermore, many of these PIFs don't just influence or affect the aircrew. Engineers are also under increased pressure to get or keep their aircraft serviceable, often with reduced resources and detached from their operating support and infrastructure. Event organisers also have unique commercial or reputational pressures to consider and the person at the helm of the entire event, the Flying Display Director (FDD), is unlikely to be experienced or particularly current in that role if the task is being carried out by a serving military officer who isn't in a position to dedicate 100% of his time to the task. You could therefore say that air shows create the conditions for a 'Perfect Storm' and the significantly enhanced risks that exist, either individually or cumulatively, require much greater levels of mitigation than most other activities.

But... I hear all the display pilots say: *"we already undergo much greater levels of supervision than we do in other tasks and our routines are approved and continually supervised throughout the season"*. This is true. However, it is one thing to supervise a practise display routine at an individual's home base where they are familiar with the environment, ATC and support infrastructure. To then subsequently assume that this mitigation will remain appropriate in the diverse and often chaotic environment of an unfamiliar air show or environment should not be taken for granted. If we therefore acknowledge

that the work up process has natural limitations, how do we address these shortfalls?

This is where experience plays a pivotal role. The professional military display teams do, with varying success, try to retain their corporate Air Display knowledge. However, operational demands, new aircraft types/teams or natural career progression often prevent them from keeping the levels of experience they desire. If we accept that this is par for the course in the military, and I'm not suggesting we should, then the next best option is to ensure that all this experience is properly captured and recorded for subsequent generations to learn from. Sadly, and this is the crux of my concern, the current air show reporting rates on DASORs is woefully low. The MAA database of related DASORs averages less than 60 per year. Yet, during discussions at the Air Display Symposium training sessions, it is abundantly clear that most display crews experience a great many more issues worthy of a report. Unfortunately, this information is not being properly captured and it would appear that many teams have bespoke, unit level handover notes. Whilst these may be useful, the issues identified are unlikely to be elevated to the appropriate level i.e. the Duty Holder, MAA or CAA. It is also unlikely that, in this format, the information will be shared across the wider display community. Furthermore, if you think this reporting rate is poor, I can assure you the civilian rates are even worse. This suggests that the unique challenges being faced by all are not being properly analysed and addressed. Without this work it is virtually impossible to prevent the reoccurrence of previous accidents/incidents. So again, how can we all do better?

I've already covered many of the initiatives being undertaken. Reports are easier to complete and more readily available with the continued rollout of ASIMS. The quantity and quality of reports are improving with increased awareness gained through a multitude of training courses and the improved ASIMS software. However, we all need to up our game. Supervisors at every level, both in the operating and supporting roles, need to carefully consider and document (on ASIMS) the unique risks they face. Those risks need to be reviewed and updated after each display to ensure they remain accurate and effective. The participants (aircrew, engineers, organizers and supporting staff) need to feel they are able, and have sufficient time allocated, to capture their issues or hazard observations. This also needs to include lessons identified during the work-up phases, both in the aircraft and the synthetic environment if applicable. As this database develops and improves, supervisors and operators need to regularly review previous reports and ensure their mitigation remains appropriate for each venue. The civilian community has the CHIRP reporting system but its usage, as I alluded to previously, is poor so we need to improve our ability to share this information. This work is already underway and anyone who attended the MAA's Air Display Symposium in Feb would have seen that ASIMS information, analysis



and reporting cultures were briefed in considerable detail. Additionally, ASIMS V3 now has an additional box on the report which, if ticked, means the report automatically gets shared with the CAA so this should enable better sharing of information.

I know that many of you will, by now, be thinking that this is all very logical information but, in the real world, you simply don't have the time to complete all this paperwork or explore every feasible risk. To that end, I will ask you to consider just two things:

1. Wouldn't it be easier, more efficient and ultimately more effective to not have to keep re-learning painful old lessons?
2. If you think you don't have time to generate a report and study existing data; consider the workload, or worse

still, the potential consequences of having an accident and see what impact that will have on the remainder of your display season or operational output.

Finally, I will leave you with some questions to ponder as you prepare for the forthcoming Display Season:

1. How accurate is your picture of the Air Display safety risks you or your people are likely to face and how confident are you that you have the relevant facts and knowledge upon which you are making your risk based decisions?
2. How confident are you that the identified safety risks are being proactively and continuously managed?
3. How effective are you at identifying and reporting hazards before something serious occurs?

4. What percentage of the generated reports in your unit are 1st, 2nd, or 3rd Age?

5. How are you learning from the existing datasets?

6. How are you documenting these risks to ensure future generations benefit from your experiences?

7. How confident do you feel that the work you're doing in identifying and managing the risks to life, both to aircrew and spectators, will withstand the scrutiny of a coroner or deceased persons family if the worst does occur?

For those involved in the coming Air display season, I hope you have found this article of some value. It aimed to provoke thought and provide you with some pointers as to

how you can better mitigate some of the unique risks that Air Display flying generates. I will therefore leave you with one last quote on the value of learning from our mistakes. James Russell Lowell, a famous 19th century American poet, once stated: "Mishaps are like knives that either serve us or cut us as we grasp them by the blade or the handle".

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