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ON COMMERCIAL AVIATION SAFETY

SPRING 2004

ISSUE 54

THE OFFICIAL PUBLICATION OF THE
UNITED KINGDOM FLIGHT SAFETY COMMITTEE

ISSN 1355-1523

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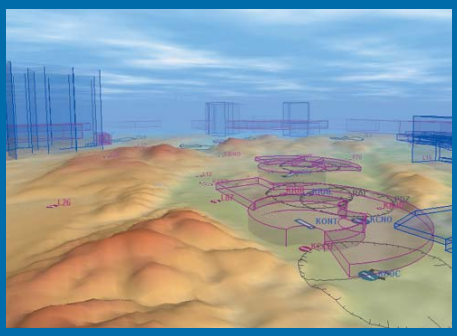

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The Official Publication of
THE UNITED KINGDOM FLIGHT SAFETY COMMITTEE

ISSN: 1355-1523 **SPRING 2004** **ON COMMERCIAL AVIATION SAFETY**

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Front Cover Picture: Aerial view of Heathrow Airport, provided with the compliments of Flightimages.

***FOCUS** is a quarterly subscription journal devoted to the promotion of best practises in aviation safety. It includes articles, either original or reprinted from other sources, related to safety issues throughout all areas of air transport operations. Besides providing information on safety related matters, **FOCUS** aims to promote debate and improve networking within the industry. It must be emphasised that **FOCUS** is not intended as a substitute for regulatory information or company publications and procedures.*

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Office Hours: 0900-1630 Monday-Friday

Printed by:
Woking Print & Publicity Ltd
The Print Works, St.Johns Lye, St.Johns
Woking, Surrey GU21 1RS
Tel: 01483-884884 Fax: 01483-884880
ISDN: 01483-598501
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Flight in Uncontrolled Airspace

For the past three years a number of Shairspace meetings have been organised by the Director of Air Staff of the Royal Air Force at various venues around the United Kingdom. The purpose of these meetings has been to create awareness about the use of class F and G airspace. These meetings are co-chaired by the Director of Air Staff and the Chief Executive of the United Kingdom Flight Safety Committee.

Many users of uncontrolled airspace are unaware of what other users are flying in the airspace, at what height they are operating and what they are doing. The result is that they may be choosing to operate at height in high demand by other users, particularly when operating close to the ground.

On the 5th February the second Norwich Shairspace meeting was held at the Hilton Hotel, Norwich. This meeting attracted 85 interested delegates.

Speakers are generally drawn from the main users and service providers in the area and have as their key objective the education of all those who attend.

Uncontrolled airspace is used by a disparate mix of operators from private pilots to police and air ambulance helicopters, pipeline and power line inspection helicopters, military fast jets, military training aircraft, commercial airlines, gliders and microlights. From this it will be understood that the range of performance and preferred operating altitude is very wide.

If one considers that the primary rule for maintaining separation in the open FIR is that of see and avoid, then it should be obvious to all that there is a real need to be cautious and to improve lookout skills. Some of the tasks being performed require the concentration of the pilot to be diverted away from this very important lookout task and so it is therefore no wonder that aircraft sometimes come in close proximity to others without being seen until the last moment.

Coupled to this is the lack of conspicuousness of the aircraft brought about by personal choice of colours carefully selected by their owners to make them look attractive without a thought for whether they will be easily seen when flying against a background of cloud or pale sky. Many military aircraft are painted to make them all but invisible when flying close to the ground. The result of this is that some aircraft paint schemes make the principle of see and avoid more difficult, even for the trained eye.

The obvious solution would seem to be for all aircraft to be fitted with TCAS. Then at least the pilots would have ample warning of other aircraft in their immediate area, their direction of travel and their altitude. This solution is however, not a simple as it would seem.

Most commercial off the shelf (COTTS) equipment is too heavy and bulky to be fitted to the smaller aircraft. The cost of such equipment would also preclude it from being fitted by most small aircraft owners. Current commercial off the shelf equipment is not suitable for the military fast jets and it will be some time before a suitable solution is developed.

So where does that leave us?
It would seem that until a suitable light weight, low cost solution is developed for the small aircraft and until the military can acquire a suitable system, the status quo will remain.

Pilots will therefore need to be far more aware of what aircraft types that are sharing the uncontrolled airspace with and where they most frequently operate and at what altitude. They would then be in a better position to plan their route and choose their altitude. Developing good airmanship should be a priority for any pilot. At the end of the day good airmanship could save your life.

For all those flying in the open FIR consider the following:

1. When repainting your aircraft, consider making it more conspicuous.
2. Stay away from power lines and pipe lines. Inspection helicopters follow these at about 600feet above ground level.
3. Avoid flying close to the ground. Apart from inspection helicopters the military often lurk close to the ground.
4. Think about the approach and departure routes from airfields.
5. It is your responsibility and in your own personal interest to improve your lookout and visibility to other users.
6. Commercial aircraft operators should understand that the risk of operating in uncontrolled airspace is considerably greater than operating in controlled airspace.
7. Listen to your radio and pay attention to who is flying in your area.
8. Police and medivac helicopters could be encountered anywhere.
9. If flying along the coast give thought to helicopters operating to the oil rigs.

Feedback from the Shairspace meetings has been very positive. Those who attend find the meetings not only interesting but meet other operators from the area and have an opportunity to discuss a great number of related flight safety issues. The presentations involve all types of operations, are well researched and presented in a professional manner.

It is the intention to continue to hold Shairspace meetings throughout the country and is a practical demonstration of the commitment of the military to promote open discussion in an effort to improve flight safety.

Chairman's Column

This is my first Chairman's Column for FOCUS since stepping in as chairman following the premature retirement of John Dunne.

John took over the Chair of the UKFSC six months after the terrorist attacks in the USA. World aviation was still trying to recover from the turmoil of those events and not only was aviation security headline news, but the war drums were starting to sound in the Middle East. There then followed the war in Afghanistan and the second Gulf War. We all know that none of these events did anything to help aviation.

In spite of these disruptions and the continually changing demands of both the UK and foreign governments, John managed to steer the UKFSC through the tide of change. He has been aware of the many pressures on aviation companies throughout this period and the difficulties that we all now find ourselves in trying to balance Flight Safety against the new kid on the block - security. The 'Directions' being served on the industry regularly stray into areas of Flight Safety. The result of this has at least seen closer liaison between the DfT and CAA to achieve workable and safe compromises. This has also called for closer working relationships within companies between FSOs and Security Managers.

It is in all our interests, particularly the aircrew, to be more inquisitive of whom we have in and around our aircraft. They are, after all, the last line of defence against the new enemy. It is right that the UKFSC should take an active interest in the security solution, but this must be balanced against the objectives of the Committee. We are here to promote and offer Flight Safety to aviation and must resist being side-tracked into an area already well served by others.

The task of the company Flight Safety specialist does not get any easier. The financial backlash from the 11 September attacks have resulted in 'leaner and meaner' airlines, airports and service providers. The changing role of the FSO means that not only are tact, diplomacy, logic and mediation essential skills, but financial wizardry at making cases for resources must now be added! The temptation to cut Flight Safety budgets should be avoided. If anything, more resources are probably going to be required in the future to ensure that all areas at the 'sharp end' remain pro-active in maintaining the high standards that we already have. Flight Data Monitoring, due by the end of this year, is, for those not already running a system, another drain on company resources at a time when most could probably do without it. It can however if used wisely, apart from significantly adding to Flight Safety standards, contribute to the economic health of the company.

The next few years see interesting times for aviation and the Committee in particular. We must continue to strive to achieve our objectives in a continually changing environment. The way ahead requires careful thought so that we maintain maximum Flight Safety contribution to aviation on the 'home front', as well as being able to offer thoughtful and constructive advice to other organisations trying to establish appropriate flight safety standards.

Finally, we all wish John Dunne well in his new appointment.

By Stuart McKie-Smith,
flybe.british european

UK FLIGHT SAFETY COMMITTEE OBJECTIVES

- To pursue the highest standards of aviation safety.
- To constitute a body of experienced aviation flight safety personnel available for consultation.
- To facilitate the free exchange of aviation safety data.
- To maintain an appropriate liaison with other bodies concerned with aviation safety.
- To provide assistance to operators establishing and maintaining a flight safety organisation.

Just Culture in Aviation Safety Management

by Doug Church – Executive Vice President Professional

Aviation traditionally was an environment in which no, or at least very few, errors were made. We tended to believe that individuals working in the aviation industry belonged to a special breed of super-humans who perform error-free throughout their careers. In a small number of cases where an accident occurred, industry and the general public readily accepted an explanation that one or more people involved had made an error or errors that caused the accident to happen.

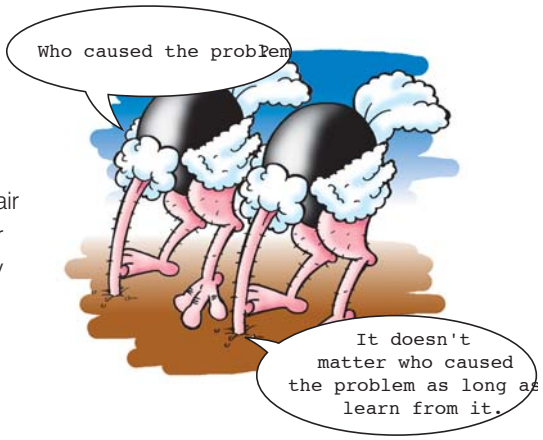
Some twenty-five years ago this perception of the aviation industry began to change. People realized that the aviation industry is not populated by super-humans, but normal everyday people, each as prone to committing errors as any other. Industry attention has shifted from determining who made the error to identifying the circumstances under which the error was made. The purpose was two-fold: first, by understanding the circumstances it might become possible to introduce changes that could make it less likely that similar errors would be made again (Error Prevention); and second, understanding the circumstances might make it possible to develop strategies to minimise the negative effect of the error (Error Recovery). Safety Occurrence Reporting Programmes are a cornerstone for finding these circumstances.

The Legal System – Fundamental Differences

A similar shift, as in aviation, has not (yet) occurred in the judicial world. In many legal systems aviation professionals (e.g. pilots, air traffic controllers, and maintenance personnel) can and will face criminal prosecution if they become involved in an incident or accident, even though they were acting in accordance with their professional training and experience. In the International Federation of Air Traffic Controllers Associations (IFATCA) view criminal prosecution is counterproductive to improving aviation safety. Instead of creating an open culture in which errors and incidents are reported for analysis leading to systemic improvements, prosecution creates a "don't get caught" culture in which few reports are made and consequently little systemic improvements occur.

In today's environment Regulatory Requirements related to Safety issues call for both States and Service Providers to implement Safety Occurrence Reporting Systems. Many feel that by sharing knowledge and experience(s) by way of comprehensive and systematic reporting, occurrence of air navigation incidents can be prevented, or perhaps more realistically, be significantly reduced. This approach centres on two very important initiatives: a confidential reporting system, and a non-punitive environment. IFATCA takes the position that voluntary reporting systems are essential; however we do not encourage joining a voluntary incident reporting system unless there is guaranteed immunity for the individuals who are providing the information. Reluctance of individuals to participate for fear of retribution jeopardizes the programme. What has to be remembered is that only a very small percentage of control/pilot error can be attributed to a lack of intellectual, physical or emotional ability. The reason people fail to perform is that they work in a flawed system. Simply blaming (an) individual(s) is an expedient form of removing blame from the organization and effectively masks any latent flaws in it.

As the sole objective of any investigation is the prevention of accidents and /or incidents, the investigation process must not apportion blame or liability. This is not to say there is no role for legal actions in aviation. In many countries there are laws enabling (or obliging) authorities to investigate aviation-related occurrences. In cases where operators are guilty of wilful misconduct in a form perceived to be beyond the limits of acceptability such as acts of sabotage, gross negligence or substance abuse it is necessary that criminal prosecution will follow. In these instances the operators could reasonably foresee the negative outcome of his or her actions. But in the majority of cases the operators were acting with best intentions and did not wish, nor expect, their actions would lead to disastrous results.



Blame and Punishment

This brings to light another difficult aspect of the equation for consideration: the issue of blame. Blame focuses on the defects of individuals; it does not necessarily take into account all system components. Blame leads to the adoption of defensive attitudes, and encourages an ineffective reporting system. IFATCA does not subscribe to the theory that progress on safety is synonymous with learning from failure, as it categorizes learning and punishment as mutually exclusive activities. It implies that we either learn from accident/incidents or punish the individuals involved in them, but not to do both at the same time (Dekker, 2002). The result of the "punishment" theory is the perpetuation of false beliefs about the safety of the system, and characterizes humans as unreliable components.

Punishment emphasizes that failures are deviant, that they do not naturally belong in the system. Learning means that failures are seen as "normal" as resulting from the inherent pursuit of success. Punishment points a "guilty" finger and conditions others to not get caught next time something goes wrong. Learning is about avoiding a next time altogether. Punishment is concerned with closure, about moving beyond and away from the event, whereas learning is about continuous improvement, and closely integrating the event into the system. Most of us who are in a position to be directly affected by this (air traffic controllers and pilots) seem to agree that a non-punitive and confidential environment cannot be equated with total immunity.

There always is, and always will be a threshold beyond which an ANS safety occurrence will be subject to a punitive treatment. A crucial first step in clarifying the matter is to recognise and make public the fact that Confidential Incident Reporting Programmes will be based on "honest mistakes." It is to be understood that any behaviour beyond the notion of "honest mistake" cannot be protected by confidentiality and immunity.

The Need for Non Punitive Reporting Systems

If this becomes the agreed-to scenario, the possibility for difficulty exists in the fact that the categorizing of behaviour as an "honest mistake" or otherwise, cannot be determined until after an investigation has been carried out. No guarantees for confidentiality or for non-punitive treatment can be given until the investigation process is completed. Air traffic controllers, as an example, may, in full good faith, report incidents based on the understanding that they did nothing wrong, but still face the risk that the investigation board takes a different view on the subject. In most cases, Service Providers will not have the luxury to ignore reports filed in a non-punitive reporting environment, should they not conform to conditions for immunity. A necessary improvement to the process will be to provide for assurances of fair treatment, and the respect for confidentiality. It is of paramount importance to demonstrate that individual reporting systems guarantee the fair treatment of personnel involved, particularly as far as the notion of "honest mistakes" is concerned.

Based on ICAO guidelines the aviation industry has an effective system to learn from incidents and accidents and has achieved an impressive safety level. The free flow of safety related information among the various levels and players in the industry is key. Safety reports are forthcoming only when their originators (e.g. pilots, controllers and maintenance staff) know they are in a non-punitive environment and are secure in the knowledge that whatever deficiencies they do report will not backfire on them.

Criminalization of Error

Possibly the most feared of all repercussions is what has come to be known as the "criminalization of error". This may simply be defined as "criminal proceedings against a person or persons involved in an incident or accident." Witness the ever-increasing occurrences of these actions against individuals in the aviation industry, and it would appear there is a distinct increase in cases in recent years. Among them have been several high-profile examples whereby aviation professionals, acting in accordance with appropriate levels of training and experience in their respective areas of operation, have fallen victim to some unfortunate transgression. Typically, the guilty party is not an organization but an individual or individuals; be they air traffic controllers, aircrew or technicians. The reason? It could be many reasons, but whatever they may be, the threat of any form of retaliation (punishment) leads people to adopt a "don't get caught" attitude. This does little to foster meaningful improvements to system safety.

From a Human Factors perspective, this is a lose-lose proposition. To quote Dr. Sidney Dekker of the Swedish Center for Human Factors in Aviation: "Incarceration or alternative punishment of pilots or controllers has no demonstrable rehabilitative effect (perhaps because there is nothing to rehabilitate). It does not make a pilot or air traffic controller (or his or her colleagues) any safer-indeed, the very idea that vicarious learning or redemption is possible through criminal justice is universally controversial."

Accidents are rarely the result of the failures of individuals. There are always additional factors, each on its own an integral part of, and a contributor to, the whole. Accidents are the products of the system, not individual parts of it. Blame-free, or no-blame cultures are extremely rare; however we believe real progress will come as we move beyond a "blame" culture. Criminalization of error is a key contributor to adversarial relationships we sometimes see in the aviation industry, and as long as there is the potential for it to play a role in an incident or accident, the "real" truth may never surface. Various versions of the truth will emerge, perhaps following particular agendas such as staying out of jail or limiting corporate liability. Learning becomes severely restricted, if not impossible.

The Role of Human Error

The aviation industry has accepted that humans cannot be changed but nonetheless are required to make the system work safely. The legal world holds the view that the system is inherently safe

and that the humans are the main threat to that safety. As mentioned earlier, the safety improvements in the aviation system are largely achieved as a result of an open exchange of information between the layers of the system. Contrary to what some may believe, human error cannot be avoided by "designing it out of the system" or disciplining operators. Error is a normal component of human performance. This fact must be incorporated into the design, implementation and operation of complex systems where safety is the expected outcome. Air Traffic Management (ATM) systems are a prime example of such a complex system.

The IFATCA View

IFATCA is of the opinion that criminal prosecution is counter-productive to improving aviation safety. The effect of legal prosecutions is that if pilots and controllers perceive they will be held personally liable for any safety related events in their work, they will stop reporting such events. This means legal prosecutions achieve the exact opposite of what they are aiming to achieve – they don't help to improve aviation safety. However, we must still have a mechanism for holding people accountable even in a blame-free atmosphere. Blanket amnesty on all unsafe acts would lack credibility in the eyes of employees (workforce) and may even be seen to oppose natural justice. Accountability is possible if we can come up with workable solutions to re-constructing our relationships with each other throughout the industry. Perhaps such "mending of fences" will enable us to move toward a "just" culture.

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Towards a Just Culture

Graham Braithwaite from Cranfield University examines how organisations can learn from their mistakes

Error is fundamental to learning. From being a child, we learn from our mistakes and, as we get older, hopefully we start to learn from other people's mistakes without having to repeat them for ourselves.

This is the same for organisations, where error is a fact of daily life and also part of the learning process. In terms of system design, we work to ensure that errors made in aviation can either be trapped or managed before they are consequential. However, when such errors occur, how does the organisation maximise its ability to learn from the experience?

Reporting culture

In part, this is dependent upon the reporting culture, or moreover the safety organisational culture. The term "reporting culture" refers to the willingness of individuals to report an error or violation and can be described in several ways.

An anonymous system allows anyone to report anything in complete anonymity, but such a system is open to abuse by the reporter, which in turn can affect the credibility of the output.

A confidential system increases the integrity of the output whilst still protecting the reporter from identification. However, both of these types of systems, whilst being a vast improvement on no reporting, have a common weakness. That is that they suggest that employees feel a need to be protected if they report safety deficiencies.

The ideal system is one where the organisation is eager to learn and accepts that errors are the natural by-product of being human.

No blame

This is where the debate between "no-blame" or "just culture" comes to the fore. The concept of "no-blame" has been crucial to the success of safety investigation from the start. It is human nature that individuals are more likely to be truthful if they are not incriminating themselves.

Accident investigators have as their sole aim the prevention of future accidents and not to apportion blame. Only by knowing what really happened (and why) can the appropriate measures be put in place to prevent recurrence. The problems start when "no-blame" is seen as a way of absolving all responsibility, especially in the case of deliberate violations.

Just culture

A "just culture" takes the extra step of saying "we will not blame individuals for genuine errors, but reserve the right to discipline those who wilfully violate". How effective a just culture is depends upon the implementation of such a policy. Imagine an employee who violates the speed limit on the airport ramp even though they had received appropriate training. This may be a clear violation, but as violations are motivational, the organisation may need to seek out the reasons why.

If the speeding was because of an overly ambitious turnaround schedule and the employee is violating to maintain on-time performance then their motivation is very different from one who is speeding simply because they want to get a longer lunch break.

A just organisation recognises that the two scenarios are different and will act accordingly.

A just culture does not guarantee immunity from consequence, but does suggest fair treatment of individuals. This works for individuals and their work colleagues alike.

A "blame free" culture that was seen to be unable to touch a serial offender would have a negative effect on the morale of other staff, just as one that unfairly prosecuted an individual that had made an error trying to do the right thing for the company.

A just culture starts at the top and is a function of the organisational culture at large. There is no magic solution to guarantee a "just culture", but every employee, not just those in safety, can influence the establishment of such a culture.

About the author: Dr Graham Brathwaite is a Senior Lecturer and Director of the Safety and Accident Investigation Centre at Cranfield University. His main research interests are in the fields of human factors, system safety and the influence of culture on safety.

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Incident Reporting – A Small Airline's View

1. Improving the Number of Incident Reports

The key to improving the number of reports is an understanding of why people submit reports – and why they don't.

In addition to dealing with the incidents reported, the successful Safety Manager will constantly monitor the reporting culture in his domain. As well as looking for particular trends in the incident types, one has to take note of trends in reporting itself. Key indicators include:-

1. Who is reporting?
2. What is reported?
3. How successful is the investigation of events?
4. How good is the feedback?
5. Are there any specific issues that might be affecting trends at the time?

Much has been made of "Safety Culture" and its effects on the reporting culture. Operators must strive to develop a culture throughout the management and workforce that seeks to discover the 'why' of incidents without placing too much emphasis on the 'who'. At the same time they must draw the difficult line between "blame free" reporting and tolerating a slack workforce if they are to maintain the professional standards of the industry on which safety depends. The problem lies in the average employee's perception that even a call to the office to discuss a report they have submitted somehow implies "blame".

A general summary of the reporting culture in the writer's organisation at the present time would be:-

1. Pilots are good at reporting.
2. Cabin Crew are not good at reporting.
3. Ground staff are starting to see the advantages.
4. Engineering staff consider reporting into an open environment to be a gross invasion of their professional privacy!

It is noticeable, however, that there are reporting trends even within the pilot group:-

1. New pilots, and particularly new captains, tend to submit more reports than the established group. One reason for this may be the establishment of a level at which the reports are perceived to be 'useful'. This in itself might depend on the success of the feedback system.
2. Particular individuals report more. Generally these are pilots who have previously worked in Flight Safety (eg. FSO in the military), or have a multi-disciplinary background (eg. in Engineering or Law).
3. The small core of pilots who join the company after retiring from British Airways tend to report well. This undoubtedly reflects the good reporting culture within that organisation.

Outside of the pilot group, one major influence on the reporting culture stems from the traditional implementation of a "Flight" Safety system run from within "Flight" Operations by a "pilot" reporting to the Chief "Pilot". Flight Safety can be perceived as a "pilot thing" and this feeling can be exacerbated when the FSO is given insufficient time to deal effectively with the other groups.

One of the greatest barriers to reporting by other groups is the "dirty washing in public" syndrome which often stems from the management within the groups. In a large organisation it is possible to have separate Safety Officers within each group and deal with issues in-house. This is not possible in a small organisation and, in any event, tends to stifle the flow of valuable safety data across departmental boundaries.

In the writer's organisation (small operator), small but significant improvements have come from an early adoption of the JAR principles of an "Accident Prevention and Flight Safety System" and the development of a company wide Safety Management System. Significant points include:-

1. The appointment of a full time Safety Manager.
2. The dropping of the term "Flight" from that title.
3. A continuous process of developing the acceptance of Safety as an inter-departmental discipline that has advantages for all.

Whilst the Safety Manager still does not have full autonomy and, from an administrative point of view, is a member of Flight Operations, there is a growing acceptance of his role in the other departments. This is reflected in a growing number of reports from those departments. Education is the key. In summary, the number (and, more importantly, the breadth) of incident reports will improve in an organisation that can convince all staff and management of the value of their reports and can sustain a culture that is supportive of reporters.

2. Improving the Quality of Incident Reports

In general, much of what has been stated above also applies to improving the quality of reports.

Again, education is the key. The Safety Manager must use effective feedback to demonstrate the positive results that can be achieved from a high quality report.

Probably the most effective means of assisting people to produce good quality reports are well designed reporting forms and an easily understood reporting process. These must take account of the fact that it is not always possible to compile a report at the time of the incident. Flight crew in particular may have to wait until the end of a flight when they are tired and want to get home. A well designed set of forms with simple guidance on who should use which and when is essential. These will guide the reporter along a logical path that will encourage correct recall of all the essential data needed to carry out an effective investigation. In general, it has been found that a series of "tick boxes" is more effective than relying on wordy prose.

In summary, the quality of incident reports will improve in an organisation with a well designed reporting system and which can demonstrate the positive value of that quality.

3. Barriers to Successful Data Sharing

Two main barriers to successful data sharing exist, one cultural and one practical.

The cultural barrier tends to exist at top management level and again has its roots in the "dirty washing" syndrome. Even organisations with a good open safety culture in-house can be reluctant to share their problems outside. The fear is that information will fall into the hands of the media and be misinterpreted to the detriment of the organisation.

The justification of this fear was exemplified by an article in the Sunday Times in 2002. This broadsheet is not normally taken to sensational reporting. In this case it had managed to obtain details from the UK CAA Mandatory Occurrence Reporting (MOR) database and dedicated two whole pages to trying to prove the "danger" of flying in one particular aircraft operated by a UK charter operator. The basis of the argument was the number of incidents relating to this aircraft in the MOR database. Notwithstanding the effects on the travelling public, this vilification of an operator whose only "failing" was a very open reporting culture brought the whole MOR system into disrepute. The incident highlighted the question of whether the operator with the least incident reports is the safest.

The cultural barrier is also sustained by the increasingly litigious approach to life. One of the most obvious means of sharing safety data concerning similar types is by support of the manufacturer's Safety Information Exchange (SIE). However, promulgation of event data may be delayed while the manufacturer considers the legal implications of the event.

The practical barrier arises from the need for data consistency if a sharing system is to be fully effective. Much work has been put into the development of the popular safety information systems (such as BASIS) in an attempt to produce this consistency, but, at the end of the day, it is down to the person entering the data. One person's perception of which events fall under which of the primary headings of "Operational", "Technical" and "Environmental" are not necessarily shared by others. Extend this down through the various sub-classifications and the usefulness of the system, which relies on data mining techniques, declines rapidly.

An example of the magnitude of this problem comes from the IATA "STEADES" programme. IATA took over the basic British Airways SIE in 2001 with the intention of extending it into a full statistical analysis product. Mid way through 2003 the full STEADES product is still awaited and the main stumbling block has been the lack of data input consistency.

In summary, while there remains a need to protect individual, departmental and organisational interests there can never be a fully effective safety data exchange. Equally, until a totally consistent means of gathering the core data is devised, the usefulness of a true SIE in accident reduction will not be realised.

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Aerostructures Hamble
Dr. Marvin Curtiss

AIG Aviation
Jonathan Woodrow

Air Contractors
Capt. Tony Barrett-Jolley

Air Mauritius
Capt. Francois Marion

Air Scandic
Jonathan Annet

Air Seychelles
Bob Blagborough

Air Wales
Capt. David Warren

ALAE
Dave Morrison

Astraeus Ltd
Capt. Simon Robinson

BAA plc
Francis Richards

BAC Express

BAE SYSTEMS Reg. A/C
Alistair Scott

BALPA
Carolyn Evans

bmi regional
Capt. Steve Saint

British Airways
Steve Hull

British Airways CitiExpress
Capt. Ed Pooley

British International
Capt. Terry Green

British Mediterranean Airways
Robin Berry

BUZZ Stanstead Ltd
Peter Walton

CAA
Dave Lewis - MRPS
Chrys Hadjiantonis - Safety Data Dept.
Ed Bewley - Flight Operations
Alison Thomas - Intl. Services

CargoLux Airlines
Capt. David Martin

Cathay Pacific Airways
Capt. Richard Howell

Channel Express
Rob Trayhurn

CityJet
Capt. Mick O'Connor

CTC Service Aviation (LAD)
Steve Flowers

DARA
Brian Plenderleith

DHL Air
Peter Naz

Dragonair
Alex Dawson

DUO Airways Ltd
Capt. Graeme England

Eastern Airways UK Ltd
Capt. Jacqueline Mills

easyJet
Capt. Lance Jordan

Emerald Airways
Capt. Roley Bevan

European Aviation Air Charter
Derek Cottrill

EVA Airways
Richard Lovegrove

Excel Airways
Peter Williams

FlightLine
Capt. Derek Murphy

FLS Aerospace (IRL)
Frank Buggie

Flyjet Ltd
F/O Martin Wood

Ford Flight Europe
Richard Newton

GATCO
Richard Dawson

Goodrich Actuation Systems Ltd
Keith Joyner

Independent Pilots Association
Capt. Mike Nash

Irish Aviation Authority
Capt. Bob Tweedy

KLM uk Eng.
Jim Gibbons

Loganair
Doug Akhurst

London City Airport
Simon Butterworth

London-Manston Airport
Wally Walker

Lufthansa Consulting
Capt. Simon Searle

Malaysia Airlines
Capt. Ahmed Zuraidi

Manchester Airport plc
Peter Hampson

Monarch Airlines
Capt. Tony Wride

MyTravel
Capt. Phil Oakes

NATS
Paul Jones

PrivatAir
Capt. Boris Beuc

Ryanair
Capt. Gerry Conway

SBAC
Martyn Graham - Secretariat
Vic Lockwood - FR Aviation

Servisair
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RAeS Eng.
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AAIB
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CHIRP
Peter Tait

GASCo
John Thorpe

Royal Met. Society
Dr John Stewart

Sky Marshals: A Step too Far?

Europe and the United States appear to be as far apart on the issue of sky marshals as they are geographically divided. As political pressure hastens their introduction, Simon Phippard and Edward Spencer examine the potential legal implications.

With the recent refusal to allow certain flights to operate to the USA as scheduled, fears are rife that terrorists may still be looking to target civil aviation as a vehicle for their atrocities. Against this background, all passengers on international air services may now be asking themselves whether an armed sky marshal is on board their aircraft and, if so, whether that presence is more reassuring or less so.

Under the overall responsibility of the Department for Transport, sky marshals or APOs (Aircraft Protection Officers) have been cleared for deployment on UK-registered aircraft. The APOs are government employees, specifically members of the police service. The CAA in this country gives a special dispensation to allow APOs to travel on board civil aircraft.

Officially, the flights on which APOs are allocated are chosen randomly. Concerns have been voiced, however, as to whether it would be appropriate to deploy APOs on specific flights on an intelligence-led basis. The issue is whether, in that event, the flight should be allowed to operate at all: if there is specific intelligence of a heightened risk for a certain flight, should it not be grounded?

The operator has its own responsibility, as does the captain to ensure the safety of the service. While the issue has not been tested before the courts, it is unlikely that that duty is delegable. This does in turn raise very sensitive issues: plainly there is a limit to which the security and intelligence services should share all their knowledge not only with the operator, corporately, but also with the individual captain.

It is equally clear that there is a range of views as to the likely efficacy of APOs in any event. Leaving aside the debate as to whether the particular events of 11 September 2001 were foreseeable, from the perspective of a passenger on one of the hijacked aircraft, it is obviously arguable that the presence of APOs might have reduced or minimised the consequences.

Time, however, has since moved on and terrorists will be all too aware of the additional obstacles which they will now need to overcome in pursuit of their objectives. This has provoked fears that the deployment of APOs risks creating as much of an opportunity as a deterrent. Sophisticated terrorists could, for example, create a disturbance or a diversion to draw APOs into taking action, thereby revealing their identity and increasing their vulnerability to other attempts to overcome them or seize their weapons. It is also said that with flight deck doors now generally strengthened and secured, the risk of terrorists turning a commercial airliner into a missile is significantly lower.

Views on the usefulness or otherwise of APOs vary greatly and this is not the place to debate them. Clearly, there are a number of difficult policy issues at stake, including such factors as whether APOs should be dedicated full-time to aircraft protection duties or whether they should be allowed to combine them with their other roles on the ground. Obviously any operator must be satisfied that there is a net benefit but this is a highly subjective judgment.

Details of APOs' precise rules of engagement are being withheld for security reasons, although it is widely accepted that the captain will continue to enjoy overall command of the aircraft. Quite how this would actually work in practice in a fast-moving terrorist incident is hard to conceive. Nevertheless, the principle that the captain remains in command is understood to have been a significant factor in the agreement which saw UK airlines abandoning their opposition to APOs. Another is thought to have been a government concession to accept full liability for insurance claims in the event of a hijacking over the UK.

Even if a concerted terrorist effort is ultimately defeated by the intervention of APOs, it would not be unreasonable to anticipate some collateral damage, either in the form of damage to the aircraft or injury to innocent passengers. This would of course raise questions over the airline's liability, with Article 17 of the Warsaw/Montreal Convention system imposing an assumed or strict liability for an 'accident'. Defined as 'an unexpected

or unusual event or happening that is external to the passenger' the test would in all likelihood be satisfied in the event of passengers being caught in the crossfire, however benign the weapons used.

In such circumstances, the airline may be able to rely on a defence under Article 20, if it can demonstrate that it took 'all necessary measures' (which is often understood to mean all reasonably necessary measures) to avoid the damage or that it was impossible to take such measures. Given that APOs in the UK are government employees and airlines are more or less obliged to accept them on their aircraft, it is conceivable that an Article 20 defence could be sustained, thus avoiding or, in the case of EC carriers, limiting their legal liability.

The position may, however, be different where APOs are privately commissioned by the airline, either as employees or agents. In these circumstances, pursuing an argument under Article 20 could be more difficult; it perhaps being harder to contend that the airline had no practical option but to accept APOs if it wished to continue to operate the route in question.

In the aftermath of 11 September 2001, there was, for a while, a hope that plaintiffs would refrain from legal action against anybody and everybody against whom some criticism could be levelled. The volume of litigation now pending against certain carriers, however much, on any balanced view, those carriers were more sinned against than sinners, shows that that hope may have been misplaced. It further demonstrates that if APOs were involved in a terrorist incident in which innocent people were injured or killed, the basis upon which decisions were taken to deploy APOs, not to mention the safety and security judgments, would come under very close scrutiny.

There may now, in practical terms, be little choice for many carriers other than to deploy APOs in certain circumstances, but it could prove invaluable to give careful consideration to the basis on which a decision to deploy is taken, or the specific instructions issued to those personnel.

The CAA Initiative to Improve Birdstrike Reporting

By Sandy Sawyer, Flight Standards Officer, Civil Aviation Authority

The Continuing Hazard

From the beginning of aviation history, aircraft have faced the threat of birdstrikes. The first known incident was in 1908 and in 1912 the first fatality was caused when the pilot of a Wright Flyer collided with a gull. This set a trend that has continued throughout the development of aviation. For example, in the last ten years alone many thousands of birdstrike incidents have been recorded in the UK and, worldwide, a number of catastrophic birdstrike accidents have occurred, including the following:

Falcon 20
Paris Le Bourget — 10 fatalities

C130
Eindhoven — 34 fatalities

E3
Elmendorf — 4 fatalities

E3
Aktion, Greece — aircraft destroyed

AN-8
Congo — over 20 fatalities

Lear 45
Milan Linate — 2 fatalities

Over the same period there also have been a number of serious incidents in the UK, some of which are still under investigation, with B747, B767, B737 and A319 aircraft losing engines on take-off and returning or diverting, and a Metroliner crashing, apparently after striking gulls on takeoff.

In addition to passenger and public safety issues, birdstrikes have major financial implications. A recent study, extrapolating from data supplied by a major international airline that tracks and records costs meticulously, suggests that the annual cost of birdstrikes to civil aviation worldwide may be as high as $1.2billion. There are also liability issues for aerodromes: A number of airports have faced costs amounting to millions of dollars following birdstrike incidents.

The Historical Situation

The Civil Aviation Authority (CAA) has been collecting and analysing data on birdstrikes to UK-registered aircraft and on UK aerodromes since the 1960s. Most birdstrikes, including those with serious consequences, involved birds of species that are commonly found on airfields. However, over time, there have been changes in the proportions of birds of different types.

Throughout much of the period for which data are available, about two thirds of birdstrikes reported in the UK involved gulls and lapwings. However, since the general adoption of effective habitat management and active surveillance and dispersal procedures on major UK airports, incidents involving these birds, and especially multiple strikes with flocks, have decreased. At the same time, other birds such as woodpigeons and rooks have become more important. The reasons for this are probably complex and related to population and environmental changes. There have been significant increases in the relatively low number of birdstrikes involving large and potentially very hazardous waterfowl, such as Canada goose, mallard and heron. Populations of these species, which exploit a variety of man-made wetland habitats, are increasing with the proliferation of water bodies created in mineral extractions and for drainage, recreational use and environmental enhancement.

Using the Data

Aerodrome bird control is a complex multi-faceted task. It is impractical for CAA aerodrome inspectors to review all aspects of aerodromes' bird control organizations during each inspection visit. However, by using analyses of recent historical birdstrike data by bird control specialists as a starting point, they are able to identify areas where there may be problems that require further investigation. Clearly, full and accurate birdstrike reporting is vital to enable the CAA to do this and to assist aerodromes to correct any weaknesses.

Safeguarding is the consultation procedure that protects aerodromes from hazardous new developments through the local government Planning process. Recently, responsibility has been transferred from the CAA to the aerodrome operators. There is increasing pressure from developments like wetlands and landfills around aerodromes that attract hazardous birds. Consequently, it is necessary to support the aerodromes' safeguarders by ensuring that planning authorities are provided with full information on the nature and importance of the birdstrike hazard, and that they are given clear guidance on the priority that air safety should be given in relation to many other

competing demands, such as mineral supply, flood relief and conservation. For Government to be able to act to improve guidelines on planning and, possibly, introduce strengthened legislation in favour of air safety, it is necessary for the CAA to be able to demonstrate fully the cost and safety implications of birdstrikes, and the relation between the risk and developments that attract birds. Again, therefore, the need for comprehensive reporting of birdstrikes is evident.

Limitations of the Data

Despite the extensive work undertaken by the CAA and industry to reduce the numbers of hazardous birds present on licensed aerodromes, the potential for birdstrikes continues to rise with increases both in air traffic and in populations of some hazardous birds. However, it is clear that variations in reporting standards over time, and between different airports and aircraft operators are responsible for serious distortions in the picture presented by the available data. While reporting standards and the identification of the birds involved have improved generally, there remain significant differences between airports, and in some instances the standard of reporting has deteriorated, rather than improved. In recent years, a number of major aircraft operators have ceased to use the CAA Birdstrike Occurrence Form (CA1282), but instead submit partial information on in-house air safety report (ASR) forms. Others have ceased to report any birdstrikes at all.

These are serious weaknesses that limit the usefulness of the data for monitoring the birdstrike hazard and the effectiveness of current control measures and airport bird control organisations. Inadequate and incomplete information does not assist the CAA to persuade Government that the birdstrike issue is serious, both in terms of safety and economically. The shortcomings are due, at least in part, to the lack of clear definitions of the incidents that should be reported and because the reporting system is voluntary. At present, the system only mandates the reporting of birdstrikes that cause damage to aircraft, and has allowed airports and aircraft operators to adopt arbitrary local "birdstrike" definitions, leading to a significant understatement of the true scale of the problem. It is believed that less than 50% of birdstrikes are reported to the CAA. More accurate and more detailed reporting would enable the industry and the CAA to determine the real extent of the costs and safety implications of birdstrikes, and identify trends and their causes earlier and with more confidence.

There is a perception by some in the aviation industry that the number of birdstrike reports originating from an aerodrome or airline will be, or can be, used as indicators of inadequate performance of aerodrome bird control organisations. This can lead to reluctance to report all incidents in the hope of avoiding criticism. This attitude does not help anyone: not the aerodromes, who need to justify the investment in bird control measures, the aircraft operators (and their insurers?) who generally deal with the direct and indirect costs of birdstrike incidents, nor the CAA who are striving to determine the true scale of the problem and produce the necessary guidance, policies and legislation. The CAA does not judge aerodromes' performance on the numbers of birdstrike incidents reported. The types of birdstrikes that are reported, the risk factors that are involved and whether there are practical control measures that could reduce the incidence of the more high-risk incidents are, however,

important. "Raw" birdstrike numbers, or even rates corrected for aircraft movements, should never be considered to be a measure of the performance of aerodrome bird control organisations nor of risk to aircraft operations. As an example, one birdstrike with ten Canada geese carries infinitely more risk to an aircraft and it occupants than ten birdstrikes with swallows - but by the crude statistical measure the latter situation could be represented as ten times worse! Birdstrikes with small birds are unavoidable and are statistically important as a measure of reporting standard because there are many such incidents at all airports. In order to appreciate the true picture we need full, uninhibited reporting of all bird incidents as defined below.

Improving Reporting Standards

NOTAL 6/2002 set four criteria for what the CAA requires aerodromes and aircraft operators to regard as a "reportable bird incident." These are:

1. A bird/aircraft collision is observed (or thought to have occurred) and is noted by a pilot or observer on the ground, with or without physical evidence.

2. Direct physical evidence in the form of signs of impact/damage on the

aircraft is found, even though no collision was observed or reported by the pilot or observer on the ground.

3. Physical evidence in the form of fresh bird remains are recovered from a location on the ground in which the bird was likely to have been struck by an aircraft, even though no collision was observed or reported by a pilot or observer on the ground, and no physical evidence found on any aircraft.

4. Any incident in which a flight is affected (aborted take-off, precautionary landing, go-around, delayed departure, returned to stand, engine shutdown, speed reduction, etc.) by birds, irrespective of whether an actual collision occurred.

Also, at the aerodrome or aircraft Captain's discretion a report may be filed for any other "near miss" or similar incident where it is felt that safety margins were or could have been compromised or where hazardous concentrations of birds have been repeatedly noted in the same location whether on or off an aerodrome. These "near miss" incidents, and incidents where the recovery of birds remains cannot be tied to a specific aircraft, will be recorded, but not regarded as "confirmed birdstrikes" in accordance with current ICAO guidelines. All incidents where the occupants of an aircraft or an observer on the ground believe that a bird has been struck will be treated as "confirmed" whether or not confirmatory evidence is found. Many birdstrikes leave no obvious mark on the aircraft, and bird remains may fall beyond the aerodrome perimeter or be lost in the airfield grass.

As a further measure to improve reporting, the Air Navigation Order (ANO) will shortly be amended to mandate the reporting of all birdstrikes, regardless of whether damage was caused to the aircraft. Any aircraft commander flying in UK airspace who believes his aircraft has collided with one or more birds will have to inform the CAA, unless it has already been reported as an accident or damage occurrence through the CAA's Mandatory Occurrence Reporting system.

The first fruits of the current drive for improved reporting are beginning to filter through. To mid October 2003 we have already logged more than double the total number of reports received in 2000, with many airlines still yet to join the reporting scheme. It has become clear that many birdstrike reports filed by airlines have remained internal only, are missing from the CAA birdstrike database and, in many cases, were unknown to the aerodrome at which they occurred! This situation is clearly unsatisfactory, but it is anticipated that it can be corrected with the new reporting system and the whole industry can cooperate in both fully describing and dealing with the birdstrike issue as wide-ranging team effort.

Filing a Report

Individuals reporting a birdstrike should complete the Freepost Form CA1282 (version 2 dated 01/02/2003), which is held at every licensed aerodrome and is also available on the CAA website at http://www.caa.co.uk/docs/33/FORSRGCA1282.pdf.

Alternatively, where companies have a standard reporting procedure an automatic data transfer will be established. Airlines may continue to use in-house ASR forms to report birdstrikes but these forms should be amended, where necessary, to include all the fields included on the CA1282 form, as this is based on international ICAO reporting standards. Additional information can be obtained by emailing the CAA at birdstrikes@srg.caa.co.uk, or by phoning Nick Ahmed on 01293 573273.

Arrhythmias Present Pilots With Range of Risks

Some irregular heart rhythms are harmless, but others are associated with loss of consciousness or sudden death. Thorough medical evaluation often is required to determine the severity of a pilot's arrhythmia and whether the ailment might affect the safety of flight operations.

FSF Editorial Staff

An arrhythmia (also called a dysrhythmia or an irregular heartbeat) is a change in the regular beating of the heart that, in most people, presents no risk. In some people, however, the arrhythmia may be associated with heart disease or may constitute a serious health problem that can result in loss of consciousness or death.

For pilots, arrhythmias typically require further evaluation by medical specialists to determine whether the condition prohibits medical certification.

The International Civil Aviation Organization (ICAO) Manual of Civil Aviation Medicine says that medical certification generally should not be granted if a pilot's arrhythmia is a result of heart disease, if recurrence of the arrhythmia cannot be predicted or if other elements of the pilot's condition could present a risk to safe flight operations.

Annette Ruge, M.D., Ph.D., medical coordinator for the European Joint Aviation Authorities (JAA), said that JAA is reviewing its requirements for the evaluation of pilots with arrhythmias and that those requirements may be changed in late 2003 or early 2004. Current requirements are that all but the most minor arrhythmias require further medical evaluation.

Warren Silberman, D.O., M.P.H., manager of the U.S. Federal Aviation Administration (FAA) Civil Aerospace Medical Institute Aerospace Medical Certification Division, said that arrhythmias are "one of the more common things that we deal with." In many cases, after medical authorities are satisfied that the arrhythmia does not present a risk to the pilot's safe operation of an aircraft, he or she is issued a medical certificate; in cases involving more serious arrhythmias, medical certification is denied."

Electrical Impulses Determine Heart Rate and Rhythm

The heart is a muscular pump, divided into four chambers (Figure 1). The two upper chambers are the left atrium and the right atrium; the two lower chambers are the left ventricle and the right ventricle. The right atrium contains the heart's sinus node (sinoatrial node), a natural pacemaker that transmits an electrical impulse through the heart, causing it to contract (beat).

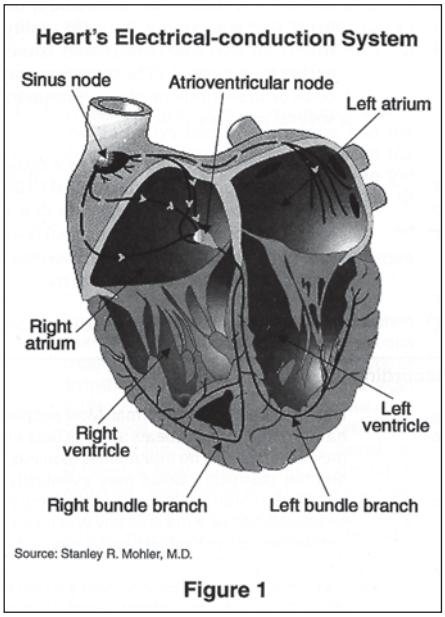


Figure 1

For the heart to pump blood properly, the electrical impulse must follow a path that begins in the right atrium and spreads through the atria to the atrioventricular node, an area between the atria that connects to fibers that carry the impulse to the ventricles. The impulse causes the heart to contract — the atria contract first, pumping blood to the ventricles. When the ventricles contract a fraction of a second later, blood is pumped out of the heart. Normally, when the electrical impulse is transmitted properly, these contractions occur about 60 times to 100 times per minute in a person at rest (more often during periods of exercise, pain or anger), and the heart beats at a regular rate. (Aerobically trained athletes, however, may have normal resting heart rates below 50 beats per minute; resting heart rates of more than 90 beats per minute are unlikely in healthy adults.)

If the impulse is not transmitted properly, however, an arrhythmia may result. There are many types of arrhythmias; they occur when the heartbeat is inappropriately fast or more than 100 beats per minute (tachycardia), inappropriately slow or less than 60 beats per minute (bradycardia), or when the electrical impulse travels on an abnormal path and the heartbeat is irregular.

Irregular heartbeats often are either premature heartbeats, which occur when the regular beating of the heart is interrupted by an early beat, or fibrillations, which occur when a chamber of the heart experiences a spasm and does not pump.

Arrhythmias are identified according to the part of the heart in which they originate and the effect they produce on the heart rhythm (see "Arrhythmias Classified According to Location, Effect," page 38). For example, in atrial fibrillation the most common type of arrhythmia — the atria undergo rapid, uncoordinated contractions. (The ICAO Manual of Civil Aviation Medicine says that atrial fibrillation "may cause pilot incapacitation" and that pilots with atrial fibrillation often should be denied medical certification; some pilots who have experienced single episodes of atrial fibrillation, however, "may be considered for restricted flight crew duties, subject to [further evaluation].") In ventricular tachycardia, an accelerated heart rate begins in the ventricles. (ICAO says that pilots with this condition, which typically is associated with heart disease, usually "are medically unfit for licensing.")

Heart Disease Is Most Common Cause of Arrhythmia

The causes of arrhythmias sometimes are not apparent. Most are a result of heart disease, especially coronary artery disease (in which the flow of blood through the arteries is obstructed by an accumulation of fatty deposits on the artery walls), heart failure (in which the heart fails to pump enough blood to satisfy the body's requirements) and heart-valve function (in which the heart valves either leak or fail to open fully). Arrhythmias also can be caused by some diseases and medications. For example, hypothyroidism (low thyroid activity) and some blood-pressure medications are among the causes of bradycardias. Tachycardias can result from use of medications such as decongestants, diet pills and thyroid medication; exercise; and diseases such as adrenal tumors, hyperthyroidism (elevated thyroid activity), lung disease, imbalances in blood electrolytes, dehydration and anemia.

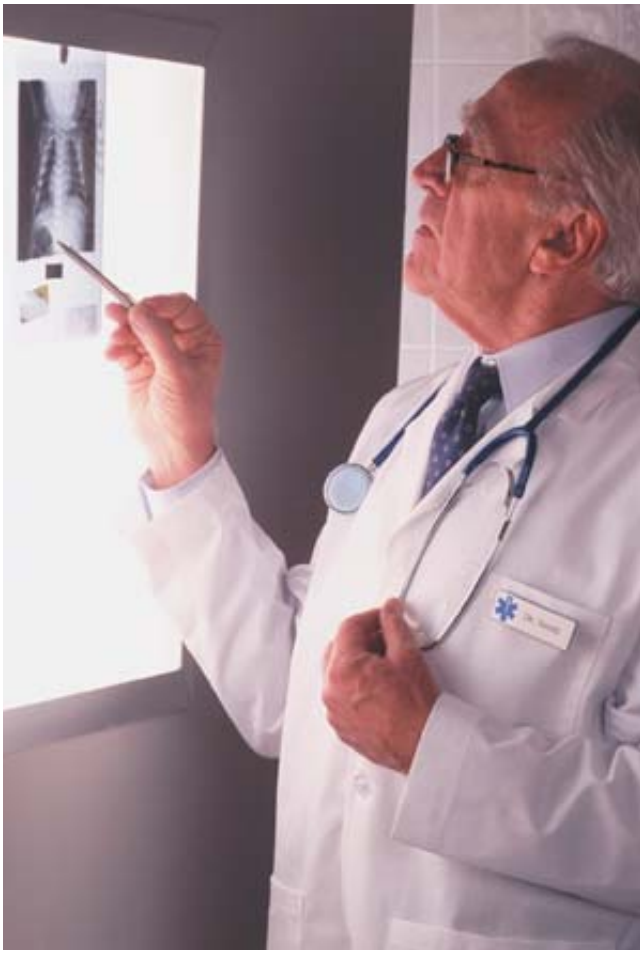
Minor arrhythmias can result from stress or excessive consumption of alcohol or tobacco.

Also among the risk factors for arrhythmia are advancing age; a family history of heart disease; a high-fat, high-cholesterol diet; and obesity.

Symptoms Include Palpitations, Chest Pain

People with arrhythmia may experience a number of symptoms — or they may have no symptoms. The most frequent symptoms include the following:

- Palpitations can be felt as a pounding or racing of the heart or a fluttering sensation in the chest. Sometimes, the heart seems to skip a beat. (In reality, this is an extra heartbeat that comes earlier than normal.) The sensation may be over in seconds or may continue for several minutes or hours;
- Lightheadedness may occur as a result of the reduction in blood supplied to the brain as a result of a heart rate that is too fast or too slow. If the abnormal heart rate persists for longer than six seconds, loss of consciousness may occur;



- Chest pains may result from tachycardias. The increased beating of the heart causes an increase in the heart's oxygen requirements; when the increased oxygen cannot be provided, chest pains occur;
- Shortness of breath sometimes is a symptom of a rapid heart rate that hinders the ability of the heart to fill with blood and results in a back-up of blood into the lungs; and,
- Fatigue — although usually associated with a cause unrelated to the heart — sometimes is a symptom of arrhythmia. A heart rate that is either too slow or too fast can cause tiredness.

Arrhythmias Classified According to Location, Effect

Different types of arrhythmias are identified according to the part of the heart where they originate and the effect that they have on the heart's rhythm.
Types of arrhythmias originating in the atria include the following:

- Atrial fibrillation occurs when muscles of the atria emit uncoordinated electrical impulses. The atria attempt to pump too fast (about five times to seven times faster than normal) and unevenly and do not contract completely. Because not all of the atria's electrical impulses affect the ventricles, the ventricles continue to pump blood, but the ventricular rate may be uneven. A trial fibrillation can be associated with various arrhythmias, congestive heart failure and stroke; people with atrial fibrillation are about five times more likely to suffer strokes than people without atrial fibrillation. Atrial fibrillation is the most common of all serious arrhythmias;
- Atrial flutter occurs when rapid electrical impulses cause the atria to contract quickly, as many as 200 contractions to 320 contractions per minute. The result is a fast heartbeat;
- Premature atrial contraction occurs when premature heartbeats or extra heartbeats cause irregularity in heart rhythms. Premature atrial contraction produces the sensation that the heart has skipped a beat; in reality, there is no skipped beat but rather an extra beat that comes earlier than normal. Most people have premature heartbeats at some time in their lives. Usually no treatment is required, and the premature beats may eventually cease. Sometimes, because premature heartbeats can be a result of illness or injury, further medical evaluation may be required;
- Sick sinus syndrome occurs when the sinus node (the primary pacemaker, located in the upper right atrium) does not send electrical impulses properly and the heart rate slows. In some cases, the heart rate may be alternately too slow and too fast;
- Sinus arrhythmia occurs when the heart rate slows when an individual inhales and speeds up when the individual exhales. Sinus arrhythmia is normal;
- Sinus tachycardia occurs when the sinus node transmits signals faster than usual and the heart rate increases (above 100 beats per minute). This arrhythmia can accompany fever, excitement and exercise; in these cases, treatment is not required. Rarely, diseases such as anemia (low blood count) or hyperthyroidism (increased thyroid activity) cause sinus tachycardia; in these cases, treatment of the disease eliminates the arrhythmia;
- Supraventricular tachycardia (also called paroxysmal atrial tachycardia or paroxysmal supraventricular tachycardia) occurs when a series of early beats in the atria cause the heart rate to increase (to 160 beats to 190 beats per minute) .Treatment often is not required; and,
- Wolff-Parkinson-White syndrome occurs when the pathways between the atria and the ventricles are abnormal, and as a result, the electrical impulse arrives too soon to the ventricles. The result can be bursts of accelerated heart rates.

Types of arrhythmias originating in the ventricles include the following:

- Premature ventricular contraction occurs when a premature contraction or extra contractions result in irregular heart rhythms. In this type of arrhythmia, the premature contractions begin in the ventricles, and, as with premature atrial contraction, premature ventricular contraction produces the sensation that the heart has skipped a beat. Usually no treatment is required, and the premature beats may eventually cease. Sometimes, because premature heartbeats can be a result of illness or injury; further medical evaluation may be required;

- Ventricular fibrillation occurs when disorganized electrical impulses within the ventricular muscle result in rapid and uncoordinated contraction of the ventricles, causing the heart to pump little or no blood. Without immediate medical treatment, this arrhythmia can result in collapse and sudden death within four minutes. Treatment includes electric shock to restore normal heart rhythm. Subsequent treatment may include medication or surgical implantation of an electronic defibrillator: and,

- Ventricular tachycardia occurs when an accelerated heart rate begins in the ventricles. This arrhythmia may be a result of heart disease and usually requires prompt treatment in the form of medication, ablation (the nonsurgical elimination of heart tissue or electrical pathways that cause arrhythmia) or surgery.

Other types of arrhythmias include those caused by obstructions of other pathways traveled by the electrical impulses that are generated by the sinus node. These arrhythmias include:

- Adams-Stokes disease occurs when the normal heartbeat between the atria and the ventricles is interrupted, causing a heart block (improper transmission of the electrical impulse from the atria to the ventricles), a decrease in heart rate, an inadequate supply of blood to the brain and fainting:

- Bundle branch block occurs when there is a block in one of the two pathways (the right bundle branch or the left bundle branch) that are followed by electrical impulses as they travel through the heart. The block forces the electrical impulses to follow a longer, alternate path; the slowdown means that the ventricle on that side contracts more slowly than the other ventricle;

- Heart block occurs in the following three forms:

  - First-degree heart block, in which the heart rate and rhythm remain normal, occurs when the electrical impulse moves more slowly than normal through the atrioventricular node;

  - Second-degree heart block occurs when some signals from the atria do not reach the ventricles; and,

  - Third-degree heart block (complete heart block) occurs when none of the electrical impulses from the atria reach the ventricles. This can cause the heart to beat too slowly. In these cases, secondary pacemaker cells in the ventricles deliver electrical impulses to contract the ventricles, but the contractions occur at a slower rate than would be directed by the atrioventricular node; and,

- Long Q-T syndrome is a relatively rare hereditary disorder in the heart's electrical-conduction system in which a longer-than normal time is required for the electrical system to recharge after each heartbeat. The syndrome, which usually affects children and young adults, can result in a fast abnormal heart rhythm that prevents blood from being pumped out of the heart and can lead to sudden cardiac arrest.

ECG Aids in Diagnosis

Diagnosis of an arrhythmia usually requires an electrocardiogram (ECG; also known as EKG) to measure the electrical current that travels through the heart when the heart beats and to provide information needed to analyze the heart's rhythm and rate. To administer an ECG, small patches containing metal contacts (electrodes) are placed on the skin to measure the electric currents emitted by the heart; the information is recorded on paper or in a computer.

The record shows three major waves of electrical impulses: the P wave, which measures the electrical activity of the atria; the QRS wave, which measures the electrical activity of the ventricles; and the T wave, which measures the heart's electrical repolarization and its return to the resting state. The shape and size of the waves and the time between the waves can be analyzed for information about how long electrical impulses take to travel through the atria, the atrioventrical conduction system and the ventricles.

In addition to identifying abnormal heart rhythms, ECGs can help identify inadequate blood supply to the heart, thickening of heart muscle (sometimes a result of high blood pressure) and a thinning or absence of heart muscle (often a result of a heart attack). ECGs are either "resting" ECGs, conducted while the person is lying down, or "exercise" ECGs, conducted while the person pedals a stationary bicycle or walks on a treadmill. The results of exercise ECGs can show whether exercise causes an arrhythmia or makes it worse and whether blood flow to the heart may be inadequate.

Other diagnostic tests include a 24-hour ECG documented by a portable ECG recorder (Holter monitor). Electrodes are placed on the patient's chest, with the electrode wires connected to the battery-powered recorder. The monitor operates while the patient continues his or her normal activities. Afterwards, the data

collected by the portable ECG are analyzed using computer software that identifies abnormalities in the heart's rhythm and helps determine whether the abnormalities are a result of the patient's activity level.

For monitoring arrhythmias that occur less often than once a day, the patient wears a portable ECG "event monitor." After the patient feels an arrhythmia, he or she transmits the ECG by telephone to specialists who analyze the resulting data.

Other diagnostic tools also may be used, including the following:

- Echocardiography uses sound waves to observe the size, structure and motion of the heart;
- Electrophysiologic testing can be used to collect information on infrequent arrhythmias or suspected arrhythmias. After a local anesthetic is administered, temporary electrode catheters are placed in the atria, the ventricles and along the electrical-conduction system to record electrical impulses and determine how they spread with each heartbeat. The process shows where in the system a heart block is located and where tachycardia originates;
- Esophageal electrophysiologic procedures are used to diagnose and/ or treat tachycardias. A thin, flexible tube is inserted through a nostril into the esophagus (the tube connecting the mouth and the stomach), where — because of the location near the atria — an ECG recording can provide more precise information than a regular ECG. During the procedure, specialists may use an electrical stimulator to restart an arrhythmia for diagnosis, and they may test different medications to find the most effective one;
- Intracardiac electrophysiologic procedure (cardiac catheterization) involves inserting a thin, flexible tube through a large blood vessel in the legs or arms into the heart to record the heart's electrical impulses. This procedure can provide more precise information than a regular ECG;
- Radionuclide ventriculography (first-pass technique or multiple-gated acquisition scanning) is a nuclear-medicine test to measure the heart's pumping ability. The test involves the injection of a radioactive isotope into a vein. Cameras or other equipment are used to observe the radioactive isotope as it travels through the heart; and,
- Tilt tests may be used to diagnose the cause of recurrent fainting spells. The tests are conducted using tables that can be tilted to specific angles while the patient's heart rhythm and blood pressure are monitored through plastic tubes inserted into the blood vessels.

Civil aviation authorities use several of these diagnostic tests when conducting further evaluation of pilots with arrhythmias. For example, Ruge said that if, during a routine ECG, a pilot is found to have one of the most minor arrhythmias, the aviation medical examiner enters a notation in the pilot's medical records. JAA requirements specify that pilots with most other arrhythmias undergo resting ECGs, exercise ECGs, 24-hour monitoring with a portable ECG and echocardiograms. Some pilots also may require either electrophysiological testing or coronary angiograms (X-rays that can determine the condition of coronary arteries), Ruge said.

Silberman said that FAA requires similar testing for many types of arrhythmias and that, in many cases, after medical authorities are satisfied that the arrhythmia does not present a risk to the pilot's safe operation of an aircraft, he or she is issued a medical certificate, Medical certification generally is denied in cases involving the more serious arrhythmias, such as most ventricular fibrillations and many ventricular tachycardias; in such serious arrhythmias, decisions on medical certification take into consideration the underlying medical condition that led to the arrhythmia.

Treatments Include Medication, Pacemakers, Surgery

Some mild arrhythmias require no medical treatment, or they can be alleviated if the patient holds his or her breath or slowly drinks water. Other arrhythmias require treatment of an underlying cause, such as heart disease, or treatment of the arrhythmia itself. In some cases, treatment may preclude medical certification for pilots with all classes of medical certificates.

Treatment often includes antiarrhythmic medication to stop the abnormal transmission of electrical impulses, but the specific medication depends on several factors, including the type of arrhythmia, other medications being taken by the patient and the patient's response to the arrhythmia medication. Medications intended to manage arrhythmia can have serious side effects, including the worsening of the existing arrhythmia or the creation of a new arrhythmia. If medication is prescribed, an ECG or some other test often is conducted to monitor its effectiveness. JAA sometimes does not grant medical certification to pilots who use antiarrhythmic medications. FAA generally does grant certification.

Other medications sometimes are prescribed, including anticoagulants to prevent the clotting of blood pooled in the atria. JAA requirements prevent medical certification of pilots using anticoagulation medications; in many cases, while FAA

allows medical certification of pilots who use anticoagulants.

Some tachycardias are treated with radiofrequency ablation, in which a thin, flexible tube with an electrode at its tip is inserted into the heart muscle to deliver radiofrequency energy to kill the aberrant heart muscle cells that were transmitting the electrical impulses responsible for the rapid heartbeats.

Patients with serious ventricular arrhythmia can be treated with surgical implantation of an automatic defibrillator in the chest. The defibrillator monitors the patient's heart rhythm, identifies serious arrhythmias and delivers an electrical stimulus to prevent fatal arrhythmia. FAA and JAA do not grant medical certification to pilots with implanted automatic defibrillators.

In other cases, when the heart's sinus node is not functioning properly as the natural pacemaker or when one of the pathways for the heart's electrical impulses is blocked, an artificial pacemaker can be implanted. The artificial pacemaker then replaces the sinus node to send the electrical impulses that make the heart beat. Most civil aviation authorities require that medical certification be denied to a pilot who is dependent on a pacemaker.

When other treatments are ineffective, open-heart surgery may be performed to alter or remove the heart tissue that is causing an arrhythmia. One relatively recent surgical approach to treating atrial fibrillation is the Maze procedure, in which an incision is cut in the heart and then sewn together; the incision blocks irregular heartbeats and stops the fibrillation.

In emergencies, cardioversion (electrical stimulus) may be administered to restore a normal heart rhythm. Afterward, medication usually is administered to prevent a recurrence of the arrhythmia.

Prevention Measures Include Healthy Diet, Exercise

Because people with heart disease have the greatest risk of developing arrhythmia, medical specialists say that prevention of arrhythmia involves preventing the development of heart problems in general (and receiving proper treatment for existing heart problems). To eliminate risk factors for heart disease and arrhythmia, medical specialists recommend actions including the following:

- Exercise regularly. Typical recommendations are for 30 minutes of exercise on most days of the week;
- Consume a healthy diet that includes a variety of foods in moderate portions — especially fruits and vegetables, whole grains and low-fat meats — and that limits fats, cholesterol, sugar and salt;
- Maintain a healthy weight;
- Do not smoke, and avoid second-hand smoke;
- Limit consumption of caffeine, alcohol and other substances that may contribute to arrhythmias or heart disease;
- Avoid unnecessary stress and learn to manage stressful situations that are unavoidable; and,
- Schedule regular physical examinations and seek treatment for health problems that may contribute to arrhythmia or heart disease, including elevated blood pressure, elevated cholesterol, diabetes and thyroid disease.

An arrhythmia can be harmless, symptomatic of a serious disease or life-threatening. In pilots, a thorough medical evaluation is necessary to assess the severity of an arrhythmia, develop the best course of treatment and determine the advisability of continued medical certification.

Acknowledgement to Flight Safety Foundation.

Poacher Turned Gamekeeper

By Captain Phil Jones, easyJet

As an ex-military fast jet flying instructor and now a civilian airline Captain, I have been asked to write an article, which will hopefully enable crews on both sides of the fence to be more aware of a number of the concerns which can impact on all of our lives in aviation. The article will also highlight some of the over-arching problems from our (the civilian) perspective, cover working conditions and contain a number of personal thoughts.

Communication is a wonderful thing, but it is seldom perfect. So I have agreed to write this (with the risk of personal ridicule) for the simple reason I do think that there is a basic lack of awareness of the different roles between military and civilian flying (the them & us syndrome) and some of the issues surrounding this. So here goes, but please remember that these are my views based on my experiences, they are probably not PC (how refreshing!!) but may lay to rest several injustices that float about in both crew rooms.

Planning

Civil pilots report for work one hour prior to pushback, to meet the crew, collect the weather and flight plans, have a cup of coffee, decide on the all-important fuel figures for the day and so on. We try to second-guess what might go wrong: are the French on strike, will the Spanish refuellers turn up on time, are there slot delays etc? Simple really, mainly due to the fact that we use repetitive flight plans, the aircraft computers are excellent and we are but one very small cog in the wheel of commercial aviation.

Conversely, for a normal military training sortie a briefing of 45 minutes is not uncommon, with safety issues, rules and airspace considerations probably accounting for 40% of that time. For a large exercise the planning can take days or weeks. So, we'd be wrong to think that the 'chaps' are just hooligans flying at low level for a 'buzz' - those days are long gone. With serviceability problems, the British weather and manning issues, if a fast jet goes flying there is every chance that it is part of a well co-ordinated exercise with a very serious training purpose.

Fuel

The first area where military pilots differ from their civil colleagues must be on the subject of fuel. Fast jets have only one fuel load - FULL. In the civil world, the performance characteristics of each airport that we operate to and from mean we have to balance the requirements of fuel load and passenger weights to ensure we can make the journey. Sometimes these considerations can be very tight (hot day, wet runway, short runway with obstacles at the end, heavy payload etc). At other times we are easily able to carry extra fuel (tanking) to achieve economic advantage. Airliners are very efficient machines, but the basic truth is that it costs fuel to carry fuel, so there have to be valid reasons why we carry more fuel than the flight plan tells us (oh boy, could this open a can of worms!). So how does this affect me once airborne? Well quite simply. I want every short cut I can get, I want to push back and taxi expeditiously, fly as many 'directs' as possible at the heights I want - above all I want to do it safely. Remember the 'second guess' statement earlier. Well this is all part of it, but on a Liverpool to Barcelona run I can easily save 5% of fuel with a helpful ATC service, but I can conversely lose 10% if ATC keep me low or vector me off route, etc. Here is an interesting fact: I can fly from Liverpool to Madrid with a full passenger load and use less fuel than an F3 Tornado uses in a 30 minute combat sortie or an hour-long intercept sortie! OK - so what? Well, a large amount of airspace is reserved for the military; from the civilian perspective this airspace is placed annoyingly in big blocks in between airways and control zones. We want the most direct routings possible and see airspace as a commercial asset that enables us to reduce both time and fuel; we also want the protection that goes along with Class A airspace, primarily no Visual Flight Rules (VFR) traffic. Ultimately we would like airways between the airports. Conversely, the military want - and some would argue need - more airspace, yet this valuable commodity is under threat as the airlines expand and the public benefit from the joys of low cost travel. The military sees this as an intrusion into their ability to train and operate a modern fast jet fleet of aircraft to safeguard our nation, particularly as the introduction into service of future aircraft types such as Typhoon and the Joint Strike Fighter (JSF) with their increased agility, new weapons systems and tactics has brought significant new demands for airspace: we see it as saving time and fuel. I'm glad I'm not a politician.

Professionalism

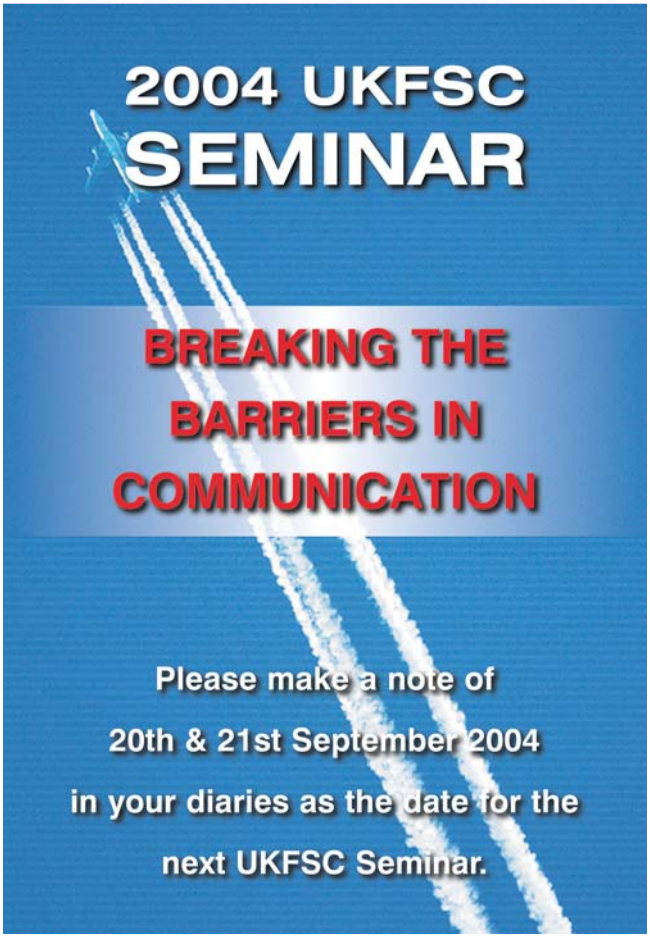
Please be under no illusions: the military pilots are highly trained professionals who are extremely safety-conscious. In my experience nothing gets in the way of Flight Safety. However, there was a feeling amongst the military that the civilian pilot was a fat chap who pontificated a lot and couldn't fly an aircraft without an autopilot. Far from it. All those who know someone who has gone over to the other side of the fence will know that the CAA exams are not an annoying inconvenience - they are actually quite hard and the Instrument Rating Test (IRT) is no pushover. Finding that dream job takes time and effort too. So a little more respect for the civilian pilot please - we may not do air-to-air

refuelling or close formation, but then again we don't have to!

Conflictions

What are the problems? Well, airlines have had numerous encounters with fast jets in various areas, arriving or departing at airports outside Controlled Air Space (CAS). Inverness is a case in point. There are several reasons for this: first, Radar Control is not always available, and ATC requirements may include handovers, such as from Scottish Control to Lossiemouth; there is only an Advisory Route (ADR) connecting Inverness to Perth and ADRs do not offer the level of protection that we civilians so crave. It is a busy area for the military, with aircraft operating from Kinloss and Lossiemouth, as well as those aircraft transiting through the area, and there have been close encounters, which need to be learned from. Military pilots need to be made aware of the increased civilian activity and the civilians informed of the probable locations of the military operations, such as the area between Newcastle and Edinburgh. Sounds simple really, but the word 'communication' crops up yet again.

Why is this important? Well, the revolution of low cost airlines is changing the face of aviation in the UK, whether we like it or not. Recently, Liverpool has had its Standard Instrument Departures (SIDS) and Arrivals (STAR s) changed to enable more efficient co-ordination with traffic using Manchester. The number of aircraft movements have exploded at Stansted and Luton, Blackpool is now host to Ryanair, the old RAF Finningley is being proposed as a new civil airport, and easyJet have recently moved into Newcastle.



Basically, it is not the principal airports that should give the military crews cause for concern, as they are already protected. Rather, it is the regional airports, which are not yet as fully protected in terms of airspace as their more established cousins. Of course, this may change in the future under the Flight Safety umbrella - which gives the airliners more protection: although also reducing the available airspace for the military. For example see the 'NORCA' between Pole Hill and Newcastle where an advisory route was established, which subsequently became a full airway a couple of years later.

We all need to be more aware of each other's operations; civilians want straight lines and gentle manoeuvres, the military want to hang upside down, go very very fast at low level and to use large volumes of airspace in order to achieve their training needs. So who gets the priority? Well that's up to the politicians. But let's now look at ways to help each other on a day-to-day basis.

Consideration to our Fellow Aviators

In essence, Fast Jets are very manoeuvrable, have impressive performance characteristics, and are flown by highly trained, professional and safety-conscious aircrew. Importantly many of the military are still not fitted with a collision avoidance system (TCAS), the cockpits are claustrophobic workspaces and at the end of the day, the only purpose of getting these chaps airborne is for them to train as intensively as possible in the art of detecting and eliminating targets, whether these targets are airborne or on the ground. It is very easy to get target-fixated (I've done it at low level when the overriding urge to shoot down the Jaguar that has side-stepped the Squadron Boss or better still the arrogant QWI - outweighs all else) so what if I clipped the Newcastle control zone? Let's be brutally honest, the only perceived success in military terms is to achieve the aim. A kill is a kill. Possibly not the most helpful attitude to have, while we are all trying to make best use of the congested airspace available.

When conflict with another aircraft is detected, military crews are able to manoeuvre as required, but due to the fact that close formation flying is drummed into the pilots from basic training, their impression of a 5nm visual

separation from an airliner is probably a lot different from ours, simply due to the size and relative speeds of the two aircraft types. This point can be highlighted by the fact that I have yet to fly with another pilot who has not remarked that 1,000 feet separation in airspace with Reduced Vertical Separation Minima (RVSM) 'is a little too close for comfort' when crossing with high relative speeds.

The airline pilot is also a highly-trained professional, intent on flying safely from A to B, avoiding all other aircraft by the required separations, keeping to the schedule, burning as little fuel as possible (and keeping up the coffee intake!). We are TCAS equipped - and a very valuable tool it has proved to be in improving 'Situational Awareness' of what's happening around us - but we are obviously not as manoeuvrable as our military counterparts and our crews and passengers are not strapped in all of the time. An 'avoiding action' turn can easily cause personal injury and this is one reason why we are so concerned about flight outside controlled airspace. I know the military take great delight in ribbing us about our 'seat belt signs off / seat belts signs on' - but in this litigious world, that switch is very important. One day you may be grateful for it.

Conclusion

I've gone on long enough, so in conclusion, I'd ask all pilots to respect each other's professional skills and judgements. We all want to operate our aircraft, in our own way, SAFELY. Airspace is a valuable commodity; if the military wants to keep the free airspace exactly that, then they need to ensure that they don't violate CAS and that they stay aware of the increasing number of civilian operations outside CAS. Please, give airliners more avoidance than you might think we deserve. Conversely, it doesn't help if airline pilots cry 'foul' every time they see a fast jet - we are not trained in range estimation, we only have TCAS and if we accept a direct routing which takes us outside CAS, then it is our decision and the idea is to then look out of the cockpit a little more than usual; we have to decide whether the 2-minute saving is worth the increased risk?

I'm not an authority on anything I have written here, it's just my opinion having jumped the fence. But I hope it causes discussions on the flight decks and in the crew rooms around the country because it means that we can all be a little more aware of the need for mutual respect.

Fly safe and happy landings.

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Book Review

Fatigue in Aviation

A Guide to Staying Awake at the Stick

By John A.Caldwell, Jr. and J. Lynn Caldwell

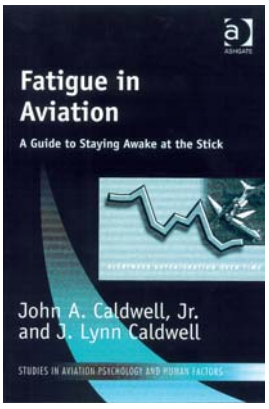
Published by Ashgate
ISBN 0 7546 3300 4
Paperback £20.00

This overview of fatigue includes fatigue definitions, the measurement/assessment of fatigue, and the performance, mood, and safety problems associated with fatigue in the operational setting. The physiological bases of fatigue are discussed, so the reader understands that fatigue is a physiological phenomenon that is not 'just a state of mind'. Scientifically valid countermeasures are discussed and data from a variety of sources are included to provide readers with a 'toolbox' from which they can choose solutions to fatigue-related problems.

The book is of interest to aviation crews in both civilian and military sectors, managers as well as aviators, flight deck as well as maintenance crews. It aims to be 'user-friendly', although scientific information is included to help the reader understand why certain behaviours occur.

About the Authors

John A.Caldwell, Jr, Principal Research Psychologist, and J.Lynn Caldwell, Senior Research Psychologist, both work for the Warfighter Fatigue Countermeasures Program in the U.S. Air Force. They are Consultants for Fatigue-Management in Military Aviation, Commercial/Civilian Air Operations, and Emergency Air-Ambulance



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