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"Celebrating 50 years!"

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Contents

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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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Front Cover Picture: Air Contractors A300 Freighter at night loading.

Fatigue and Sub Part Q - A Wake-Up Call for Europe?

by Rich Jones, Chief Executive UKFSC

Extensive scientific analysis of the phases of flight when accidents and high risk incidents occur in the commercial aviation sector has shown that approach and landing brings the greatest risk. It requires very little scientific or intellectual stretch to conclude that this phase of flight will invariably take place when the crew are at their most vulnerable to poor decision making and low levels of alertness generated by fatigue.

In researching the background to our understanding of effects of fatigue, I was amazed to learn that the logic behind the total number of hours that a pilot can safely fly each year was first established in the US way back in the Thirties. The 900 hours limit appears to have been set, not based on any scientific analysis, but on what it was considered to be physically possible to endure whilst flying mail across the vast continent of America in basic aircraft.

I was equally astonished to learn that science once again failed to intervene in the logic of flight time limitations in the Forties, when the annual flying hours allowed was increased to 1000 hours. This revision was based on the notion that American aviators, with the US having joined in the Second World War, should demonstrate their commitment and support to their country by increasing the hours they would be willing to fly. Once the war was won, the limit reverted back to 900 hours and there it has stayed for the past 65 years.

We are all aware that aviation safety has moved on significantly, in parallel with commercial air transport manufacture and training since the Forties. Air accidents numbers have been reducing by roughly a half every decade up until the last one, when air accidents appear to have reached an undulating statistical plateau. No doubt, increasingly more sophisticated flight time limitations such as individual flight duty periods, specific rest periods between duty and set hours for a set number of days have all made a contribution towards this reduction. Science and our understanding of human factors as they apply to fatigue have also come on in leaps and bounds. The gradual development of fatigue rate management systems is an important output of such work, since it is the insidious and cumulative effect of fatigue over time that must also be taken into account alongside the short term daily impact.

Current UK CAA regulation on flight time limitations, known as CAP 371, is the result of initial work by Sir Douglas Bader in 1973 which has been further modified by scientific study and practical experience. Although to some extent prescriptive, with a requirement for approval of each operator's schedule, this scheme allows for a degree of flexibility to cater for the significant variations in routing, distance, roster and sector requirements amongst UK AOC holders. Further afield and more recently, the FAA is now responding to fatigue and its effects on flight crews by developing flight time limitation regulation based on scientific and safety analysis expertise. Sadly, it took the Buffalo accident to drive fatigue up, and onto the top of, the US safety agenda.

So where are we going in Europe? Although the environment and operating conditions do vary between road and air, comparison of the European Union rules are useful indicators of the application of science and experience to the man-machine interface and effects of fatigue on performance. The rules for commercial lorry and coach drivers are straightforward and are legally enforced through regular checks of their ubiquitous tachograph; 4 and half hours driving, 45 minutes rest, a further 4 and a half hours driving. An extension to 10 hours for 2 days each week is allowed. And that's it for the remainder of 24 hours.

Turning to the aviation regulator's approach, a good start was made in 2008 when EASA commissioned the Moebus Report, consisting of a team of scientific and human factors aviation fatigue experts, to assist in EASA's evaluation of the likely Sub Part Q regulation on flight time limitations. Unfortunately, it appears that the recommendations of the report were widely disregarded by EASA in the resulting draft EU Ops Sub Part Q. However, the Consultation phase of rulemaking has attracted a record number of comments which has, in turn, gained the attention of the European Commission, to the point where they have appointed a team of three fatigue specialists to review the latest EASA proposal.

To say that there are many competing and contrary pressures being exerted on EASA, when it comes to producing flight time limitations to meet the commercial and safety needs of the air transport sector, is clearly an understatement; a balance, which is firmly and fairly applied across the entire European commercial aviation sector, is vital. But it should be borne in mind that a more scientific approach to flight time limitations which effectively counters short and longer term fatigue now, would be more cost-effective for airline operators and much more acceptable to the European air traveller than a European repeat of the US 'Wake-up Call' from Buffalo in 2009.

"Security And You"

by Capt. Tony Wride, Monarch Airlines

I watched with interest the events that occurred recently and were reported in the news. The first major event was something that I fear could have serious repercussions on the Aviation Industry, perhaps more so than the tragedy that was 9/11 and ultimately led to what happened recently. It could be argued that the Navy Seals that finally found and killed Osama Bin Laden concluded the long overdue revenge (justice?) for the loss of lives at the World Trade Centre and other terrorist attacks over the last decade. It could also be argued that by killing Osama Bin Laden those Navy Seals had simply fuelled an already burning fire and giving the terrorists even more justification for carrying out their acts. Only time will tell but I fear that the latter is what's going to happen and as an Industry we will have to be even more vigilant with our security.

If you had to nominate "The Person Who Has Had The Greatest Impact On Commercial Aviation In The Last Decade" who would you choose? You might nominate the inventor of the Southwest Airlines business model who enabled the masses to fly for peanuts but who has forced many airlines to the very brink of survival. You might nominate the Boeing CEO for the revolutionary B787 that at the time of writing, is years late and still grounded, leaving companies still dreaming of their Dreamliner. Or you could nominate Osama Bin Laden! No, I'm not joking! If you think about our industry before he came onto the scene and the 9/11 tragedy and compare it to now a lot has changed because of what he instigated.

Security was always something we had to take seriously in our industry but before 9/11 some parts of the world had become blasé about it, allowing curb side check-in and very lax screening of hand baggage and passengers. In the UK we had lived under the terrorist threat from the IRA for decades so we did take security seriously. After 9/11 aircraft had to be modified with secure flight deck doors, security screening had to be stepped up to a state now where as you pass through security they can almost tell you what you ate for breakfast! I still find it amazing to hear the complaints from crews about inconsistency in security screening not because the screening is lax but because it is too thorough! We had the benefit a while back to have the person responsible for setting DfT policy on screening give the Committee a presentation which explained the rational behind what was happening. Personally I take the view that the Security staff have a task to perform to ensure our safety so if they need me to strip off, do a handstand, and empty my case then that's what I will do! I may not enjoy doing it but if that's what's required to ensure nothing dangerous gets onto my aircraft then it has to be done. But it's not just the Security staff that are responsible for security it's all of us!

Anybody planning an attack on an aircraft, airport, or wherever, will carefully study the target and identify the weak points that will enable them to achieve their aim. If they identify that screening of airport staff and access to the ramp area is not strictly controlled then that will be their way in to do their worst. If they know that screening of pilots and crew is particularly lenient then that's what they will use. Remember that just because you have known somebody for a year or two doesn't mean you really know them. Their family could be being held hostage and they could be forced into doing something they wouldn't normally do. Alternative they could have long standing beliefs and have been waiting for the right opportunity to strike.

As the Summer flying ramp up starts a large number of new and inexperienced staff are recruited into our industry. They should all have been security screened and undergone security training but they are an unknown commodity and have a lot to learn. They will follow the example set by the experienced staff so if you aren't vigilant then they won't be!

The message is simple. Be vigilant and always challenge if you are not sure about somebody or something, it just might save your life or the lives of others.

The other item in the news was the discovery of the flight recorders from the Air France A330 that crashed into the Atlantic. So much has been speculated about this aircraft loss with lawyers going after Airbus, Air France, and Thales for compensation. Hopefully the recorders will finally provide the answers as to what exactly happened and we can all learn from it. If it's identified as an equipment malfunction then that equipment can be modified. If it's identified as pilot error, perhaps due to a training deficiency, then training can be modified. If however the cause is identified as the aircraft flying into severe weather conditions and getting into an unrecoverable state what are we going to do, sue Mother Nature? Perhaps if the weather is identified as being the cause then it will serve as a timely reminder that the environment in which we work can be hostile at times and seriously threaten safety.

As my 2 year term as Chairman ends, in accordance with the UKFSC Constitution, I would like to thank all the membership for your support, not just while I've been Chairman, but also during the 8 years that I have been part of the Committee. I've certainly enjoyed being an active member of the Committee and I will miss seeing you at the meetings. Your new Chairman will need your support and I'm sure you will provide it. Keep Safe!

Emotionally Enabled

by Shari Frisinger

'Emotionally Intelligence' means being aware of an entire crew's mental state, not just your own.

We watched in astonishment when Chesley Sullenberger in early 2009 skillfully piloted US Airways Flight 1549 to a safe landing in the Hudson River, and listened in horror a month later when we heard of Colgan Air Flight 3407 crashing into a Buffalo, New York, U.S., suburb.

Among the factors that caused one perfectly good aircraft to fall out of the sky, killing 50 people, while another very crippled aircraft made a safe water landing that resulted in only a few minor injuries, technical flying skills obviously play a major role. However, success or failure to a large degree can be linked to the captain's ability to control his own emotions in order to think clearly, while being aware of the crew's emotional and mental states.

When the role pilots play in aircraft incidents and accidents is considered, the initial focus of the U.S. National Transportation Safety Board (NTSB) and many analysts is on the technical abilities of the pilots: When was their last recurrent training? How many flight hours did they have in the aircraft type? How many total hours of flight experience?[1] But some time ago it was realized that technical skills are not the only desirable traits a captain should have.

A major factor in maintaining the safety of the crew and passengers is the combination of the leader's objective thought process and his or her emotional awareness.

Many years ago, airlines implemented cockpit resource management (CRM) techniques to enhance crew coordination. This new concept was partially based on a U.S. National Aeronautics and Space Administration investigation that discovered a common theme in many accidents — *failure of leadership and ineffective crew interaction*.

CRM focused on how the crew interacted in the cockpit, not necessarily on acceptable or appropriate cockpit behaviors. During the first decade of CRM use, it morphed into *crew* resource management, to include helping all crewmembers work more effectively as a team, improving situational awareness and providing techniques to break the error chain.

CRM has become a training mainstay. To date, CRM has included only the technical skills and thinking abilities — analytical, conceptual and problem solving. However, research beginning in the 1980s demonstrated that emotions greatly influence a person's cognitive abilities.

To be effective, the next level of CRM needs to include more of the "people" side — self-confidence, teamwork, cooperation, empathy and flexibility in thoughts and actions. A major factor in maintaining the safety of the crew and passengers is the combination of the leader's objective thought process and his or her emotional awareness.

The word "emotion" may conjure up negative elements that tend to degrade safety: anger, fear, crying, shouting and other unhelpful behaviors, but everyone every day experiences more subtle varieties of emotion.[2] In the cockpit this might include satisfaction for having achieved a smooth landing, pride in maneuvering around turbulence, excitement in getting desirable days off, irritation when plans don't work out, and sometimes annoyance with others.

Regardless of the situation, there always exists some degree of emotional response, and emotions are simply another type of information that must be considered in making effective decisions, especially in a team environment. A high degree of situational awareness relies on a person being attentive to the environment. Internal situational awareness consists of understanding one's own emotions and emotional triggers. External situational awareness involves insights into team members' moods and unspoken communication, and appropriately addressing them.

The cornerstones of *emotional intelligence* (EI) are consciousness of one's thoughts and moods, of how the behaviors resulting from those impact and influence others, and of the moods and behaviors of others.[3] People with a high level of EI recognize and control their own emotional outbursts, step back from the heat of any situation, analyze it objectively and take the appropriate action that produces the most desirable results.

A person's perception of reality shapes emotions and feelings, and these drive thoughts and behaviors. Status quo is maintained until new strong feelings are experienced. Simply being unhappy in a job is usually not enough to warrant a change. Getting passed over for a promotion, accompanied by the belief that the decision was wrong, usually sparks anger and an active job pursuit. The *amygdala* is the part of the brain that controls a person's level of emotional reactivity. It never matures, and, if left unchecked, it can bring chaos to a life. To compound the problem, the human brain instinctively cannot distinguish between a real threat and an imagined one.

Sitting in a theater, watching a panoramic or 3-D movie, the sudden loud sound of an airplane approaching will make most people reflexively duck. Intellectually, they know the airplane is not real, but the emotional brain hears the loud sound and tells the body it needs to avoid getting hit. When a situation changes, the emotional brain determines if the stimulus causing the change is a threat. If a threat is sensed, awareness becomes heightened and physiological changes take place to cope with this new danger. Adrenaline is released to pump the heart faster and prime the muscles for action.

If the situation is later deemed to not be a threat, logic and objectivity take over again, but it takes four hours for the adrenaline to dissipate from the body.

Today's fears, threats and dangers are not unlike those of prehistoric man. A flight department manager who needs to justify the expenses of his department can experience the same "fight or flight" reaction that the caveman did when faced with a saber-toothed tiger. A similar reaction occurs when people feel their reputation or credibility is threatened. Fear and stress envelop thinking and people over-focus on a narrow selection of solutions, disregarding alternative approaches.

When people allow their stressed brains to overtake thoughts, the perspective narrows and the main focus becomes escaping from the situation. Unable to think of alternatives, they don't see the "big picture" or question assumptions. At this level of thought, perception of the complexity of the situation becomes paralyzing, and the focus is on current limitations.

Remember the last time you became angry during an argument? It probably wasn't until later, after you could see the situation without emotion, that you thought of several obvious points that could have helped your case. These become apparent because your rational mind was back in control. Your primary focus, in the midst of that argument, was to defend yourself. Success is more assured when this emotionally downward spiraling thinking is halted and the problem is addressed more creatively.

The next level of CRM needs to include more of the 'people' side — self-confidence, teamwork, cooperation, empathy and flexibility.

The captain in the Colgan Air 3407 accident chose the "flight" reaction; he chose to avoid a developing situation.[4] When the first officer brought up the icing conditions — "I've never seen icing conditions. I've never deiced. I've never seen any, ... I've never experienced any of that" — the captain's response was, "Yeah, uh, I spent the first three months in, uh, Charleston, West Virginia and, uh, flew but I — first couple of times I saw the amount of ice that that Saab would pick up and keep on truckin'... I'm a Florida man..." Then he added, "There wasn't — we never had to make decisions that I wouldn't have been able to make but ... now I'm more comfortable." The captain was still unaware of what was rapidly developing around him, chatting while the aircraft's airspeed rapidly decayed. His failure to quiet his instinctive emotions narrowed his perception to the point that airspeed, one of the most basic elements of flying an airplane, no longer had his attention.

There were few instances when the captain referred to the first officer's health. He did not ask how she felt about her ability to perform her flight duties, even though she sneezed twice and six minutes later, she mentioned her ears. Basic understanding of CRM and crew performance should have tipped off the captain that the first officer was not feeling well that day and her performance could be negatively impacted. A person with higher EI could have recognized that, and probably would have been empathic to her condition and her inability to actively participate as a viable crewmember.

The captain told stories for most of the flight. At one point, he rambled for over three minutes while the first officer only said 34 words, most of which were "yeah" and "uh-huh." Research on how the mind processes information has revealed that people can only consciously execute one task at a time, and unconsciously perform one additional task. When driving in heavy traffic or merging onto a freeway, are you able to continue your conversation? Your mind moves from the conversation you were having to looking at traffic, calculating vehicle speeds and analyzing the best opportunity to speed up and merge. Your automatic mind does not have the ability to safely handle non-routine driving tasks.

Captains infected with 'captainitis' are so absorbed in their own world that they lose their situational awareness.

A classic example is United Airlines Flight 173, a McDonnell Douglas DC-8, which in 1978 was destroyed when it crashed during an approach to Portland (Oregon, U.S.) International Airport.[5] The captain's intense preoccupation with arranging for a safe emergency landing prohibited him from considering other anomalies. His concentration was so focused on the emergency landing checklist that he did not modify his plans when the first officer and flight engineer twice warned him about their airplane's dwindling fuel supply. Ten people were killed when the aircraft crashed into a wooded area due to fuel exhaustion.

The NTSB said, "The probable cause of the accident was the failure of the captain to monitor properly the aircraft's fuel state and to properly respond to the low fuel state and the crewmembers' advisories regarding fuel state. ...His inattention resulted from preoccupation with a landing gear malfunction and preparations for a possible landing emergency."

This accident was one of the key events driving the adoption of CRM in airline training. Contrast the reactions and situational awareness of the Colgan and United crews to those of the captain of the US Airways A320 that landed in the Hudson River. Sullenberger kept his emotions under control and remained focused on doing his job — to safely land the plane.

The captain's words "my airplane" when he took over the controls after the bird strike could have been trigger words, words to focus on, snapping his rational brain into action and putting him into a safety frame of mind.

He repeated the commands from the first officer, indicating that during those critical seconds there was no room for any misunderstanding. This flight crew's emotional intelligence was as good as it gets, which enabled their processing information quickly and using every resource available to them at the time.

The captain of United Airlines Flight 232, a McDonnell Douglas DC-10 that in 1989 attempted to land in Sioux City, Iowa, U.S., with catastrophic hydraulic and flight control systems failures, could have reacted to his challenges by becoming indecisive, shutting out the crew or dictating orders to them.[6] If he had responded in any of these ways, the captain would have reflected the emotional pressures he was experiencing, and, as a result, his crew would have had his pressures added to their own. Instead, he worked as part of the crew, alternating between giving direction and explaining his actions and taking input from anyone in the cockpit, including a training pilot. Emotions are contagious, and the strongest expressed emotion will be felt unconsciously by others and mimicked.

In this case, the captain's calm demeanor was mirrored by the crew and they were able to contain their emotional reactivity.

Aviation history is overflowing with accidents due to pilot error. Many of them could have been avoided if the crews were more aware of their own emotional reactivity and those of the others. Captains infected with "captainitis" are so absorbed in their own world that they lose their situational awareness.

The captain in Colgan Air 3407 was self-absorbed, talking about himself for nearly 20 minutes of the last 40 minutes of the flight, missing a number of clues that eventually led to the crash; on the other hand, the captain of US Airways 1549 maintained his composure throughout his short flight and focused on every element of the emergency.

Why is EI relevant? The Center for Creative Leadership found that the leading causes of failure among business executives are inadequate abilities to work well with others, either in their direct reports or in a team environment. Another study of several hundred executives revealed a direct correlation between superior performance and executives' ability to accurately assess themselves.

What actions demonstrate an increased level of EI?

- When crewmembers voice their concerns in a calm, firm manner, giving evidence to back up those concerns;

- When leaders acknowledge the atmosphere and question crewmembers in a non-defensive manner to determine the causes of the uneasiness; and,

- In a crisis or stress situation, when leaders maintain their composure and communicate more frequently and more calmly with the crew.

There are several techniques that can raise your level of EI:

- Be aware of the thoughts going through your mind. Are they stuck in the past and wallowing in problems, or are they focused on the future and actively looking for solutions? Once we choose negative thoughts, they can very easily spiral downward, the cycle descending into hopelessness.

- Acknowledge your emotions. Remember they are neither good nor bad, they are what they are. Next, identify these emotions: Angry? Irritated? Defensive? Disappointed? Guilty? Frantic? Miserable? Naming your emotions makes them less abstract and helps release their influence on you. It becomes easier to detach yourself and think objectively.

- Look back over your previous reactions. How could you have made a better choice? What information and alternatives are clear now that weren't at that time? As we frantically search for quick solutions to rectify the situation, we automatically use the techniques that we have used before, whether they are the best choice or not. Our mind is not free to explore new alternatives.

- Put yourself in the other person's position. How would you react if you were on the receiving end of *your* emotions? The other person's brain will send him through the same fight/flight/freeze reaction that yours is experiencing.

Imagine both people fighting for their pride or their reputation – chances are slim that the discussion will end well.

Leaders need a considerable amount of cognition.[7] The ability of the leader to broaden his or her focus from technical and task-related activities to include an awareness of the moods of the crew is critical to success. It would benefit all parties to know which skills in specific circumstances are most appropriate.

A leader's behaviors directly affect the team's disposition, and the team's disposition drives performance. When the leader can analyze and manage his or her own emotional reactivity, the team members can more easily manage their own emotions. How well the leader performs this can have a direct effect on the safety and morale of the crew.

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Notes

1. Helmreich, R.L.; Merritt, A.C.; Wilhelm, J.A. "The Evolution of Crew Resource Management Training in Commercial Aviation." *The International Journal of Aviation Psychology*. Jan. 1, 1999.

2. Goleman, D. "What Makes a Leader?" *Harvard Business Review*. Jan. 1, 2005.

3. Mayer, J.D.; Salovey, P.; Caruso, D.R. "Emotional Intelligence: Theory, Findings, and Implications." *Psychological Inquiry*. Jan. 1, 2004.

4. NTSB, Colgan Air 3407 cockpit voice recording. <www.ntsb.gov/Dockets/Aviation/DCA09MA027/418693.pdf>.

5. Aviation Safety Network. <aviation-safety.net/database/record.php?id=19781228-1>.

6. Aviation Safety Network. <aviation-safety.net/investigation/cvr/transcripts/cvr_ ua232.pdf>.

7. Helmreich et al.

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European Aviation Safety Programme, a pioneer approach for safety in Europe

By Rodrigo Priego, Safety Risks Expert - European Aviation Safety Agency

In order to further improve the already high level of safety obtained in the civil aviation industry, ICAO has promoted the principles of safety management[1] revolving around Safety Management Systems (SMS) for industry organisations and State Safety Programmes (SSP) for contracting states. When developing these principles, ICAO mandated that all contracting states have an SSP, but certain political systems such as the one set up in the European Union need further consideration.

The sharing of roles between the European Union and the Member States, as described in the Basic Regulation makes it impossible for the Member States to alone take full responsibility for an SSP. Many States do not have such a programme today. There is a need for a European Aviation Safety Programme (EASP) to complement what is done by the Member States which encompasses the powers transferred to the Union.

In view of this need and in order to streamline the strategic approach, a European Aviation Safety Advisory Committee (EASAC) was established in October 2009 with representation from industry, some Member States, EUROCONTROL, the European Commission and the Agency. Its fruitful guidance and the collaboration mechanisms established have culminated in the development of two important elements of the EASP: *a manual and a safety plan*.

The last piece of the puzzle will be provided by the European Commission in the form of a suitable *strategy* for the future of European aviation safety. This will be a high level statement expressing where we wish to be in a few years; thus providing direction. With these three elements: a strategy, a programme and periodic safety plans the picture is complete.

Europe is pioneer in this endeavour as no other region in the world has similar documents that turn safety management into action. Both elements have been warmly endorsed by the Management Board of the Agency in December 2010.

The main elements

The proposed approach for European aviation safety is based on three elements:

- A set of policies and objectives from political authorities *(the strategy)*.
- An integrated set of regulations and activities aimed at improving safety *(the programme)*.
- A high level safety issues assessment and related action plan *(the safety plan)*.

The Manual

A manual describes the EASP and how it should function. It comprises a set of processes and activities.

It is divided in two parts. The first part addresses the European aviation safety system created by the Basic Regulation, the so called EASA system. It sets the scene. It describes the different actors, their roles, their responsibilities and how they interact with each other. This is fundamental to understanding how the system can be used to improve safety. The document also describes the external actors who influence the system. They are quite varied and also have a significant role on the functioning of the system.

The second part describes how the system should work to continuously improve safety. The introduction of formalised safety management in all sectors of the civil aviation industry is still in its infancy. Indeed, ICAO has introduced a paradigm change which is being deployed at the moment. This change of paradigm consists of two elements: SMS/SSP and performance based regulation using a total system approach. To take into account this changing environment, this part of the document proposes aspirations as well as existing processes. It constitutes EASAC's proposal for transitioning towards a safety management approach which encompasses this change in paradigm that is not implemented today in all cases. The proposal places the collective management of safety at the core of the aviation system.

The EASP manual is an initial document. As the implementation of the safety management principles develops, the system will have to evolve. The institutional framework adds an extra level of difficulty to an already complex exercise. That is why the document must serve as a basis for a collaborative development of a more mature EASP in the future. Collaboration is the key to the successful implementation of safety management. This is especially true in our case and may well serve as a model for other regional cooperation approaches.

The EASP also aims at providing assistance to Member States in preparing their SSPs. It gives the European view of the different interfaces and of the common issues to be addressed. This European vision is fundamental to the collaborative approach and vice-versa. Indeed, a common understanding of how the EASA system functions and of the roles and activities of all the actors is the basis of the teamwork we will have to set up in order to succeed in this challenging endeavour.

The Safety Plan

The management of safety has evolved over the years. The review of the rare accidents that occur is not enough to achieve significant improvement; incidents and occurrences must be analysed to understand the risks to aviation safety. Improving our safety records has become a challenging job that requires collective effort and prioritisation of scarce resources. The publication of a Safety Plan shows the European commitment to action.

The intention behind such a document is to close the safety management loop by connecting the safety issues identified at European level through the analysis of safety occurrences with the action plans and initiatives launched to mitigate the underlying risks. It states the European will to resolve the key issues that concern aviation safety.

The first edition has been developed following a bottom up approach. The initial priorities have been set up by aggregating the national priorities provided by the Member States. These priorities have been compared to priorities established by ECAST[2], EUROCONTROL or the Agency.

This first version of the Plan allows starting a process of fruitful exchanges between the various actors (EC, EASA, Member States, EUROCONTROL, stakeholders and safety initiatives) and will be a clear sign of Europe's determination to achieve high consistent levels of safety.

Future editions will follow a more robust cooperative methodology as opposed to the one (bottom-up) used for this first version. The principles for development of the next plans are described in the EASP manual.

The Safety Plan proposes a path for the next 4 years that depicts a comprehensible picture of the safety work in Europe across all domains of aviation. It establishes the first layer of priorities which is further complemented at national level by safety plans and SSPs and at Agency level by an internal safety programme. It builds a network for action. Coordination and close collaboration are key to keeping it up to date and effective.

Content of the first Safety Plan

This first edition of the Plan encompasses three broad areas: systemic, operational and emerging issues. The risks identified in these areas are mitigated by safety actions that Member States, EUROCONTROL, the European Commission, the industry and the Agency will consider taking on board. All the partners work together, streamline their activities and add their efforts to drive our accident rates even further down.

Among the systemic issues within the Plan is the implementation of Safety Management principles in the States and across industry, along with the enablers of such implementation. These principles will have to be embedded in a system that is becoming more and more complex.

The operational issues cover the main risk areas that affect fixed wing commercial air transport operations: runway excursions, mid-air collisions, controlled flight into terrain, loss of control in flight and ground collisions. Most safety outcomes fall under one of these broad families. Some of the operational issues affecting other types of operation like helicopters or general aviation are also addressed.

Actions to address issues that are emerging, like the introduction of new systems and types of operations, new regulatory and oversight approaches, environmental factors or the next generation of aviation professionals have been also identified in the Plan.

Human factors and human performance affect all the above areas and are addressed in a dedicated section.

The ultimate value of this Plan resides in the actions it contains and stakeholders' commitment to implementation. It is a living document.

Notes

1. Requirements are now included in ICAO Standards: Annex 6, 8, 11, 13, 14 and parts of Annex 1.

2. ECAST is the European Commercial Aviation Safety Team, a component of the European Strategic Safety Initiative (ESSI). ESSI is an aviation safety partnership between EASA, other regulators and the industry. For more information visit http://www.easa.europa.eu/essi/

Mode S Interrogation Pattern – Operator's Fact Sheet

by Philip Worgan, Systems Engineer, NATS

What is the current situation?

As part of the transition to Mode S, NATS radars were configured such that Mode S equipped aircraft would respond with both a Mode S and a Mode A/C reply as a failsafe to protect against possible transponder anomalies.

Whilst using this mixed interrogation pattern does provide a belt and braces approach to detection it also has the following issues:

- It places the radio spectrum under much greater strain increasing the risk of corruption or reduced detection.
- It causes a number of false targets to be presented to controllers, including:
  - Reflections (where a radar detects a second copy of a real aircraft in a false position some way from the true aircraft)
  - Splits (where the Mode A/C and Mode S returns appear as two separate aircraft side by side)

What is changing?

In response to The National IFF/SSR Committee (NISC) letter (Ref. 8AP/65/02/58_SS3/07/102) we have now started to reconfigure our radars so that Mode S equipped aircraft will only respond to Mode S interrogations. The requirement they have set, is to complete this by 31/12/2011.

Mode A/C equipped aircraft are unaffected by this change.

When is the change being made?

- Five radar stations spread across the UK have already been switched across - these are being used to identify aircraft faults through analysis.
- NATS is planning to re-configure the remaining radars to a Mode S interrogation pattern by the end of June 2011.

So what's the catch?

A small number of Mode S transponders do not reply correctly to Mode S interrogations and these aircraft will therefore be undetected by a Mode S interrogation pattern. This may happen for a number of reasons:

- A design fault with a particular transponder type
- A systematic fault with the way an aircraft manufacturer fitted a transponder to an aircraft type (e.g. crossed wires)
- A random fault which has occurred with a particular installation (e.g. a loose connection, damaged feeder cable or faulty weight on wheels switch)

What do these False Targets look like to controllers?

Figure 1 - Reflection of aircraft near Biggin Hill appears close to Luton Approach – this would not appear had the radar be configured in the new Mode S pattern.

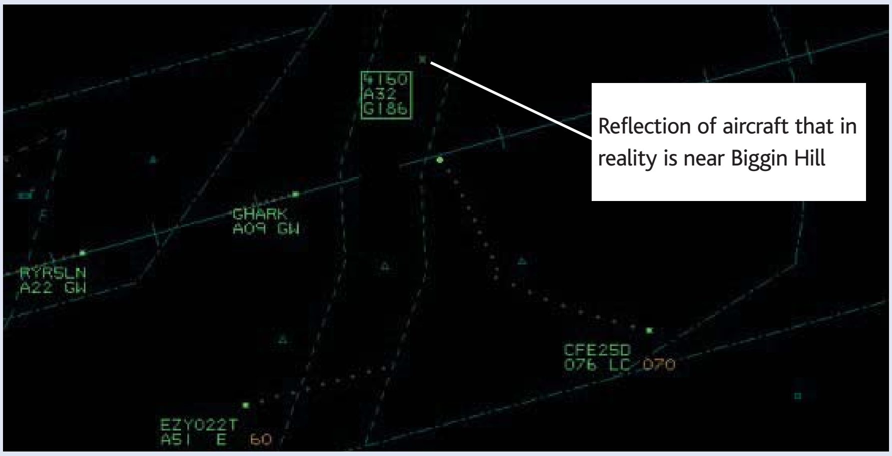
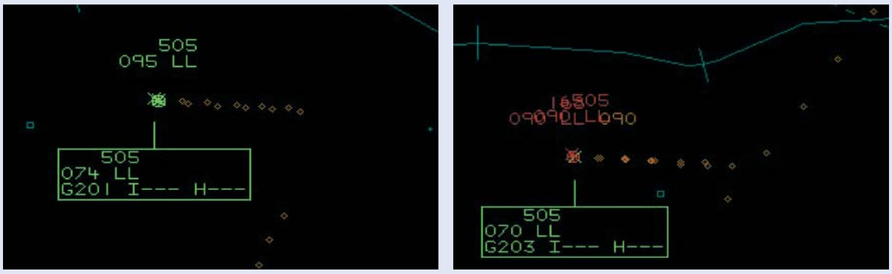


Figure 2 - Splits and Corruption in the Lamborne Stack. One aircraft is detected as two with the same identity (505) but corrupt and different heights this then leads to a false conflict alert with a second non existent aircraft, that results from a subsequent corruption of identity (505->168) – this would not have occurred in the Mode S pattern.



Controllers will inform the pilots of aircraft that they cannot see and amend their clearance as appropriate – this may involve aircraft being refused access to controlled airspace. Reports on these occurrences will be raised in the normal way and the aircraft operator informed.

NATS are working with other ANSPs and the UK CAA through Eurocontrol to address the issue and are also engaged in offline analysis to provide early notification to operators of issues before an event occurs.

What should Operators do?

- Respond as soon as possible to resolve any issue with a particular airframe if it is reported to you by CAA, NATS or another ANSP.
- Be proactive in looking at airworthiness directives and manufacturers service bulletins to identify and fix issues which may exist within your fleet.
- If you are a military operator and have the ability to disable Mode S responses from within the cockpit please ensure that any time you have Mode A/C enabled you also have Mode S enabled.

What Types are affected?

Many different types of aircraft are affected (Micro-lights to 747s), and a random fault may occur with any type of transponder. However systematic design or implementation issues account for a large proportion of faults observed, associated Air Worthiness Directives have been published on the following transponder types:

- Rockwell Collins TDR-94 and TDR-94D
- Honeywell MST-67A
- Funkwerks/Filser Avionics TRT-800 and TRT-600
- Narco Avionics AT-150
- Terra TRT-250

For more information, search for "transponder" at http://ad.easa.europa.eu/

Aviation Safety's Weakest Link Can Also Improve It

The majority of aviation accidents today are related to human error, but the human element is also that which can lead to greater aviation safety. Chuck Weirauch gives an update on human factors training.

On April 26, 2010, the FAA released Information for Operators (InFO) 10003 on Cockpit Distractions, which addressed "the safety risks of personal electronic devices in the cockpit." Presumably this document was in response to the incident when the flight crew of Northwest Airlines Flight 188 overflew the Minneapolis-St. Paul International Airport last year when they reportedly became distracted while using their laptop computers in the cockpit. However, ultimately it is just another example of the increasing focus on human factors on the flight deck by the agency, other regulators and the airline industry throughout the world.

Since the InFO also called for training directors to "review and reinforce crew training on this subject" as a Recommended Action, it was also another reminder of the correlation to and importance of human factors in aviation training. Human factors elements have long been considered a part of crew resource management (CRM) training from a crew communications and human performance aspect, and are increasingly becoming a part of threat and error management (TEM) training, as well as safety management systems (SMS).

Above John Cox and. Kathy Abbott provided a joint human factors presentation at WATS. Image credit: David Malley/Halldale Media.

Human Factors Impact

The Flight 188 debacle is just one example of how a distracted flight crew could lead to an incident or accident. During the ongoing National Transportation Safety Board (NTSB) public hearings that were being conducted in May in relation to H.R 3371, the Airline Safety and Pilot Training Improvement Act, it was reported that the flight deck crew on two regional airliners in two separate incidents "forgot" to start the second engine before the

rollout to takeoff because of distractions. And of course, distractions that implied a violation of the sterile cockpit rule, along with crew fatigue, were considered by the NTSB as factors that led to the crash of Colgan Air Flight 3407 in February 2009.

According to various aviation sources, such human error has been identified as a causal factor in 60 to 80 percent of aviation incidents and accidents. An Airbus Flight Operations Briefing Note goes further than that, stating that "ultimately, human factors are involved in all incidents and accidents." Since aircraft technology has advanced to the point where equipment and mechanical failures have been greatly reduced, the effort to further improve aviation safety has focused on the reduction of human error.

Distractions and fatigue are just two human factors that have been implicated in aviation incidents and accidents. Others include lack of communication, complacency, lack of knowledge, lack of teamwork, lack of resources, pressure, stress, lack of awareness and traditional "norms", or the "that's the way we have always done it" attitude. While in the US most of the recent human factors awareness efforts have been directed at maintenance personnel and for flight crews through CRM, it is also becoming understood that human factors awareness and training is vital for the whole of aviation systems and organizations as well. That is because the responsibility for incidents and accidents can no longer rest solely on the shoulders of the flight crew members and maintenance personnel involved in incidents and accidents.

"We have to consider that organizational factors can play a role in accidents," said Dr. Kathy Abbott, the FAA's Chief Scientific and Technical Advisor for Flight Deck Human Factors. "It's not just the individuals that are out there flying the airplane or maintaining them or controlling them that have a role in these safety events, it's the environment in which they operate as well. So I think that much of the intent of things like safety management systems are intended to address some of these factors."

Rather than citing a list of the key human factors most often implicated in incidents and accidents, such as fatigue, the FAA is taking a global approach to human interaction with aircraft operations. According to John Duncan, Manager of the FAA's Flight Standards Air Transportation Division, the agency is looking at all aspects of air carrier operations that impact human factors within an organization. Some specific areas on the flight deck include not only the direct interfaces between automation and the crew, but the design of the tasks and procedures involved with automation and how they might "load up" the crew, he explained.

Many aviation safety experts and others in the international aviation industry agree that human factors must be considered in all aspects of organizations and systems, including John Cox, President and CEO of Safety Operating Systems. He and Abbott provided a joint presentation on aviation safety and training at the 2010 World Aviation Training Symposium and Tradeshow (WATS) in April.

"Human factors needs to be included in the very first step of any aviation endeavor, be it design, certification, training or operation," Cox said. "Human factors needs to be a seamless integration throughout the entire industry because we have been and will be dependent on humans to sort things out. Automation is great and has helped reduce the accident rate, so now we need to focus on such human elements as loss of control as the key to further reducing the accident rate."

Human Factors and Training

During the WATS presentation, Abbott and Cox cited a number of human factors-related elements involved in a recent analysis of airliner accidents. Of those accidents studied, inadequate knowledge was considered to be a causal factor in slightly over 40 percent of the accidents. While this area "is a critical piece for training," it can't be considered just as what the flight crews knew, Abbott pointed out.

Other causal factors involved could also be flight deck instrument and equipment design, as well as documentation available on the flight deck, she explained. In 50 percent of the accidents studied, communication errors between flight crew members were considered to be causal factors, Abbott and Cox stated, while aircraft handling input errors were implicated in 60 percent of the accidents.

Based on the analysis of the accident data. Abbott and Cox cited several areas for improved pilot training. They include:

- Manual handling of the aircraft
- Flight plan management systems, including automation management
- Unusual attitude recognition and recovery (loss of control)
- Managing malfunctions, including those for which the flight crew has no checklists
- Managing distractions from other sources, including distractions from other systems that are distracting the crew from the flight path management system
- Crew coordination and communications

"Loss of control in flight is the largest accident type that we are seeing in airliner and business aviation today," Cox emphasized. "There is nothing else near it. As far as the rate of accidents caused by specific action or inaction by the crew, it stands alone. We have to look at it from a multifaceted approach with multiple layers of mitigation. I think that we have to train better, and that means academic training. That's because we are finding that there is inadequate knowledge by too many pilots on basic aerodynamics and stall recovery procedures. From an academic standpoint, we have to demonstrate proper procedures in flight simulation and even the use of actual inflight training. All of these will bring together a pilot group that is more capable of dealing with a loss of control event."

Flight Deck Automation

While automation on the flight deck has helped reduce accidents, it has also increased in complexity as more advanced flight systems are integrated into the aircraft. The foremost thing to recognize is that as aviation has moved into the increasing use of automation, the criticality of human factors in the relationship to automation has grown, Cox pointed out. On few rare occasions, there has been a breakdown between the automation and the flight crew, and that is what can be improved, he pointed out.

"What we are really focusing on is looking at management of the flight path of the aircraft," Abbott said. "So rather than focusing exclusively on automation, we talk about it in terms of flight path management, and automation systems like the autopilot and the auto throttle are some of the many tools that the pilots on the flight deck use to help manage the flight path of the airplane. Automation is part of the picture, not the whole focus of the picture. The focus of the picture is flying the airplane. So that is what we are trying to emphasize in what is coming out of our research."

Abbott is involved with a govemment-industry Flight Deck Working Group that is studying all aspects of human factors on the flight deck, including the man-machine interface aspect of automation. The group anticipates releasing its findings sometime this fall, she said.

"One thing that I would like to emphasize about this is that it is not just about improving man-machine interfaces," said Terri Stubblefield of the FAA Flight Technologies and Procedures Division. "This is also about how the operating environment, including existing and new operational concepts affect how the equipment is being used. From our perspective, improving where man-machine and other interfaces, such as instrument approach procedures design and the way new technologies are used on the flight deck is something we have studied from the beginning to ensure that they are optimized for what the pilot is going to use them for. We have made changes to improve human performance in the area of RNAV instrument procedure design, for example."

Another recent effort is the development of new regulations on the aircraft certification side to help address design related pilot error, Abbott pointed out. This is to ensure that newer aircraft have equipment with design characteristics that are known to reduce such error, she explained.

"We certainly have been seeing that there are malfunctions that are occurring for which there are not specific checklists, such as the Malaysia Airlines 777 that had a software issue," Abbott said. "As the flight systems are getting more complicated, we are realizing that there are different interactions that can occur that we didn't fully anticipate. So that's an area that we are looking at very closely, because this is an area that might prove to be very important. This area has some implications for training and procedures certainly, or else equipment design and how we do regulation during the aircraft certification process."

Humans Can Improve Safety

Despite the fact that humans are the most unreliable component of the aviation system because most aviation accidents today are related to human error, the human element is also that which can lead to greater aviation safety, Abbott and Cox stressed at WATS.

"We have to think about how humans can contribute to safety through such efforts as risk mitigation and equipment design," Abbott emphasized. "We have to unleash and leverage human performance to improve aviation safety, and we need to recognize the significant contributions humans can make in the areas of task management, flying the airplane and automation - and think beyond human pilot error."

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Mixed Blessings

The global positioning system (GPS) is a precious gift to aviation. But several new studies have found there are real issues about how pilots use the system, and these issues apply to both private and commercial licence-holders.

On a good day, GPS easily fulfills science fiction writer Arthur C. Clarke's dictum that 'Any sufficiently advanced technology is indistinguishable from magic'.

When the system is working perfectly it can locate an aircraft to within a wingspan (or a rotor diameter) and guide it with similar accuracy.

GPS is the US military navigation system that was made available for full-performance civilian use in 2000. It is one of several global navigation satellite systems (GNSS), along with the Russian GLONASS, European civilian Galileo systems, and the Chinese Beidou-2 system known as Compass. GPS is the only one of these systems in widespread civilian use in Australia.

Alas, GPS is not magic, but technology, and a fallible one at that. The results when it goes wrong or is used wrongly can range from hairraising to deadly. Under GPS guidance, aircraft have crossed restricted areas, taken detours to waypoints that were not on the flight plan and flown their own version of the flight plan based on out-of-date data.

General aviation pilots using, or attempting to use, GPS have had collisions and near-collisions with other aircraft, and have crashed into the ground when distracted by the sometimes-cryptic interface of many GPS receivers.

GPS has been embraced by Australian aviation. GPS receivers can be found on 85 per cent of Australian aircraft, and why wouldn't they be, when prices for aviation-specific receivers start at under $500? But there's growing disquiet about how misuse and occasional failure can turn it from an acknowledged safety aid into an unrecognised risk factor.

There is a strong perception among general aviation trainers that some private and commercial pilots are letting GPS do what they should be doing - or should at least be aware of - themselves.

'If there is a crisis in flight planning, then it's GPS that's the culprit,' a chief flying instructor (CFI) with a university-linked flying training organisation says.

Another CFI mentioned being in outback Queensland, and talking to the pilot of a light twin who had flown there from the east coast with no charts, relying instead on a GPS receiver. 'He was only a battery failure away from being totally lost,' the appalled instructor said.

CASA's Flight Planning Guide for VFR pilots, due for release in March 2011, highlights the role of GPS in flight: Planning is important because it constructs a four-dimensional picture of the flight in your mind.

The benefit of planning is not that you have a schedule you can follow at all costs, but that the act of planning builds this picture of your flight in your head. You build the foundation of your situational awareness.

'To follow GPS prompts is to do exactly the opposite' the guide says. 'Now situational awareness resides in a machine, and you merely follow its directions. Your ignorance will become a problem if the machine stops.'

The guide reminds pilots that errors can occur from outdated databases, or from the inaccurate press of a finger entering flight data into a system.

It also argues pilots should only use GPS if they have a functional understanding of how the system works, and all the current information and charts–VTC, weather and NOTAM.

Private flying is not the only area of aviation where the down side of GPS is causing unease.

A GPS failure was implicated, although not conclusively established as having been involved, in the crash of a Piper PA-31T Cheyenne that killed a 14,000 hour commercial pilot and five passengers, including a Qantas jet captain and a military helicopter pilot.

The crash near Benalla, Victoria, in July 2004, happened after the aircraft diverged left of its westerly track. The pilot reported commencing a GPS non-precision approach to Benalla aerodrome, but the aircraft flew into high ground 34km southeast of the airfield.

In 2008, the Australian Transport Safety Bureau (ATSB) reopened its investigation into the crash to examine the possibility the GPS unit might have been operating in deadreckoning mode, rather than by reference to satellites overhead.

'Planning is important because it constructs a four-dimensional picture of the flight in your mind. The benefit of planning is not that you have a schedule you can follow at all costs, but that the act of planning builds this picture of your flight in your head. You build the foundation of your situational awareness.

In dead-reckoning mode, when satellites are unavailable, the Cheyenne's GPS was designed to operate as a human navigator would and calculate probable position based on time, heading and speed.

The ATSB investigation found that deadreckoning navigation could not be positively established. Inconsistencies between deadreckoning principles and the recorded radar data made it seem unlikely, as did the alerts and warnings the GPS receiver and instrument indications would have provided.

Regardless, the ATSB issued a safety advisory notice alerting users of GPS navigation receivers to take appropriate action to ensure familiarity with dead-reckoning operation and any associated receiver-generated warning messages.

'The investigation found that there was little, if any, information about the in-flight DR [dead reckoning] operation of GPS receivers in any of the operating manuals published by manufacturers of GPS navigation receivers,' the ATSB said.

'Some users of these navigation receivers may not have been aware that the GPS receiver display unit would provide tracking guidance, including the legs of a GPS instrument approach, during DR navigation. This is a safety issue.'

The ATSB's second look at the Benalla crash highlighted some other incidents with the technology. Errors have been reported that can't be explained or reproduced.
'On 9 February 2003, a Bombardier Dash 8 was observed on radar to diverge 9nm left of track during a flight from Emerald to Brisbane.

The aircraft's crew reported that the aircraft was navigated by GPS and that the autopilot was engaged. No GPS warnings or error indications were observed and it was not determined if the receiver was navigating by dead reckoning. When the controller informed the crew of the track divergence, they reverted to ground-based navigation aids and continued to Brisbane. After landing, the GPS indicated a position 59nm to the north of Brisbane.'

The operator advised the ATSB that crews had reported numerous other GPS anomalies involving the Dash 8.

'Between February and September 2003, there were three occasions when the aircraft turned and tracked well left of the intended flight path while being navigated by GPS.

In two of those occurrences, the cabin crew detected passengers using laptop computers and compact disc players. Following each of those events a functional test of the receiver was unable to detect any faults.'

The results of a recent study by Cranfield University in Britain into the use of GPS for area navigation (RNAV) in airline operations were considered alarming enough for the International Civil Aviation Organization (ICAO) to recommend its results be widely publicised.

The study focused on human factors in RNAV operations.

One of its first findings was a severe criticism of the location of the GPS-linked flight management system (FMS) on the aircraft used in the study (a working regional airliner).

'The architecture of the system means that errors are likely to be made,' the study found.

'The human factors associated with control design and how they are actually used by pilots is an important consideration-putting a button in and expecting a pilot to use it is not always the answer.'

'A point is made about the method of selecting an arrival runway where the crew have to enter a number to make the selection rather than selecting the required runway with a line select key. Entering codes to make selection requires the crew to verbalise the code to transfer it to the keypad. This creates a high risk that an error will be made because of other cockpit activity. FMS operations and the method of making selections is a human factors problem that needs to be addressed with the manufacturers.'

Its position on the flight deck was another problem.

'To access the FMS control display unit (CDU), the large angles involved make operating the system difficult through parallax, dexterity and the angle of force transfer to the keypad. This out of normal reach installation makes operating errors more likely. A further problem is the likelihood of unintentional operation of the power levers.'

Reading the FMS display could be very difficult, particularly in bright sunlight, the study found. 'In bright sunlight the display was often unreadable.'

'The location of the control display unit discouraged first officers from using the system since it was not located in their personal space, resulting in a lack of practice.'

'The human factors associated with control design and how they are actually used by pilots is an important consideration-putting a button in and expecting a pilot to use it is not always the answer.'

The study found pilots using the FMS made a significant number of errors.

During the sector with the induced GPS integrity fault, approximately 75 per cent of crews made significant errors. About 25 per cent of crews flew the procedure with the integrity light on. This highlighted considerable misunderstanding of the meaning of the light and the actions needing to be taken. In one case, the crew attempted to fly the RNAV missed approach procedure using the VOR.

Discussion with pilots revealed a disquieting level of faith in the GPS-linked FMS and lack of knowledge of its limitations.

'Many of the pilots had come through general aviation where flight management systems are rare; they appeared to be impressed by it and not understand its weaknesses. Many confused the multiple inputs and system accuracy with reliability.'

'In the interviews and exercises it was apparent that crews treated the FMS as a primary navigation source and were failing to monitor the secondary system. The analysis work showed that the redundant systems are not actually redundant, because there is a low probability that the crew will detect a failure in the primary navigation system.

Whether in the cockpit of a sport aircraft flown by a 100-hour pilot, or the FMS of an airliner with thousands of hours experience residing in its two flight deck seats, GPS presents the same issues. Arthur C. Clarke summed up not only the potential, but also the problem.

We must fly by knowledge, not faith, and never confuse technology with magic.

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Hard Lessons on Wind Shear

Planning and caution can minimize the danger of the low-level phenomenon.
By David R. Carlisle

By definition, low-level wind shear is a localized meteorological event occurring below 2,000 feet of altitude when an aircraft encounters rapidly changing wind speed or direction over a particular distance or time. When the encounter occurs at very low altitude - say, at takeoff or landing - there's a very real possibility of the pilot losing control.

It is well known to flight crews that convective weather produces severe storms that can include tornadoes, gust fronts and downbursts. Low-level wind shear often presents itself in those situations and can be difficult to forecast due to its local nature.

Less well known is the fact that low-level wind shear can occur in the narrow pressure fields (frontal zones) of weather systems between air masses having dissimilar thermal and moisture properties. Surprisingly, it is not difficult to forecast this type of wind shear.

FedEx at Narita

An example of the dangers posed by a rapidly developing low-pressure area and its associated low-level wind shear occurred at 0649 on March 23, 2009, when a FedEx Boeing MD-11 crashed into a runway and burst into flames while landing at Narita International Airport outside Tokyo. The pilot and copilot - the only people onboard - were killed in the crash.
While the accident is still under investigation by the Japan Transportation Safety Board, we do know from the Japan Meteorological Agency (JMA) that wind gusts up to 47 mph were blowing through Narita City around the time of the crash.

According to Roy W. Spencer, principal research scientist at the University of Alabama in Huntsville, and former senior scientist for Climate Studies at NASA's Marshall Space Flight Center, "The strong, straight-line winds were associated with a low-pressure center of 992 mb moving northeast and away from Narita, behind which high pressure was rapidly building in over the airport."

"The general region of highest winds can be inferred from the anticyclonically curved isobars on the 2218 and 2300 UTC weather maps seen to the west and southwest of the 992 mb low," he continued. "It is unusual to see isobars with that much anticyclonic curvature that closely spaced together, and such a condition always causes high wind speeds."

"It is also a reminder that isobar spacing on a weather map is only half the story when getting a feel for surface wind speeds. For the same isobar spacing, cyclonic curvature causes lower wind speeds, while anticyclonic curvature produces higher wind speeds. This is true whether the low- and high-pressure centers are strengthening or not," Dr. Spencer said.

In the case of near-surface winds, the stronger the winds, the greater the turbulence will be in the boundary layer, as the strong winds interact with the frictional effects of the ground.

"In the Narita event this turbulence was no doubt enhanced with cooler air rapidly moving in behind the cold front and being heated by the sun, making the boundary layer more unstable and therefore more turbulent," he said. "Finally, in this region of strong cold air advection, the wind direction was no doubt backing with height. Combined with strong solar heating, this can be expected to create horizontally oriented convective rolls, which are usually expressed as low-level 'cloud streets' if the air is sufficiently humid. but will be invisible if the air is dry. All of these effects can combine to cause rapid changes in wind speed and direction as an aircraft attempts to land."

The hourly Narita wind reports suggested little crosswind, with Runway 34R experiencing winds from 310 degrees or 320 degrees. But significant and rapid changes in the headwind could be expected, with corresponding changes in lift as the aircraft was about to touch down.

If pilot attempts at correcting for these changes in lift happen to coincide with rapid lift changes in the opposite direction, a series of unstable runway bounces could result, as did occur with the FedEx MD-11.

Airport officials told us it was premature to attribute the crash to strong winds, but a Japan Airlines (JAL) captain who landed safely 10 minutes before the accident said the tower had issued a wind-shear advisory to the FedEx pilots.

Little Rock Overrun

An example of the dangers posed by a squall line storm system and its powerful large-scale, straight-line wind outflow occurred just before midnight on June 1, 1999, when the weary pilots of an American Airlines MD-82 overran Runway 4R at Little Rock and crashed.

As the narrowbody jetliner approached the runway from the southwest, strong low-level crosswinds created by a "bow echo" squall line approached the airport from the northwest.

According to the NTSB accident report, the flight crew learned that the winds were changing direction and that a wind-shear alert had sounded on the airport due to a thunderstorm nearby.

ATC originally told the pilots to expect Runway 22L for landing, but after the wind rapidly changed direction, the captain requested landing on Runway 4R.

As the aircraft approached the new runway, a severe thunderstorm arrived over the airport. The controller's last report, prior to the landing, stated that the winds were 330 degrees at 28 knots. Those winds exceeded the MD-82's crosswind limit for landing in reduced visibility on a wet runway.

Despite that information, plus two wind-shear reports, the captain elected to continue his approach.

During their rush to land, the pilots failed to arm either the automatic ground spoiler and the auto-braking systems, both of which are essential to ensuring the airplane's ability to stop within the confines of a wet runway, especially one that is being subjected to strong and gusting winds.

After landing, the first officer stated, "We're down. We're sliding." Neither pilot observed that the spoilers did not deploy, so there was no attempt to activate them manually. This resulted in minimal braking because the wings were still "flying." The captain then applied too much reverse thrust, in contradiction to the limits stated in the flight manual and directional control was lost. The aircraft skidded off the far end of the runway at high speed, struck the ILS array, crashed through a chain-link fence, went down an embankment and collided with the approach light structure before coming to a stop on the banks of the Arkansas River. The captain and 10 of the 139 passengers were killed.

According to the NTSB, the accident probably resulted from "the flight crew's failure to discontinue the approach when severe thunderstorms and their associated hazards to flight operations had moved into the airport area and the crew's failure to ensure that the spoilers had extended after touchdown." It said contributing to the accident were the flight crew's (1) impaired performance resulting from fatigue and the situational stress associated with the intent to land under the circumstances, (2) continuation of the approach to a landing when the company's maximum crosswind component was exceeded and (3) use of reverse thrust greater than 1.3 engine pressure ratio after landing.

Takeoff at DFW

Delta Air Lines Flight 191, a Lockheed L-1011, crashed Aug. 2, 1985, while on approach to the Dallas-Fort Worth International Airport. Of the 152 persons onboard, 134 passengers and crewmembers died as did one person on the ground.

This accident is one of the first commercial air crashes in which a microburst-induced wind shear was a direct contributing factor.

The DFW weather was poor and an isolated thunderstorm was developing nearby. The flight crew noticed the isolated storm, but decided to proceed through it anyway, which resulted in the aircraft getting caught in a microburst.

At about 1,500 feet above the ground, the first officer, who was flying the aircraft, approached the runway in heavy rain. He reported seeing lightning in one of the clouds ahead. At 800 feet above the ground, the aircraft accelerated without crew intervention.

The aircraft landing speed was bugged at 149 knots, but it accelerated to 173 knots IAS. The first officer tried to stabilize the aircraft's speed, but the captain had recognized the aircraft's speed increase as a sign of wind shear, and he warned the first officer to watch the speed. Suddenly, the airspeed dropped from 173 knots to 133 knots, and the first officer pushed the throttles forward, providing temporary lift. The airspeed then dropped to 119 knots.

The copilot tried to avoid a stall by pushing the nose down, but the aircraft's vertical speed increased to 1,700 fpm and the aircraft contacted the ground on a field about 6,300 feet north of the approach end of Runway 17L. It then bounced back into the air and came down again, with the engine striking a car, killing the lone occupant.

The aircraft skidded onto the airfield at a speed of 220 knots, collided with a pair of four-million gallon water tanks and burst into flames.

The NTSB attributed the crash to pilot error, combined with extreme weather phenomena associated with microburst-induced wind shear.

The Safety Board also attributed the accident to lack of the ability to detect microbursts since the airbourne radar equipment at the time was unable to detect wind changes. Subsequently, that capability was developed and the FAA mandated onboard wind-shear detection systems for commercial aircraft.

Best Practices

Regardless of its cause, low-level wind shear continues to pose a threat to aircraft safety, but its danger can be reduced with planning and vigilance – and cautionary operating practices, such as:

- Delay departure or arrival if winds exceed your airplane operations manual limitation.
- Never attempt to take off or land if a thunderstorm or heavy rain is located within five miles of your flight path.
- Be prepared to divert or hold when heavy rain is located on the approach, departure corridor or within the airport boundary.
- Abandon your approach if your SOPS for a stabilized approach cannot be met.
- Inform ATC of your decision to hold or divert to your alternate until the surface winds subside.
- And by all means, if you are on final approach and ATC issues a "microburst alert" for your runway of intended landing, immediately execute a go-around and, if necessary, execute your wind-shear recovery technique.

- Reject recklessness, especially if you fall behind schedule, when landing at night, or if aircraft in front of you have landed in bad weather. Do not allow "get there-itis" to take hold, especially at the end of a long duty day.

- Never let anyone pressure you into making a poor decision, and never forsake your good judgment just to get your aircraft off or on the ground.

Finally, be alert for low-level wind shear from takeoff and all the way through to touchdown and roll-out. You and your passengers will be glad you did.

THE THREATS

Surface Wind and Pressure In light of the recent FedEx MD-11 crash in Narita, a review of pressure fields and isobars on the surface analysis chart is in order. It's worth the effort to study and interpret these charts before your departure, or en route if you have the capability to download weather maps in flight.

Pressure fields are represented on weather charts by sets of isobars (lines or contours along which the pressure is equal to a constant value) on a horizontal surface, such as sea level. Isobars are usually plotted at uniform increments, for example, every 4 hPa on a sea-level pressure chart e.g., 996, 1000, 1004 . . . hPa. Local maxima in the pressure field are referred to as high-pressure centers and minima as lows. The horizontal pressure gradient is oriented perpendicular to the isobars and is directed from lower to higher pressure. The strength of this horizontal pressure gradient is inversely proportional to the horizontal spacing between the isobars in the vicinity of that point.

For the most part, the winds in the Earth's atmosphere parallel the isobars. In the northern hemisphere, lower pressure lies to the left of the wind (looking downstream) and the higher pressure is to the right. Air then circulates counterclockwise around lows and clockwise around highs. In the southern hemisphere, the relationships are opposite. The circulation around a low-pressure center is cyclonic, while the circulation around a high-pressure area is known as anticyclonic.

Winds on a surface weather map do not blow exactly parallel to the isobars; instead, they cross the isobars, moving from higher to lower pressure. The angle at which the wind crosses the isobars varies, but averages about 30 degrees. The reason for this behaviour is friction.

Surface winds in the northern hemisphere cross the isobars at about a 30-degree angle away from the center of a high-pressure area and flow at a 30-degree angle toward the center of a lower pressure area.

When you examine the surface analysis chart and see isobars that are closely spaced together and with anticyclonic curvature, remember that they will always cause high wind speeds.

Microbursts According to ICAO statistics, between 1970 and 1985, there were 28 aviation accidents caused by low-level wind shear, resulting in 700 deaths.

A microburst can occur when convective activity is present. It is defined as a small concentrated pulse, or downburst, that produces an outward burst of damaging winds on the surface.

There are two kinds of microbursts: wet and dry. The former is accompanied by heavy precipitation at the surface, while the latter is common in high plains and the intermountain west, where little or no precipitation reaches the ground. Dry microbursts can exhibit virga and generate rings of dust on the surface.

Microbursts are usually a mile in diameter above the ground, spreading out to approximately 2.5 miles on the surface outward from the center. Microbursts are short-lived, lasting 10 minutes or less, and can pack violent descending vertical columns of air that can exceed 3,000 fpm downward and horizontal winds on the surface that can reach 100 to 150 mph. The winds across the surface can be quite variable. The downdrafts tend to be the strongest at about 1,000 to 3,000 feet agl over a wide area, but there can be isolated areas of intense downdrafts within 300 feet of the surface.

Be advised that multiple microburst activity in the same area is common and should be anticipated.

From an aircraft standpoint, the excursion through a microburst is a performance decreasing path. How rapidly the event is traversed determines the net loss.

If you fly through a microburst from one side to the other, you will encounter the classic headwind increase, which is performance enhancing. As the headwind decreases toward the center of the outflow, you will enter an area of downdraft. As you continue to traverse the divergent flow you will encounter an increase in tailwind.

Penetrating the heavy rain outflow of a thunderstorm during approach and takeoff 'represents the highest potential for a microburst encounter.

Keep in mind that the net effect of a microburst and its associated wind shear in the terminal area can cause a severe reduction in your aircraft performance. This is exemplified by the 1985 DFW accident, which followed downdrafts that exceeded 3,000 fpm. Because the surface winds associated with a microburst can be so variable, real-time reports from preceding aircraft must be considered with considerable caution. Do not take the absence of a PIREP or the report of a smooth ride as "an all clear signal" to continue the approach.

Gust Fronts A gust front is the leading edge of sinking, thunderstorm-cooled air that displaces the warmer air as it spreads out at the surface. The advance of the downdraft air tends to be concentrated in the gust front on the forward side of the storm relative to the direction of propagation.

A gust front is an example of a fluid flow referred to as a density current, which has been extensively investigated in laboratories and modeling simulations.

A distinct feature of the gust front is the bulbous head, with its overturning circulation in which surface wind speeds exceed the rate of advance of the front itself.

Gust fronts are characterized by a wind shift, temperature drop and powerful straight-line wind outflows. The leading edge of severe gust fronts can be accompanied by intense turbulence, reduced visibility and hail.

Following the crash of the American Airlines MD-82 in Little Rock, NASA Langley researcher Fred H. Proctor, Ph.D., determined that the storm confronting the accident crew was a "bow echo" squall line pattern system that approached the airport from the northwest. The storm system produced powerful large-scale straight-line wind outflows.

The bow echo was located at the northwest end of a squall line that stretched toward the southwest. The echo moved toward the east-southeast encroaching on the airport at 32 knots and developed a deep bulge toward the southeast as the apex of the system moved to the north and east of the airport.

A large area of strong wind speeds in excess of 36 knots was associated with the low-level outflow from the bow echo. Radar reflectivity exceeded 45 dBZ over a broad area, with embedded cells exceeding 60 dBZ. Precipitation and strong wind gusts associated with the southwestern edge of the bow echo reached the airport 20 minutes prior to the accident. The southwestern edge remained near the airport as system advanced toward the east-southeast.

An intense "bookend" cell located at the southwestern end of the bow echo passed over the airport just following the time of the accident. The cell registered greater than 65 dBZ and was associated with strong wind, hail, frequent lightning and high rainfall rates. During this time the strongest measured gust was 76 knots.

The gust front can act like a golf pitching wedge as the ambient air is undercut and wedged upward by an advancing gust front. This can create a shelf cloud that rides the leading edge of the gust front. This shelf cloud marks the interface between cold air at the back or west side and warm air on the east side, and also between the stronger gusty cold outflow and the prevailing surface winds.

A characteristic of severe gust fronts is that the leading edge or head can be quite turbulent. If you examine a cross section of the event you will see that denser mass is always being pumped into the flow and works its way forward. Due to frictional effects of shearing between the fluid and surface, it then gets rolled under, as the gust front propagates.

Because of this friction, a vortex can be created at the head. If you were up in a tower and a gust front flowed past, .you would find the gust front would first traverse that tower somewhere above the ground, and then at ground level a short time later.

The head is not stable as the area constantly collapses on itself as the denser flow moves forward, creating turbulence. Even though traversing the gust front is a performance-enhancing path, that increase in itself is usually enough to destroy a stabilized approach. The turbulence simply makes things worse. Rain is not a good indication of the gust front's edge as sometimes rain is right at the leading edge of the flow and sometimes it is well behind it.

Occasionally when the winds change direction rapidly with height, the air rising over the gust front may form a long, horizontal vortex, which can sometimes be seen as a tube-shaped roll cloud resembling a rolling pin. The roll cloud has a horizontal rolling motion to it and is indicative of strong vertical wind shear, and often-hazardous turbulence.

Old gust fronts can be found in clear air more than 20 miles away from the generating thunderstorm(s). These gust fronts can still produce a strong shear zone and cause the surface wind to change rapidly. Gust fronts that migrate over dry terrain are often made visible by thick blowing dust. Gust fronts can initially affect an approach corridor or runway without affecting other areas of the airport. Thus, tower reported winds, altimeter settings and PIREPs can often be misleading.

Regions of hazardous crosswinds may not coincide with regions of hazardous wind shear. Some meteorological conditions may produce either, but rarely in the same location.

At low altitudes during approach and departure and while on the runway, the hazards from strong crosswinds are a lack of control authority, impaired directional control, possible damage to aircraft and injury to passengers.

■ **Little Rock Bow Echo System** The late Dr. Tetsuya "Ted" Fujita's career in meteorology spanned over 50 years. The former University of Chicago meteorologist was best known for his discovery of the microburst after the crash of Eastern Air Lines Flight 66 in 1975. He also completed extensive tornado research and devised the Fujita or "F-scale," which categorizes the tornadoes' wind speed and damage Potential.

Dr. Fujita coined the term "bow echo" in reference to radar echoes that appear to undergo a forward acceleration at their midpoint, thus forming a bulge in the radar signature. Damaging straight-line winds often occur near the "crest" or center of the bow echo. Bow echoes can be over 300 km in length, last for several hours, and produce extensive wind damage on the ground.

■ **Turbulence Threat** **Definition:** Encounter with manmade or atmospheric scales of motion that produce intense, short-lived random accelerations on the aircraft.
Hazard: (1) passengers and crew subject to unexpected and violent aircraft accelerations that cause injury or death.
(2) Loss of control and possible aircraft upset, resulting in uncontrolled flight into terrain.
(3) Lack of control authority on touchdown resulting in damage to aircraft.
(4) Airborne damage to aircraft.
Phase of flight: Can occur at any altitude, and during all phases of flight.

■ **Wind-Shear Threat** **Definition:** Encounter with atmospheric events that cause critical reduction in airspeed or altitude, such as to threaten the ability of an aircraft to remain airborne.
Hazard: Flight into terrain.
Phase of flight: Low altitude, during approach and departures.

■ **Crosswind Threat** **Definition:** Strong crosswinds that may endanger the control and course of the aircraft during takeoff and landing. **Hazard:** Collision with obstacles, lack of control authority on touchdown resulting in damage to aircraft and injury to passengers, impaired directional control on the runway. **Phase of flight:** On runway, low altitude during approaches and departures.

■ **Phase of Flight Threat** Since 1975, every fatal U.S. commercial wind-shear accident has involved an aircraft attempting to take off or land in a heavy rain outflow from a thunderstorm.

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Losing it...

Captain Gavin McKellar, Chairman of the IFALPA Accident Analysis and Prevention Committee, explains why maintaining control in all situations must remain at the top of our risk management agenda.

My guess is that we have all 'lost it ' to some extent at some point in our lives. You may have felt you have lost it after being hijacked by your emotions. Suddenly, you find yourself in a place you never intended to be. Acknowledging that this is a possibility for any of us presents the opportunity to assign it a probability and define how grave a risk 'losing it' will be.

In most of the world's developed countries, road accidents are a major cause of death - certainly this is the case in my country. I would argue that most of these accidents are the result of somebody 'losing it'. Whether it's driving into something (a bit like controlled flight into terrain - CFIT), rolling your car (let's call this a loss of control - LOC), or skidding off the road (excursion), in some way somebody has lost it - of course, it might that be the person who lost it could have been the designer of the car's throttle or braking system.

The point is, whatever the reason for losing it, taking back control must always remain at the top of our risk management agenda.

Taking back control must remain at the top of our risk management agenda - whatever the reason for losing it.

Losing it, CFIT style

In aviation, for many years the top threat was from controlled flight into terrain (CFIT). By and large, CFIT accidents came as a result of the crews involved collectively losing it in the form of degraded situational awareness and continuing on a course of action despite a number of cues that something was not right, until it was too late to do anything about it. In the majority of CFIT accidents, the point of first impact is within 100 feet of the summit of the terrain.

Perhaps you can recall the loss of a Flying Tigers aircraft in Malaysia, which continued on its fatal path despite the numerous 'pull up' warnings? I'm sure that you will remember the Korean Air 747 that crashed on approach to Guam, the image of that aircraft's wreckage scattered on the hillside five miles from centreline is still imprinted on my mind. In South Africa we also had the 2002 loss of an HS748 due to CFIT, which killed the disgraced former captain of the national cricket team, Hansie Cronje.

Of course, since the development of enhanced ground proximity warning system (EGPWS) and the advances in terrain mapping, things have dramatically improved. Since the installation of this fancy kit not one aircraft fitted with it has been involved in a CFIT accident.

Of course, there are still CFIT accidents. They happen every year, it's just now they happen to the five per cent of the world's airliner fleet not fitted with EGPWS. To me, the implication is obvious: without EGPWS the CFIT risk is just as bad as it ever was.

This in turn raises a question: have those with regulatory oversight 'lost it'? What about the CEOs of airlines who have not fitted EGPWS, have they not 'lost it' too? I think it is clear that they have lost sight of the risk presented by CFIT and, as a result, taken the appropriate steps to reduce the risk.

It is an obvious imperative that EGPWS is fitted in all air transport aircraft. Additionally, we can further reduce the risk by adopting the minute-to-impact philosophy. This idea says that you should never have a rate of descent (ROD) greater than that which would have you in contact with terrain in less than a minute. In other words, at 3,000 feet above ground level (AGL), the ROD should be less than 3,000 feet per minute; at 2,000ft AGL, ROD is back to 2,000 feet per minute, and so on. Of course, by1,000ft AGL we should be in a stable approach.

To me, the implication is obvious: without EGPWS, the CFIT risk is just as bad as it ever was.

Losing it, LOC style

Since the introduction of EGPWS and the dramatic fall in CFIT accident rates, loss of control (LOC) has taken over as the number one category of accident - notice I said 'accident category' rather than 'accident cause'. An accident can have a variety of causes - or, more accurately, factors - and it is never wise to focus on just one element.

The factors leading to a LOC accident can be weather-related, as in the case of the ATR72 crash at Roselawn. In its first report into the loss of United 585, while reaching no firm conclusion, the NTSB thought that "an encounter with an unusually severe atmospheric disturbance" would be a likely cause. Later, following another fatal loss and further incidents, a flaw in the design of the rudder actuator was revealed as the actual problem.

The crews had become fixated on diagnosing a fault, to the extent that far more serious problems developed.

The same phenomenon was flagged up by the investigation into the loss of an Adam Air 737-400 in Indonesia. However, unlike other events, this departure from controlled flight happened during the cruise phase rather than on approach or immediately after an airflow disturbance. Further investigations revealed crew disorientation leading to the design limits being exceeded as the most likely cause. It seems that in this case the crew focused on a failure in the aircraft's inertial reference system (IRS) and did not notice the departure from controlled flight until it was too late to recover the aircraft.

This has echoes of other accidents, one involving an L-1011 and another a DC-8. In both accidents the crews became fixated on diagnosing a fault, to the extent that far more serious problems developed. In the first case, a change in autopilot mode which allowed the aircraft to begin a gentle descent went undetected; a descent which continued until impact with the swamps of the Florida Everglades. In the latter, the aircraft ran out of fuel while the crew attempted to troubleshoot a fault in the right main landing gear.

There have been more recent, and as yet unexplained, control loss events. Why did a nearly new Kenya Airways 737 end up destroyed in a mangrove swamp shortly after takeoff? More recently, the LOC events in the Middle East and Central Asia and the United States are causes for concern. Not to mention the pending investigations into the losses suffered by Air France, Ethiopian and Turkish in the last year.

Losing it, runway excursion style

Runway excursions and their causes are receiving a good deal of attention and rightly so, since around 30 per cent of all accidents fall into this category. Although, happily, they do not have the injury or body count of CFIT or LOC accidents, they do occur with unacceptable frequency.

In recent years there have been a number of high-profile excursions, at Little Rock, Toronto and Chicago to name but three examples. In each of these cases adverse weather and fatigue played an important part in the way the sequence of events developed.

Much can be done to mitigate the effect of an excursion and we have seen this very graphically illustrated in recent weeks. Where there was an adequate runway end safety area (RESA) or an arrester bed, the outcome was far better with few, if any, injuries to passengers and crews and little damage to the aircraft. It's not just for fun that we at IFALPA support the fitment of engineered materials arrestor systems and require proper RESA at the end of runways we use. Who can forget the Airbus overrun at Warsaw, in which the captain lost his life due to the mound of sand in the overrun area? It still happens.

What lessons can be learnt?

We see how the risk can be mitigated, but how can we reduce the risk? I argue that most excursions are the result of losing it in just the same way as a CFIT or LOG accident. If we land long and fast on a slippery runway and continue in the normal way, hoping that we will stop on the available pavement, doesn't that indicate that we are not really aware of the situation?

Where there was an adequate runway safety end area or an arrester bed, there were few, if any, injuries.

But what do the lessons of completed investigations teach us? Reports by investigating authorities of LOC and CFIT accidents often have a loss of cockpit resource management (CRM) or a loss of situational awareness in the list of accident causes. That's pretty obvious, really - if they had known where they were they wouldn't have flown into the mountain - right? To me, this is a baseline problem. I don't think that statements about loss of CRM or situational awareness belong in the causal summary.

I think they would be better placed in the findings, in the list of safety factors involved. After all, what we really want to know is why there was a loss of situational awareness or poor CRM, since this is the only way we can formulate strategies to rectify the problem and reduce the risk.

We must take into our equation the effects of disorientation, stress and fatigue. By their nature they are more difficult to address and harder to prevent, so we must have robust systems that are error-tolerant. Good monitoring can help trap errors, checklists can identify items missed, and redundancy can help mitigate the effects of errors.

The division of labour on the flight deck should be maintained-the so-called 'I'll fly, you run the diagnostics separation' - and it is also clear that the pilot 'flying' must remain focused on that activity no matter how high the level of sophistication of the automatics employed. We must make sure that the aircraft is doing what we want, and expect it to be doing what it is actually doing, and this activity must take precedence over everything else. The pilot flying must 'aviate', while the pilot not flying is tasked with the 'navigate and communicate', as well as troubleshoot.

Let's get back to basics and apply situational control to every landing. Let's get the aircraft stable by 1,000 feet AGL and touch down in the zone. Focus on using the correct techniques for the aircraft, with prompt use of braking, spoilers and reversers, and if the approach doesn't look good or you are floating in the flare, then go-around. We need to match policies with practice: even though your flight operations manual (FOM) says that if you are not going to touch down in the zone you must go-around, we don't practise the manoeuvre in the simulator. Maybe we should.

Stay 'legal' - within the regulations, standard operating systems and training you have received.

Legally does it

In all the examples I have given, another valuable lesson to learn is to stay 'legal' - stay within the regulations, standard operating procedures and training you have received. I've racked my brains and I cannot think of a single instance where being 'legal' has been unsafe. Remember, the more we rationalise, the greater the potential to accept risk and by extension, the risk increases.

Pilots tend to be mission-oriented people and the temptation to 'press on' is an alluring one. We see what we want to see, hear what will confirm the decision and act as our own 'sirens on the rocks of risk'. Being compliant and legal means managing the risk and being safe.

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Airstair Vigilance

by Wayne Rosenkrans

A small child's fall reminds adults of the need for close supervision and reveals inadequate updates to operators.

A 3-year-old girl's fall from the forward integral airstair of a Ryanair Boeing 737-800 - an approximate height of 8.5 to 9.0 ft (2.6 to 2.7 m) - has prompted the U.K. Air Accidents Investigation Branch (AAIB) to issue several safety recommendations, including one for airstair modification. She was released from a hospital after a 24-hour assessment and treatment of minor injuries.

The child had climbed the airstair to the upper platform followed by her mother, who was carrying a younger sibling and a carry-on bag. "Due to her mother's lack of a free hand, the child climbed the airstair unassisted, but she held onto the lower handrail," the report said. "When [the girl] reached the top of the stairs, she turned towards her mother, leaned backwards and fell through the gap between the extendable handrail and the top of the airstair, onto the hardstanding [ramp pavement] below." Other passengers also were on the airstair at the time.

The incident occurred at 1225 local time on July 17, 2009, at London Stansted Airport, the AAIB report said. The airplane was manufactured in 2005 and certificated to applicable European standards.

This integral airstair (Figure 1) primarily was used to facilitate routine boarding and disembarkation in place of portable ground-based steps or an airbridge, and safe operation depended on a combination of barriers, procedures and warnings on placards. These airstairs include an integral two-rung handrail on either side," the report said. "These [handrails] rise into position during deployment of the stairs, but due to the geometric restrictions imposed by the retraction mechanism design, they do not extend to the fuselage side.

"In order to bridge the gap between the top of the handrails and the fuselage, a manually extendable handrail is fitted to each of the integral rails. After deployment of the airstair, these are extended and secured to points in the entry door frame. Each extendable rail is supported by a strut extending from the side rail of the airstair."

Previous Child Falls

Four similar incidents involving small children had prompted the U.S. Federal Aviation Administration (FAA) in September 2007 to issue advisory information to all current owners and operators of 737s. This comprised a special airworthiness information bulletin[1], calling for the incorporation of the latest safety advice and advances from a service bulletin developed by Boeing Commercial Airplanes[2], and another developed by Monogram Systems, the manufacturer of the airstair.[3]

"These bulletins required warning placards to be added to the risers of the airstair steps and the aircraft door apertures, together with the addition of anti-skid material to the top platform and the side rails," the report said. "The [Boeing bulletin] also highlighted the fact that Boeing had revised the flight attendant manual for the 737 series of aircraft, to include a warning regarding the need for operators to pay particular attention to passengers boarding [or deplaning] with small children or [passengers] with special needs." The AAIB report cited a paragraph from this template for operators, which says, in part, "Small children on airstairs should be attended by an adult or responsible person.[4]"

Investigation of the 2009 incident, however, found no process in place for operators to receive amendments to these type-specific cabin safety recommendations. "The flight attendant manual received by the operator with its first Boeing 737-800 was issued on 28 September 1998," the report said.

Investigators noted that, at the time of the incident, implementation of the most current airstair safety improvements recommended by Boeing and the airstair manufacturer was incomplete. "The airstair . . . had the warning placards on the risers and anti-slip material installed in accordance with [the] Monogram Systems [service bulletin], but the door aperture placards, detailed in [the] Boeing [service bulletin], had not yet been applied", the report said.

Small children require close supervision because of limitations of the geometry of the rails. "When deployed, the left and right extendable handrails are intended to provide protection against people falling sideways off the upper section of the airstair," the report said. "While these handrails appear to provide adequate protection for adults, a gap exists between the handrail and the airstair platform which is large enough to allow a small child to pass through it and fall onto the [ramp pavement] below."

According to procedures in Ryanair's safety equipment and procedures manual (SEP), three of four flight attendants are assigned to maintain positions by the forward and rear doors, and near overwing exits for the duration of boarding. "However, during boarding, the ability of the cabin crewmember at the forward doors to identify those passengers requiring assistance, while they are ascending or descending the airstair, is limited," the report noted, citing a provision from the SEP, which says, "Passengers accompanying young children should be instructed to hold their hands when descending the stairs and on the ramp."[5] The report did not mention the positioning of the flight attendants in the 2009 incident.

Other Airlines

AAIB observers also looked beyond the airline involved to assess supervision of small children on the 737 forward integral airstair. "In 95 percent of cases, during disembarkation, passengers traveling with several small children and hand baggage received no assistance from either cabin crew or ground staff," the report said. "However, ground [staff] and cabin crew provided assistance in 78 percent of cases when single passengers accompanied by small children were allowed to pre-board the aircraft." The 2009 pre-boarding incident was an exception: Neither the cabin crew nor the ground staff provided assistance, according to the AAIB.

"When portable ground-based steps or the aircraft's integral airstair were used, an adult boarding or disembarking with 'carry-on' baggage, which could not easily be placed over the shoulder, and a small child, found themselves, in certain situations, in a position where neither hand was available to provide support during the ascent or descent.

This situation was further complicated when an adult was accompanied by more than one small child and 'carry-on' baggage, as some of the children had to negotiate the steps with little assistance from the adult."

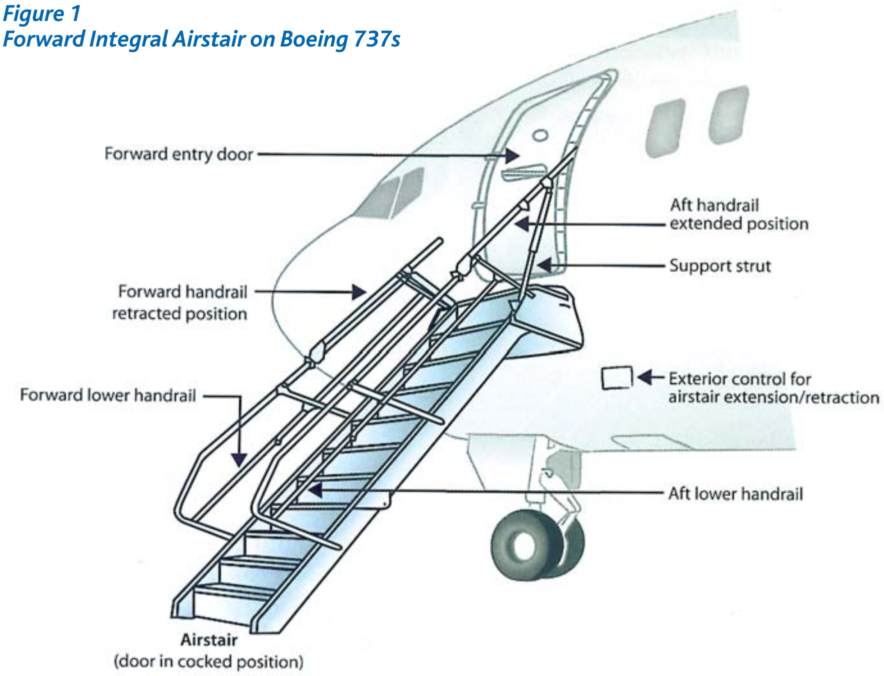
Mitigation Measures

The AAIB said that Ryanair also analyzed this incident and instituted measures to reduce the risk. "As a result, the operator raised a modification which introduces a roller-tensioned, high visibility tape between the door aperture and the extendable handrail strut," the report said. "After approval by the relevant airworthiness authorities, this modification will be embodied on the operator's fleet as a matter of priority."

The AAIB recommended that:

- "Boeing establish a process to inform the operators of all Boeing commercial aircraft of changes to the relevant flight attendant manual;"
- "Ryanair review their current passenger boarding and disembarking procedures so that assistance is made available to passengers accompanied by children, and those with special needs; [and,]

Figure 1
Forward Integral Airstair on Boeing 737s



FAA = U.S. Federal Aviation Administration
Notes: *The upper handrail extensions, when secured to the inside of the door opening, are designed to provide a continuous support from the ground to the airplane cabin. However, an FAA special airworthiness information bulletin (SAIB NM-07-47) in September 2006 advised 737-series owners and operators of four occurrences in which, during the process of disembarking or entering the airplane, unattended small children fell through or over the handrails or lost their balance and fell from the airstair.*
Source U.K. Air Accidents Investigation Branch; FAA

- "Boeing review the design of the Boeing 737 forward airstair with the intention of adding a removable barrier to minimize the possibility of a child falling through the gap between the extendable handrail and its upper platform."

The report explained the analytical basis of each safety recommendation. "The lack of an amendment service for the Boeing 737 flight attendant manual . . . applies to all of the Boeing commercial aircraft product line," the AAIB noted. "In this case . . . the operator would have been aware that some changes had been made to the manual upon receipt of [the FAA special airworthiness information bulletin]."

Investigators concluded that the absence of a barrier that specifically protects small children also should be addressed. "The gap between the extendable handrail and the upper platform of the Boeing 737 airstair represents a hazard to small children boarding or disembarking the aircraft," the report said. "Four previous events resulted in [amended guidance or safety bulletins that] do not provide physical protection against a child falling through the gap. The modification proposed by the operator provides a significant visual cue to the lack of a rigid barrier in this area, but provides only a limited physical protection against falling."

This article is based on AAIB Bulletin 8/2010, EIDLJ,EW/C2009/07/08, published in August 2010.

Notes

1. FAA. Special Airworthiness Information Bulletin NM-07-47. September 2007.
2. Boeing. Service Bulletin 737-52- 1157.
3. Monogram Systems. Service Bulletin 870700-52-2130.
4. Boeing Commercial Airplanes. *Boeing Flight Attendant Manual*, page 7.10.34.October 29,2008.
5. Ryanair. *SEP Manual*, Section 2.4.13.5.

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Scheduling to Manage Fatigue

Are you scheduling your aircrews with fatigue factors in mind?

By George C. Larson (george_larson@aviationweek.com)

Schedulers and dispatchers who operate in the real world know that it's unrealistic to expect a nine-to-five operating schedule in a typical flight department. Your department manager or chief pilot has been selling the executives downtown on how they can do three meetings in a single day and, assuming the aircraft can go the distance, on different continents. It can be an intimidating environment in which the cultural differences within an organization combine to possibly erode the safety of your operations. Preaching fatigue management may only earn you some unwanted pushback.

But you won't get any from Deborah Hersman, currently chairman of the NTSB. She delivered an address on the subject of fatigue and-its adverse effect on safety in early March before a gathering of the National Sleep Foundation, telling them, "Identifying fatigue and reducing risks for fatigue in accidents is included on our Most Wanted List." She cited the role of science in developing new sets of guidelines for duty hours among transportation workers, and added, "In recent years, our understanding of the factors that lead to fatigue has broadened, as have our recommendations." When schedulers and dispatchers confront fatigue issues with your flight departments. you now have a powerful force to wield: Science is on your side in this. Real scientific research done by real scientists using humans wired to machines at NASA Ames, among other places, has led to easily followed guidelines that replace the gut instinct we as a community used to rely on.

As just one example, it used to be thought that if the Earth didn't rotate, human biology would operate on a "natural" sleep-wake cycle of about 25 hours, not 24, and NASA scheduled International Space Station personnel accordingly. Today nobody seems to know where that figure came from. Current science says the natural number is probably closer to 24.2 hours. But what's more important is that the natural cycle is longer than a normal day, which may explain why it's easier to travel westbound than eastbound; a longer day feels slightly more normal. But one of the most important questions science has answered is what not to expect of yourselves as you manage fatigue issues in your daily scheduling and communication with flight crews.

Science says you cannot tell if people are tired simply by looking at them or talking to them on the phone. Humans generally are unable to detect early symptoms of fatigue in themselves, and therefore are almost universally inclined to deny being tired when asked. Nor is fatigue visible in others in any way - unless they're actually nodding off. Whenever the question arose as to whether a flight crew member or an aircraft technician had been fatigued prior to a mishap, a scheduler or dispatcher might find themselves being put on the spot: "Did they *look* tired?" Well, science has settled that one, and you're off the hook.

Of course, regulations are also on your side, but regulations don't have the power to prevent people from doing the wrong thing. The FAA can publish duty time limits and authorities like the NTSB can write speeches about fatigue, but if a member of a flight crew fails to heed the rules and flies anyway, he or she is placing passengers at risk. So any safety management system that does not address the complex issues of fatigue is sorely lacking. The science, being new, has not yet fully migrated into the regulations or into operations, so the policy you set within your own department should be thought through based upon our own study of the science. And only by getting total buy-in can your flight department succeed.

Accident investigators and sleep researchers had long suspected that fatigue was a factor in a majority of aircraft accidents but could never prove it. All that changed, though, on Aug. 18, 1993, when a McDonnell Douglas DC-8 registered to American International Airways and flying on a military contract as AIA Flight 808 crashed on approach to Guantanamo Bay Naval Air Station. The aircraft was written off and the crew of three survived with serious injuries. For the first time in history, fatigue was cited in the final NTSB accident report as the probable cause. Now fatigue has moved to the forefront in safety management as well as accident investigations.

Two seminal publications on fatigue are available to aviation staff via the Internet, one at NASA Ames (http://human-factors.arc.nasa.gov/zteam/) and another at the Flight Safety Foundation (search Archives for *Principles and Guidelines for Duty and Rest Scheduling in Corporate and Business Aviation)*. The NASA "Z" Team document that emerged from the Fatigue Countermeasures Group served as the basis for the FSF publication, so the latter comes highly recommended. Neither one is likely to help a scheduler or dispatcher who is trying to proactively effect an enlightened flight department policy because the charts and arrows and numbers make the subject look too complex and expensive. Accordingly, we've simplied it all so that nobody falls asleep.

The basics are easier to teach and remember, as there are just four primary factors in coming to grips with fatigue: sleep loss, continuous hours awake, circadian cycles (or time of day) and sleep disorders such as sleep apnea, which is an interruption of normal breathing, which, in turn, interrupts normal sleep.

Sleep loss comprises a daily component, meaning how much of an eight-hour sleep was lost within a given 24 hours, and sleep debt, which is a cumulative loss over a period of several days.

Continuous hours awake links to performance loss and is now equated with the use of alcohol. That's interesting, because professional flight crews would never violate alcohol rules, and everyone knows them and embraces them. And here's where science steps in to provide a clear understanding of performance. It says that being awake for 17 continuous hours is the equivalent of a Breathalyzer reading of 0.05. Keep going for 22 hours and you blow a 0.08, but go for the whole enchilada at 24 hours and you will be the rough equivalent of a drunk at 0.10.

The circadian factor has a biological basis and is one fatigue factor that's been widely understood and embraced, although regulations and your own operations manual may be subject to change as new information emerges. Unless you're an arctic reindeer, which can alter its circadian rhythm, you have a sleep-wake cycle within 24 hours that affects your body's biochemistry and, more important, your performance. The science says there are two "lows" when performance hits a wall, and both occur between three and five o'clock, one in the pre-dawn morning and the other in the afternoon. (Now you begin to see the wisdom behind taking a siesta.) A second component of the circadian factor is any irregular scheduling, whether due to time zone change, a shift to night work or flipping back and forth. Sleep apnea is treatable, but most people affected by it are unaware they have it. It's associated with snoring, and a person is as likely to be aware they have apnea as they are to be aware they snore. On one recent flight during which a crew over-flew the destination and both airmen were determined during an ensuing investigation to have been asleep, the captain was later diagnosed with sleep apnea. He'd had no idea. Visit the National Sleep Foundation Web site (www.sleepfoundation.org) and click on "Find a Sleep Professional" for medical sleep centers nearby. As awareness of fatigue as a public health issue has risen, so have the number of medical personnel trained and equipped to treat the problem.

Napping during the en route segment is finding increasing acceptance among fatigue experts who are familiar with flight operations. The only caution is to limit the sleep to about 45 minutes, no longer. Sleeping for more than 45 minutes risks slipping into a deeper sleep from which it may take 15 minutes to recover full alertness. To nap or not to nap is more of a policy matter for a department manager than a scheduler or dispatcher issue but it's interesting that the wind is shifting'.

There are some simple steps schedulers and dispatchers can take to provide some measure of intervention to prevent fatigue. The first is to study the science - not to become an expert but to be able to state your case with assurance when you need to. Another important measure is to communicate with and educate your colleagues in the flight department and your customers at headquarters. Says Ken Law, chief pilot for an S&P 500 firm, "We in the aviation department must communicate with the company on fatigue issues. . . . The company must have a policy that encourages people to report themselves fatigued and to take themselves off duty." At the NASA Ames Web site for Team "Z" there are education modules for downloading if you need help. But keep it short, keep it simple and refresh everyone's memory from time to time. Finally, when you work with anyone involved in the safety of flight or even simply talk with them on the phone, you, as a scheduler or dispatcher, have an opportunity to perform a quick fatigue "checklist" based on Sleep, Awake, Clock:

- Slept less than eight hours in the last 24?
- Awake more than 17 hours?
- Any major schedule shifts?

Durwood Heinrich presented a class on fatigue management to a standing room-only audience at the recent NBAA Schedulers & Dispatchers Convention in San Antonio. Those who attended received a slide rule-like tool he designed that makes it easy to establish duty time and required rest. Heinrich has a Ph.D. in Industrial Organizational Psychology in addition to a B.S. in Aerospace Engineering. The former chief pilot for Texas Instruments and PetSmart says, 'We as humans are terrible judges of our own fatigue. On average, we're getting two hours less sleep than we should be. There's no blood test for fatigue." He says he got interested in the issue in the course of running a flight department and sat down with all his pilots. "I said to them 'Here's the science from 10 years [of research at NASA Ames]. We can wing it or we can take these data and figure out a way to incorporate them into our daily operations so we're within the criteria.' To me it was a mandate." It's time flight departments large and small think of fatigue management the same way, and schedulers and dispatchers should lead the effort.

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